Center for Domestic Preparedness

Respiratory Protection: Program Development and Administration

Participant Manual

February 2014

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Center for Domestic Preparedness

Respiratory Protection: Program Development and Administration

This course has been formerly identified as WMD Respiratory Protection. During the transition to the new course title, some materials may reflect the older course title.

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The U.S. Department of Homeland Security is responsible for enhancing the capabilities of jurisdictions to prevent, deter, respond to, and recover from all-hazards incidents. A part of this mission is to increase these jurisdictional abilities by providing training opportunities.

The Center for Domestic Preparedness (CDP), a federal training facility located in Anniston, Alabama, is dedicated to the mission of training and preparing America's emergency responders by offering programs that are nationally recognized for providing progressive training that enhances the capability of the emergency response community.

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Introduction and Overview

Duration: 0.50 Hour

Summary: Instructors introduce themselves and share their disciplines and qualifications with participants. The instructors describe the course goal, expectations, and outcomes. A course overview that includes administrative matters of the classroom and other facilities are also provided. Additionally, participants introduce themselves so that others may know their peers and discipline expertise.

Terminal Learning Objective: At the conclusion of this module, participants will be able to describe the course purpose, goal, and scope.

Risk Assessment: Low

Methods of Instruction: This module includes a lecture and facilitated discussion to ensure the participants recognize the overall course purpose, goal, and scope.

Instructor-to-Participant Ratio: 1:30

Evaluation Strategy: The instructor uses questions to ensure participants' comprehension of the administrative information.

Special Instructions: None

Introduction and Overview

As the nation's premier all-hazards training center, the Center for Domestic Preparedness (CDP) offers training to prepare the nation's emergency responders to mitigate incidents involving chemical, biological, radiological, nuclear, and explosives (CBRNE) hazards, natural disasters, civil disturbances, and overall emergencies. The CDP offers realistic, scenario-based training to provide participants with the knowledge and skills necessary for effective and efficient response.

Purpose

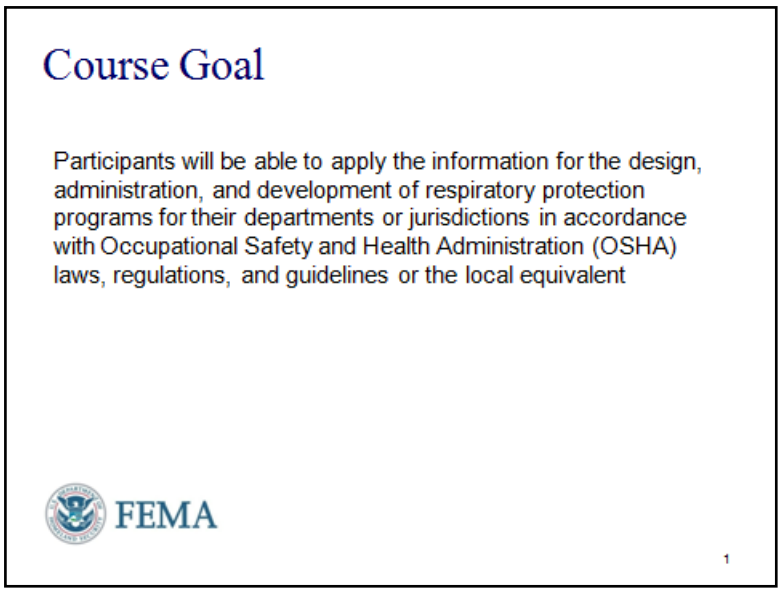
The *Respiratory Protection: Program Development and Administration* course is designed for individuals who may assist in designing, developing, implementing, administering, and sustaining a respiratory protection program. The information provided in this course will help participants develop a respiratory protection program that complies with the laws and regulations regarding emergency response actions.

According to the Occupational Safety and Health Administration (OSHA), respirators protect emergency responders "against insufficient oxygen environments, harmful dusts, fogs, smokes, mists, gases, vapors, and sprays. These hazards may cause cancer, lung impairment, other diseases, or death" (OSHA, n.d., para. 1). Emergency responders protect the public from a variety of hazards. If emergency responders are to perform efficiently and successfully, they must first protect themselves. The type of respiratory protection needed at a chemical, biological, radiological, and nuclear (CBRN) or an all-hazards incident may differ from the respiratory protection needed at a worksite-specific incident. Laws and regulations that govern the respiratory protection equipment required for materials found at a worksite-specific incident could be different from guidance associated with a CBRN incident. The planning and response

may be different based on the workplace. Emergency responders need to know the laws that regulate emergency responders' respiratory protection requirements.

The RP training course provided by the CDP is guided by documents, standards, definitions, and competencies, such as Hazardous Waste Operations and Emergency Response (HAZWOPER), 29 *Code of Federal Regulations* (C.F.R.) § 1910.120 (2013); General Requirements, Personal Protective Equipment, 29 C.F.R. § 1910.132 (2013); Respiratory Protection, 29 C.F.R. § 1910.134 (2013); Worker Protection, 40 C.F.R. Part 311 (2012); Approval of Respiratory Protective Devices, 42 C.F.R. Part 84 (2012); Occupational Safety and Health Act of 1970 (as amended through January 1, 2004); *Assigned Protection Factors for the Revised Respiratory Protection Standard* (OSHA, 2009); *National Institute for Occupational Safety and Health (NIOSH) Respirator Selection Logic* (2004); *National Fire Protection Association*® (*NFPA*®) *472*, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* (2007a; 2008 edition); *NFPA 1994, Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents* (2006); and *NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services* (2007b).

Notes:



Course Goal

At the conclusion of this course, participants will be able to apply the information for the design, administration, and development of respiratory protection programs for their departments or jurisdictions in accordance with OSHA laws, regulations, and guidelines or the local equivalent.

Notes:

Scope of Course

3-day training course

Includes lectures, class discussions, activities, and hands-on exercises that allow participants to apply Respiratory Protection, 29 Code of Federal Regulations (C.F.R.) §§ 1910.120 (2010), 1910.132 (2010), and 1910.134 (2010)

Topics for this course include:

- Introduction to Respiratory Protection,
- Hazardous Waste Operations and Emergency Response,
- CNC Fit Testing Technology Exercise,
- Personal Protective Equipment—General Requirements,

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Scope of Course (continued)

Topics for this course include (continued):

- Respiratory Protection,
- Qualitative and Quantitative Fit Testing,
- CNP Fit Testing Technology Exercise,
- Respirator Use,
- Maintenance and Care of Respirators,
- APR Cleaning Procedures,
- Air Quality,

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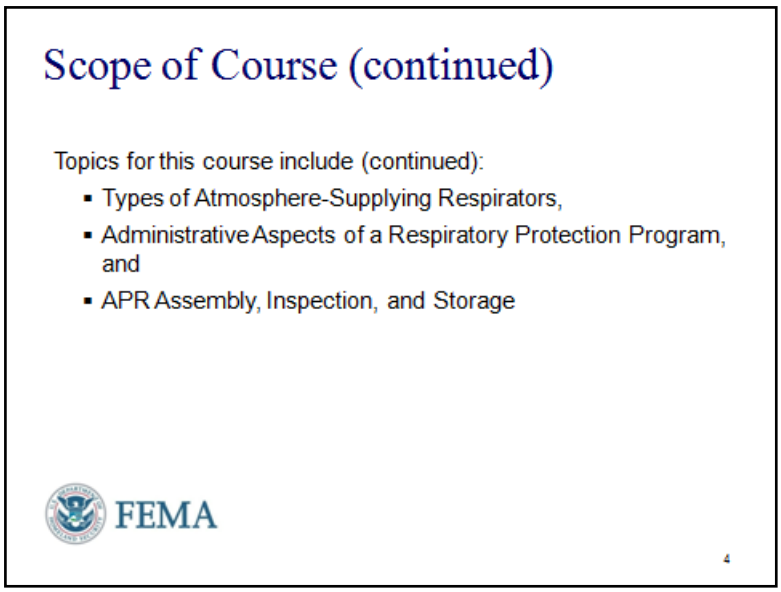
Notes:



Scope of Course

Respiratory Protection: Program Development and Administration is a 3-day, 24-hour training course with lectures, class discussions, activities, and hands-on exercises that allow participants to apply §§ 1910.120 (2013), 1910.132 (2013), and 1910.134 (2013) to a respiratory protection program. Topics in the modules of this course include the following:

- Introduction to Respiratory Protection
- Hazardous Waste Operations and Emergency Response
- CNC Fit Testing Technology Exercise
- Personal Protective Equipment—General Requirements
- Respiratory Protection
- Qualitative and Quantitative Fit Testing
- CNP Fit Testing Technology Exercise
- Respirator Use
- Maintenance and Care of Respirators

Notes:

- APR Cleaning Procedures
- Air Quality
- Types of Atmosphere-Supplying Respirators
- Administrative Aspects of a Respiratory Protection Program
- APR Assembly, Inspection, and Storage

Prerequisites

To be eligible to attend the *Respiratory Protection: Program Development and Administration* course, participants must have successfully completed the following:

- AWR-160 *Standardized Awareness Authorized Training Program* or another certified awareness training course
- IS-100.a Introduction to Incident Command System (ICS) or any of the available ICS-100 series
- IS-700.a *National Incident Management System* (*NIMS*), *An Introduction*

Participant Requirements

Participants who attend this course must

- physically be able to lift 40 pounds and
- have no limiting physical condition that would affect the wearing of respirators.

Continuing Education Units

The CDP awards 2.4 continuing education units (CEU) for the successful completion of this course. The CDP has been approved by the International Association for Continuing Education & Training (IACET) as an authorized provider of CEUs.

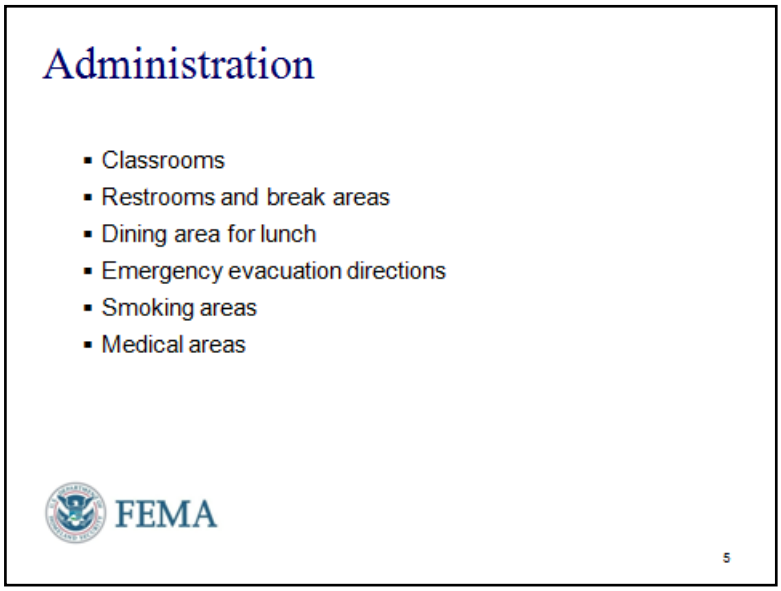
Agenda

Notes:

Module #	Module Title	Time Allocation
DAY 1		
	Introduction and Overview	0.50 hour
Test 1	Pretest	0.75 hour
Module 1	Introduction to Respiratory Protection	1.50 hours
Admin 1	*Vitals Screening (Pre)*	*0.25 hour*
Module 2 or 3	Hazardous Waste Operations and Emergency Response	2.00 hours
Admin 2	*Lunch*	*0.75 hour*
Module 2 or 3	CNC Fit Testing Technology Exercise	2.00 hours
Admin 3	*Vitals Screening (Post)*	*0.25 hour*
Module 4	Personal Protective Equipment—General Requirements	0.50 hour
Module 5	Respiratory Protection	0.75 hour
DAY 2		
Module 5 (continued)	Respiratory Protection	1.00 hour
Admin 4	*Vitals Screening (Pre)*	*0.25 hour*
Module 6 or 7	Qualitative and Quantitative Fit Testing	2.00 hours
Module 6 or 7	CNP Fit Testing Technology Exercise	2.00 hours
Admin 5	*Vitals Screening (Post)*	*0.25 hour*
Admin 6	*Lunch*	*0.75 hour*
Module 8	Respirator Use	0.75 hour
Module 9	Maintenance and Care of Respirators	0.50 hour
Module 10	APR Cleaning Procedures	1.75 hours

Notes:

DAY 3		
Module 11	Air Quality	0.75 hour
Admin 7	*Vitals Screening (Pre)*	*0.25 hour*
Module 12	Types of Atmosphere-Supplying Respirators	1.75 hours
Admin 8	*Vitals Screening (Post)*	*0.25 hour*
Module 13	Administrative Aspects of a Respiratory Protection Program	1.50 hours
Admin 9	*Lunch*	*0.75 hour*
Module 14	APR Assembly, Inspection and Storage	1.50 hours
Admin 10	Facilitated Review	0.75 hour
Test 2	Posttest	1.25 hours
	Conclusion and After Action Review	0.25 hour
Admin 11	Graduation	0.25 hour



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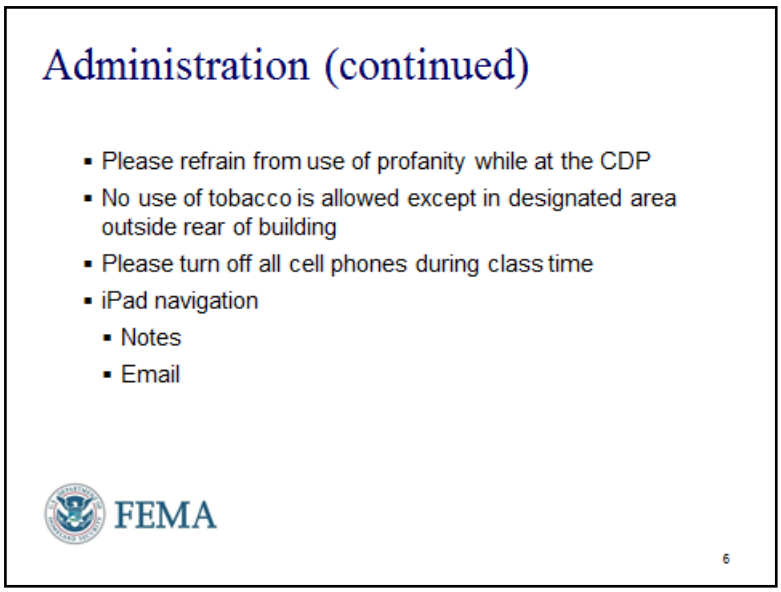

Administration

Instructors provide directions to

- classrooms,
- restrooms and break areas,
- dining area for lunch, and the
- smoking areas.
- Refrain from using profanity while at the CDP.
- Restrictions concerning cell phones and personal computers include the following:
- Cell phones
  - Cell phones must be turned off before entering the classroom.
  - If it is absolutely necessary to remain in contact with home, phones should be turned to vibrate only and answered after leaving the classroom.
  - Refrain from text messaging during the class and small group exercises.

Notes:

- iPad Naviation
  - Notes
  - Emailing notes

Safety information

- Evacuation routes
  - If there is need to evacuate dorm, information is located on back of room's door.
  - Instructors will provide participants with necessary information regarding rallying points in case of evacuation.
- Shelter-in-place location
  - Participants should move to basement level.
  - Instructors provide participants with necessary information regarding assembly point for accountability.

Hazards and Mitigations

HAZARD	MITIGATION
Tripping (extension cords, training aids, working surfaces)	▪ Secure all cords ▪ Identify and mark uneven training surfaces ▪ Communicate with others
Damaged equipment due to spilled liquids and/or food	▪ Consume food or beverages in designated area(s)
Limited Visibility (decrease peripheral vision while wearing an APR)	▪ Over-emphasize the turning of the head ▪ Alert others of hazards in the area

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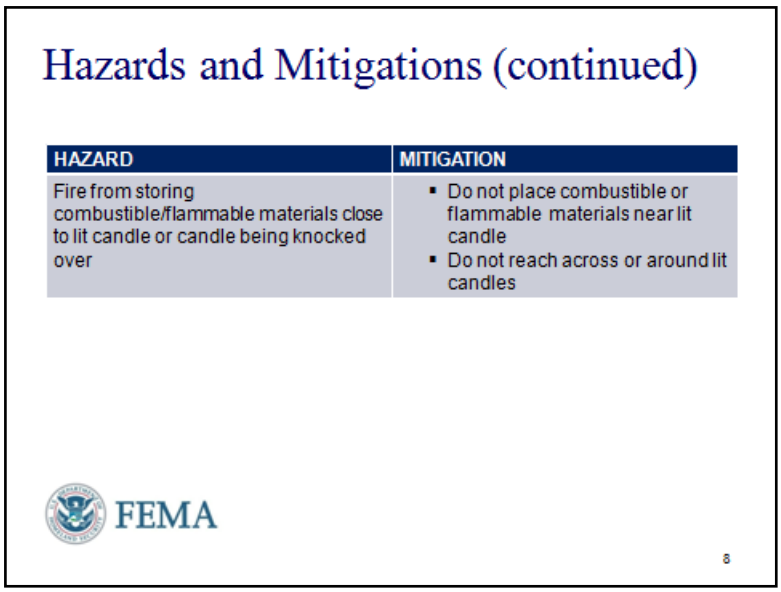
Notes:



Hazards and Mitigations

There are several hazards that participants should be aware of, to include tripping, damaged equipment, visibility, and fire. Mitigation techniques were developed to help prevent possible incidents. Follow these mitigation techniques to prevent any possible injuries.

Note: A respiratory protection program template is provided in Tab 9 of the *Respiratory Protection: Program Development and Administration Reference Manual*; however, it is a template, not the only template, and is only provided as an example for participants' future use.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Approval of Respiratory Protective Devices, 42 C.F.R. Part 84 (2012).

Bollinger, N. (2004, October). *NIOSH respirator selection logic 2004* (NIOSH Publication No. 2005-100). Retrieved from http://www.cdc.gov/niosh/docs/2005-100/pdfs/05-100.pdf

Fit Testing Procedures (Mandatory), Appendix A to 29 C.F.R. § 1910.134 (2013).

General Requirements, Personal Protective Equipment, 29 C.F.R. § 1910.132 (2013).

Hazardous Waste Operations and Emergency Response, 29 C.F.R. § 1910.120 (2013).

(Mandatory) Information for Employees Using Respirators When not Required Under Standard, Appendix D to 29 C.F.R. § 1910.134 (2013).

National Fire Protection Association. (2006). *NFPA 1994*, *Standard on protective ensembles for first responders to CBRN terrorism incidents* (2007 ed.). Quincy, MA: Author.

National Fire Protection Association. (2007a). *NFPA 472*, *Standard for competence of responders to hazardous materials/weapons of mass destruction incidents* (2008 ed.). Quincy, MA: Author.

National Fire Protection Association. (2007b). *NFPA 1981*, *Standard on open-circuit self-contained breathing apparatus (SCBA) for emergency services*. Quincy, MA: Author.

Occupational Safety and Health Act of 1970, Pub. L. No. 91-596, 84 Stat. 1950 (1970; as amended through January 1, 2004).

Occupational Safety and Health Administration. (n.d.). *Safety and health topics: Respiratory protection*. Retrieved from http://www.osha.gov/SLTC/respiratoryprotection/index.html

Occupational Safety and Health Administration. (2009). *Assigned protection factors for the revised respiratory protection standard.* Retrieved from http://www.osha.gov/Publications/3352-APF-respirators.pdf

OSHA Respirator Medical Evaluation Questionnaire (Mandatory), Appendix C to 29 C.F.R. § 1910.134 (2013).

Respirator Cleaning Procedures (Mandatory), Appendix B-2 to 29 C.F.R. § 1910.134 (2013).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

User Seal Check Procedures (Mandatory), Appendix B-1 to 29 C.F.R. § 1910.134 (2013).

Worker Protection, 40 C.F.R. Part 311 (2012).

Introduction to Respiratory Protection

Duration: 1.50 Hours

Summary: Participants review the importance of respiratory protection as part of their responder duties. They briefly discuss the Respiratory Protection Program including the routes of exposure and personal protective equipment (PPE) levels. Participants discuss the types of hazards encountered by emergency responders and measures to reduce respiratory contamination. Participants review foundational and historical information on respiratory protection. They take part in a discussion of the earliest forms of respiratory protection, historic workplace hazards, and present-day hazards. Participants discuss the six types of hazards and identify examples of each. Laws protecting workers and emergency responders who wear respirators and the agencies (e.g., Occupational Safety and Health Administration [OSHA]) that enforce those laws are reviewed. The Occupational Safety and Health (OSH) Act of 1970 and regulations, laws, and standards are reviewed. Participants, in small groups, review a case study and identify lessons learned.

Terminal Learning Objective: At the conclusion of this module, participants will be able to state the importance of respiratory protection to employers and employees according to Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

1-1 Explain the importance of using respiratory protection while performing responder duties.

1-2 Discuss the history and early techniques of respiratory protection.

1-3 Identify the types of hazards that responders encounter when responding to a CBRN incident.

1-4 Discuss how the OSH Act of 1970 applies to emergency response.

1-5 Locate the appropriate standard given a title from the C.F.R. using the OSHA website.

1-6 Identify lessons learned based on a case study presented in small-group discussions.

Practical Exercise: Participants participate in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. Participants participate in a cooperative learning activity called “Placemat,” which allows participants to identify key concepts of the module in small groups and present their groups’ common points to the whole class. For this activity, participants examine a case study and participate in an instructor-facilitated small-group discussion. In the small-group discussion, participants discuss how the standards apply to his or her agency. The approximate time for this activity is 20 minutes.

Risk Assessment: Low

Methods of Instruction: Instructors use a facilitated lecture format including visuals and a case study. Reflective questioning challenges participants’ critical thinking skills and reinforces module content. Participants participate in instructor-guided and collaborative knowledge

checks throughout the module where participants explain why respiratory protection is so important, and identify the hazards responders encounter when responding to a CBRN incident. Participants participate in a cooperative learning activity called "Placemat," which allows participants to identify key concepts of the module in small groups and present their groups' common points to the whole class. The instructor poses questions based on the case study to emphasize key information and allow participants to make conclusions about the effectiveness of the response concerning respiratory protection.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group discussions.

Required Reading: *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*]

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participants' comprehension through their participation in small-group discussions as well as presentation of key points from their groups' discussions. Throughout the presentation of the module, the instructor uses reflective questioning and observations to informally assess participants' comprehension of key information. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content as well as address any additional participant questions.

Special Instructions: Throughout the text, instructor notes identify prompts at specific points to either engage participants in an interactive discussion or question-and-answer period. Instructors should familiarize themselves with these instructor notes so that they ensure that participants are given the opportunity to actively participate in the learning process.

Objectives

- Explain the importance of using respiratory protection while performing responder duties
- Discuss the history and early techniques of respiratory protection
- Identify the types of respiratory hazards that responders encounter when responding to a CBRN incident
- Discuss how the Occupational Safety and Health (OSH) Act of 1970 applies to emergency response

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Objectives (continued)

- Locate the appropriate standard given a title from the *Code of Federal Regulations* (C.F.R.) using the Occupational Safety and Health Administration (OSHA) website
- Identify lessons learned based on a case study

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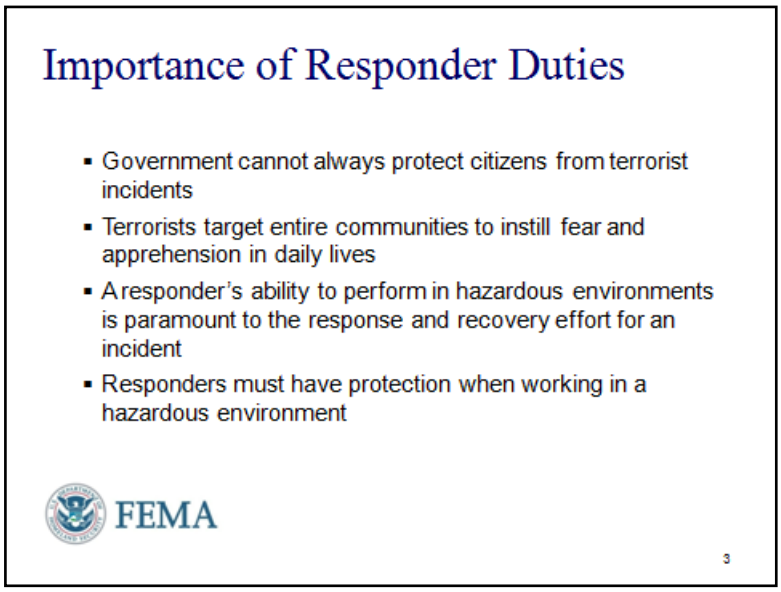
Notes:

Enabling Learning Objective 1-1: Explain the importance of using respiratory protection while performing responder duties.



Importance of Responder Duties

NOTE: Information contained within this manual should be reviewed periodically for updates to websites, regulations, and standards. This will aid in maintaining an up-to-date respiratory protection program. There is no official fit testing or OSHA certification provided as a result of course completion. Applicable regulations under state law require employers to "develop and implement a written respiratory protection program. . . . the program must be administered by a suitably trained program administrator" (Respiratory Protection, 29 C.F.R. § 1910.134[c], 2013). Employers must determine if the Respiratory Protection: Program Development and Administration course meets the suitability requirements. The Center for Domestic Preparedness (CDP) is not liable for any problems associated with a jurisdiction's respiratory protection program developed as a result of attending this course. The Respiratory Protection Program Template, provided in Tab 10 of the *Reference Manual*, is a template, not the only template, and is only provided as an example for participants' future use.

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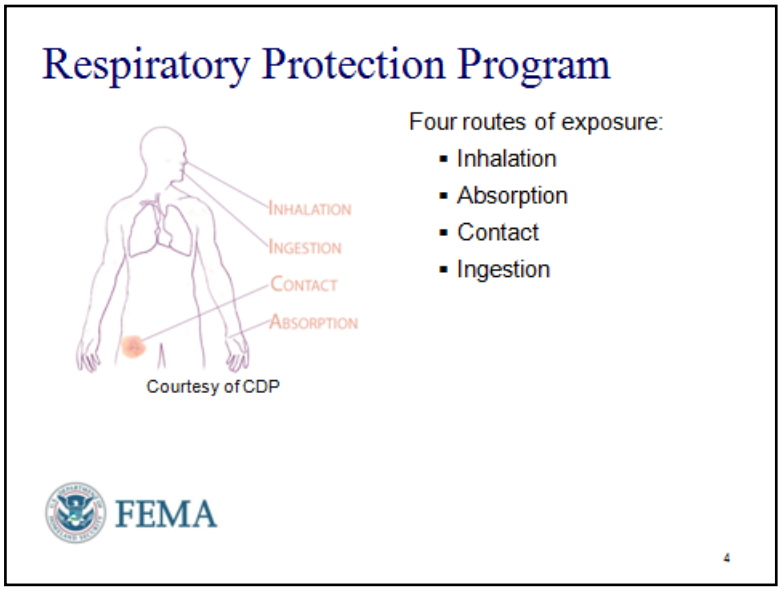
Terrorism—which has no single, universal definition—is categorized by the FBI into two groups: domestic and international (Federal Bureau of Investigation [FBI], 2007). The definitions of both groups include several similar elements, including the use of force or acts of violence against individuals and communities to create fear and intimidation for either political, social, or religious reasons (FBI, 2007). Terrorists target entire communities when planning an attack to instill fear and apprehension in daily lives as well as to affect commerce and the economy. The fear faced by the community places doubt in the government and its ability to protect citizens.

A responder's ability to perform in a hazardous environment is paramount to an incident response and recovery effort. The same is true for employers and employees. If employees cannot properly function in the workplace, then the organization suffers. Respiratory protection can be required in the workplace, which can be the response to a terrorist incident, accidental incident, or everyday job duty. The important factor is that employers are required to provide employees (responders) with proper respiratory protection necessary to perform job duties.



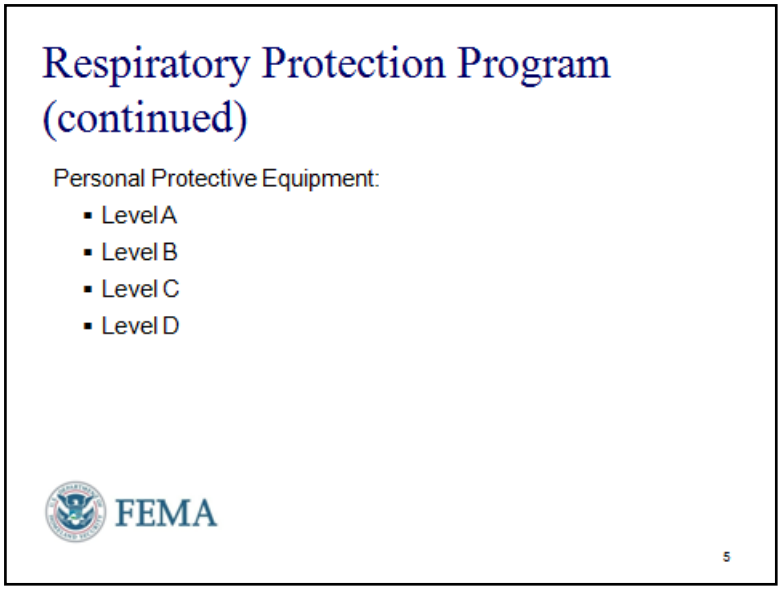
Respiratory Protection Program

Respiratory protection program administration is all-encompassing. If responders are going to manage a respiratory protection program, they must understand how individuals can be affected during a CBRN incident.

Notes:

Key Point:

There are four possible routes of exposure: inhalation, absorption, contact, and ingestion. The most serious of these is inhalation, because many toxic materials can be inhaled and quickly cause illness and injury to the body.



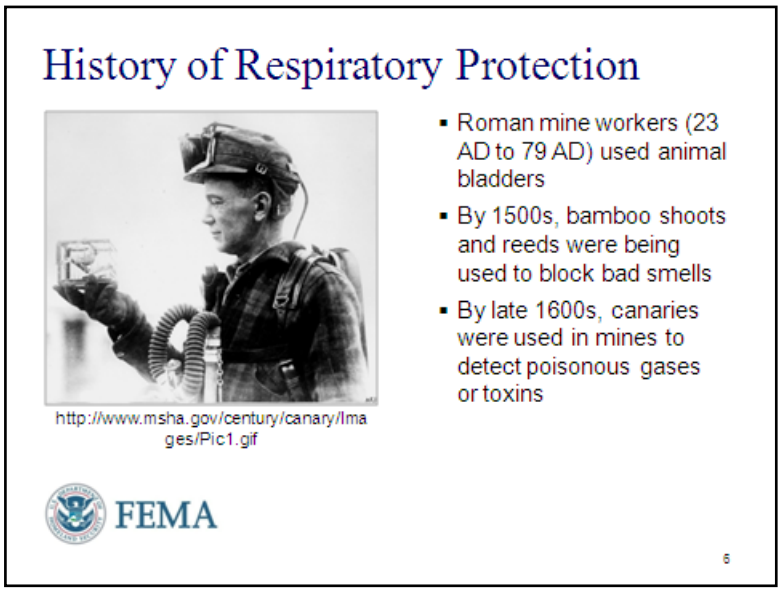
Respiratory hazards can be present in the workplace. These hazards can be in the following physical forms: dust and fibers, fumes, mists, gases, and vapors, which can also contain chemical, biological, and radiological contaminants (Occupational Safety and Health Administration [OSHA], 2009). Respiratory protection is needed to avoid these potential hazards. PPE Levels A, B, C, and D provide employees with the necessary protection against exposure to hazardous substances; however, only Levels A, B, and C provide some form of respiratory protection.

Knowledge Check:

Why is appropriate respiratory protection so important?

Notes:

Enabling Learning Objective 1-2: Discuss the history and early techniques of respiratory protection.



History of Respiratory Protection

From 23 to 79 AD, Roman mine workers noticed the need for some form of respiratory protection. They took animal bladders—which were semipermeable, meaning that they allowed passage of certain molecules but acted as a barrier to others—and placed them over workers to protect them from inhaling red oxide of lead (OSHA, n.d.)

By the 1500s, long shoots of bamboo or reeds were used as a respiratory protection device against things that smelled “bad.” They thought that if you could not smell or taste the vapor, then it could not be hazardous to the individual.

In the late 1600s, it was noted that miners began dying from exposure to poisonous gases or toxins. Miners used canaries and wick lanterns to detect the level of poisonous gases or toxins in the mines. If a canary died suddenly, the miners knew that the level of poisonous gases or toxins was too high and that they needed to exit the shaft. It was during this time that the lack of respiratory protection began to be associated with death and disease.

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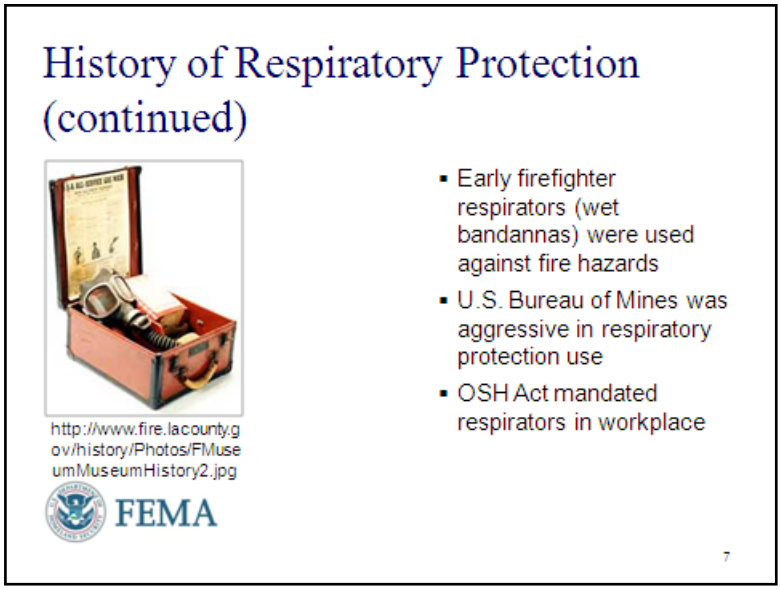
Example:

During the Industrial Revolution of the 1800s, mine safety programs were implemented, along with the use of sophisticated respirators. A particulate filter was developed; this was the predecessor of modern filters used in air-purifying respirators.



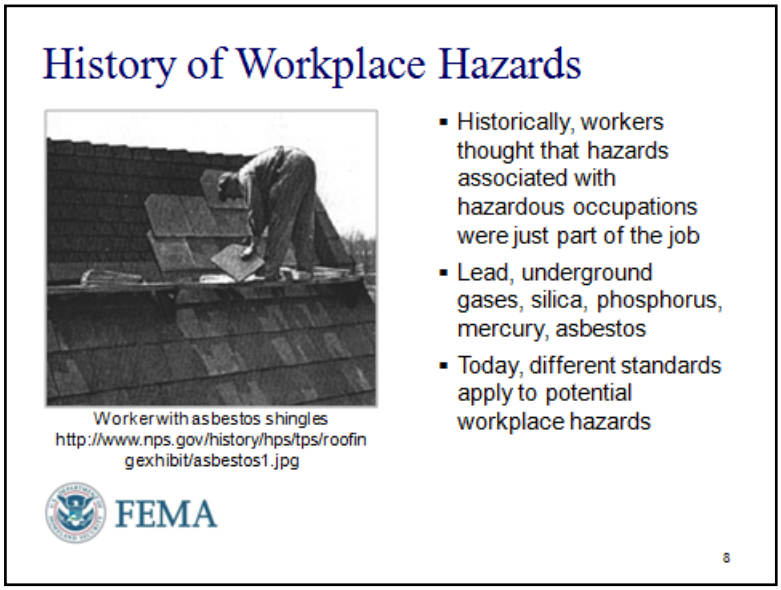
For many years, firefighters had little respiratory protection against smoke and gases during fires. Firefighters would wear wet bandannas tied over their noses and mouths to protect their respiratory systems. Firefighters would rush into burning structures and provide as much assistance as possible before being overwhelmed by smoke and gases. Firefighters would return outside, vomit, and then re-enter the burning structures. The vomiting was a result of the firefighters breathing toxic air into their lungs and ingesting it into their stomach. The toxins caused the lining of the stomach to become irritated, resulting in vomiting. These same toxins caused respiratory system illness and injury. Today, many former firefighters suffer from respiratory illnesses as a result of this type of exposure.

In 1911, the U.S. Bureau of Mines began keeping statistics on the number of casualties from exposure to hazards within mines. Although many casualties resulted from mine explosions, the Bureau also wanted to protect workers from dust particles and gases, due to the number of

Notes:

workers dying from suffocation. Observations from the firefighting and mining sectors led to efforts to create better respiratory protection. The OSH Act of 1970 set standards mandated by the new agency (OSHA) within the U.S. Department of Labor. The Act required employers to provide respiratory protection to all workers who need it.

Enabling Learning Objective 1-3: Identify the types of respiratory hazards that responders encounter when responding to a CBRN incident.



History of Workplace Hazards

Historically, many workers thought that the hazards associated with mining, firefighting, or other hazardous occupations were just part of the job. Particulates were present in the mining of lead and mercury as well as in their associated production methods, including smelting, refining, and casting. In addition, particulates from methane, hydrogen sulfide, carbon monoxide, chlorine gas, caustic soda, skin-lightning antiseptic creams, asbestos, underground gases, silica, and phosphorus produced respiratory hazards to workers. These particulates can enter the body through all routes of exposure. Today, there are machines that conduct the hazardous work that people used to perform. Another potential industry workplace hazard is dealing with cryogenic

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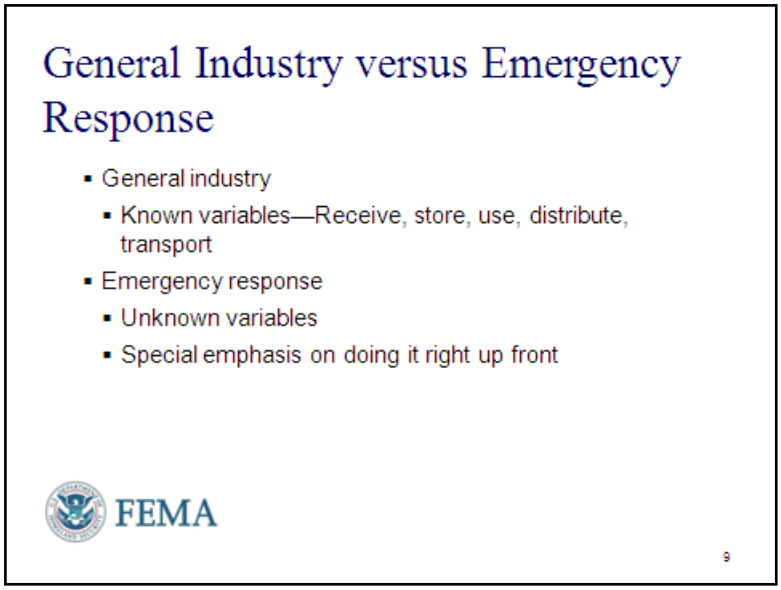
materials, such as liquid oxygen. Liquid oxygen can cause severe burns, over-pressurization, oxygen enrichment, and possible combustion (University of Florida, n.d.). When an employee must come into contact with hazardous particle substances today, he/she uses some form of respiratory protection.



General Industry versus Emergency Response

Most people who work in general industry (e.g., manufacturing and fabricating companies) are aware of any hazards within their specific work environment. In general industry, employees must read and be knowledgeable of the toxic industrial chemicals with which they work. On the other hand, emergency responders do not always have the information about particular hazards in a specific workplace, so they must be prepared for variables.

Local jurisdictions should have Local Emergency Planning Committees (LEPCs) in place within their communities. LEPCs originated from the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (U.S. Environmental Protection Agency [EPA], 2009). LEPCs are used to obtain and maintain information from businesses about the Extreme Hazardous Substances (EHS) that they have on site at any given time (EPA, 2009). Any hazardous substance that the business manufactures, uses, stores, or transports must be on file with the LEPC having jurisdiction.

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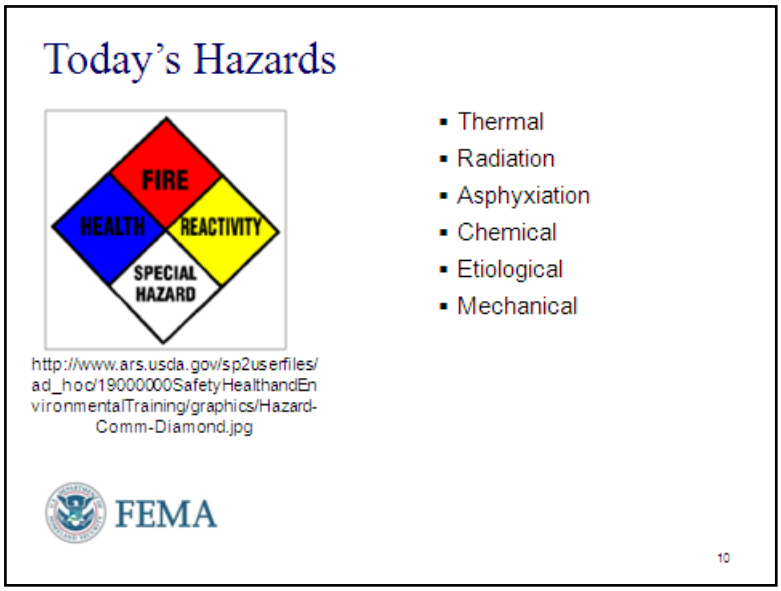


Today's Hazards

Today, the employer must identify respiratory hazards associated in the workplace; therefore, employers have the responsibility to protect employees from the identified hazard.

Key Point:

There are six types of hazards:

- Thermal—Created by heat, such as a fire; however, thermal hazards can also be cold in nature;
- Radiation—Created from anything emitting ionizing radiation, such as cesium;
- Asphyxiation—Occurs when oxygen becomes displaced or absent;
- Chemical—Caused from an industrial toxic or warfare agent;
- Etiological—Biological agents, such as plague; and
- Mechanical—Caused by bomb-blast fragmentations.

Notes:

Inhalation is the most severe entry route.

✔ **Knowledge Check:**

What are examples of thermal respiratory hazards?

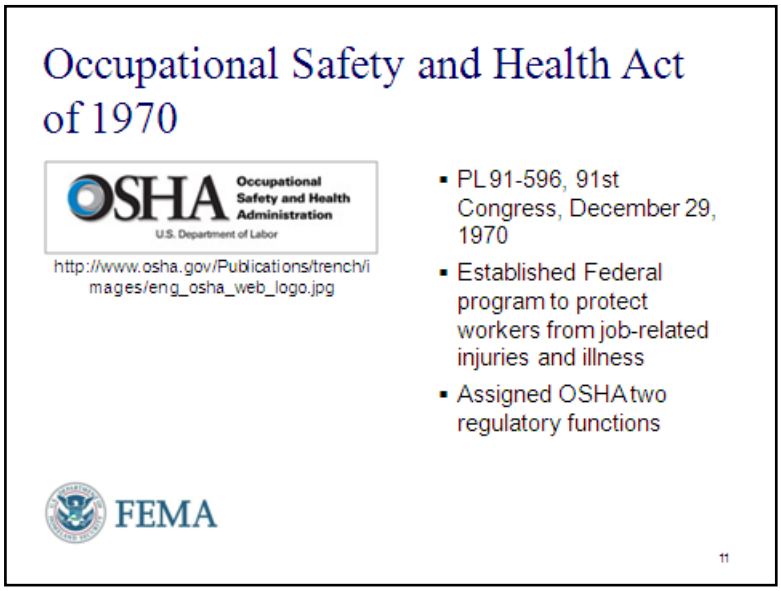
What are examples of radiation respiratory hazards?

What are examples of asphyxiation respiratory hazards?

What are examples of etiological respiratory hazards?

What are examples of mechanical respiratory hazards?

Enabling Learning Objective 1-4: Discuss how the OSH Act of 1970 applies to emergency response.



Notes:

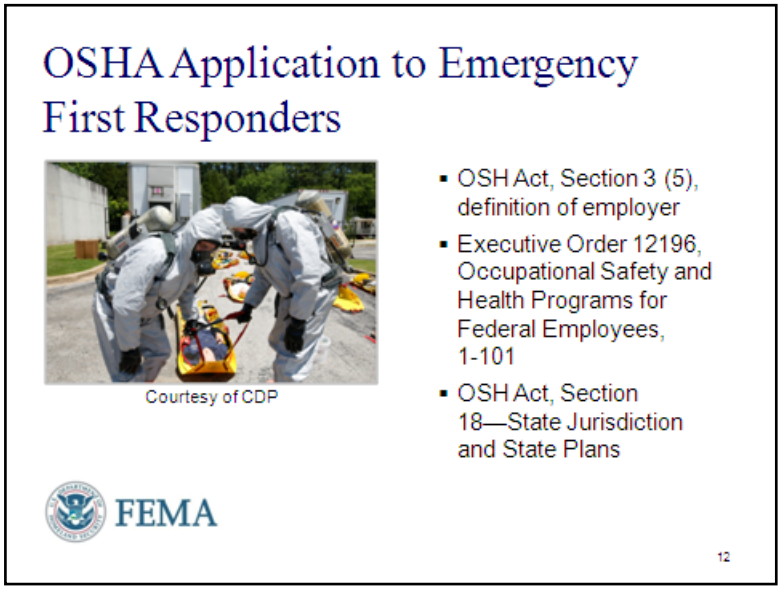
Occupational Safety and Health Act of 1970

The OSH Act of 1970 established a nationwide Federal program to protect workers from job-related injury, illness, and death (U.S. Department of Labor [DOL], n.d.a). The Act assigned "OSHA two regulatory functions: setting standards and conducting inspections to ensure that employers are providing safe and healthful workplaces" (DOL, n.d.b, Basic Provisions/Requirements section, para. 1). OSHA standards require employers to adopt certain principles and practices to create safe working environments. It is the responsibility of employers to become familiar with OSHA standards that are applicable to their employees' job functions (DOL, n.d.b).

NOTE: In the following sections and in the remainder of the course, the *Reference Manual* and associated tabs will be referenced.

✔ **Knowledge Check:**

How does the OSHA Act of 1970 apply to emergency response?



Notes:

OSHA Application to Emergency First Responders

Review Tab 1, page 17, in the *Reference Manual*. Paragraph 5 provides the definition of employer, which “means a person engaged in a business affecting commerce who has employees, but does not include the United States or any state or political subdivision of a state” (OSH Act of 1970, Pub. L. No. 91-596, 84 Stat. 1950, 1970, as amended through January 1, 2004).

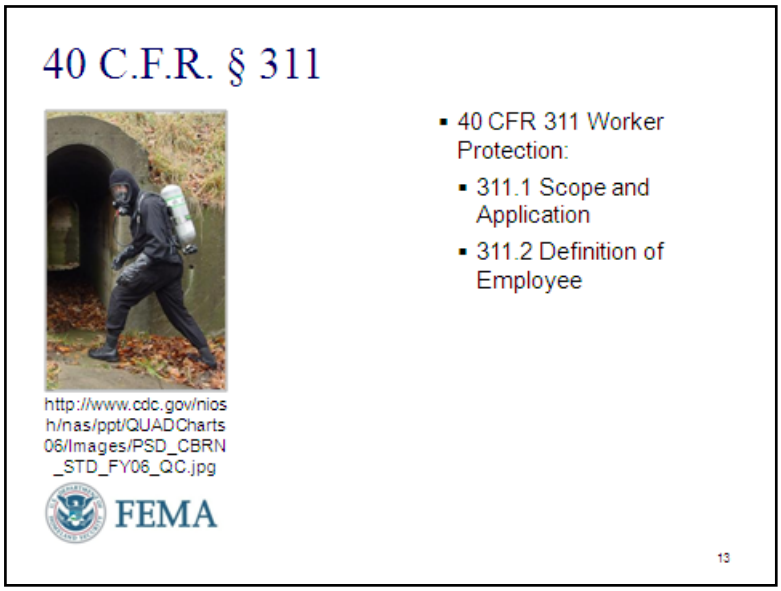
Executive Order 12196 is located in Tab 1, pages 21-26, which was signed 10 years after the OSH Act of 1970. Within Section 1-101, the president is speaking to the heads of all agencies within the Executive Branch, which includes all cabinet-level agencies, making everyone under those agencies subject to the law.

Tab 1, page 27, provides a listing of the states that operate under their own OSHA-approved state plans. Connecticut, Illinois, New York, New Jersey, and the U.S. Virgin Islands have exercised their rights under Section 18 (Tab 1, page 19) to make their own law that applies only to public employees. All other employers/employees remain protected by the Federal OSHA standard.

Key Point:

State plans must be equal to or provide more protection than the Federal plan.

Notes:



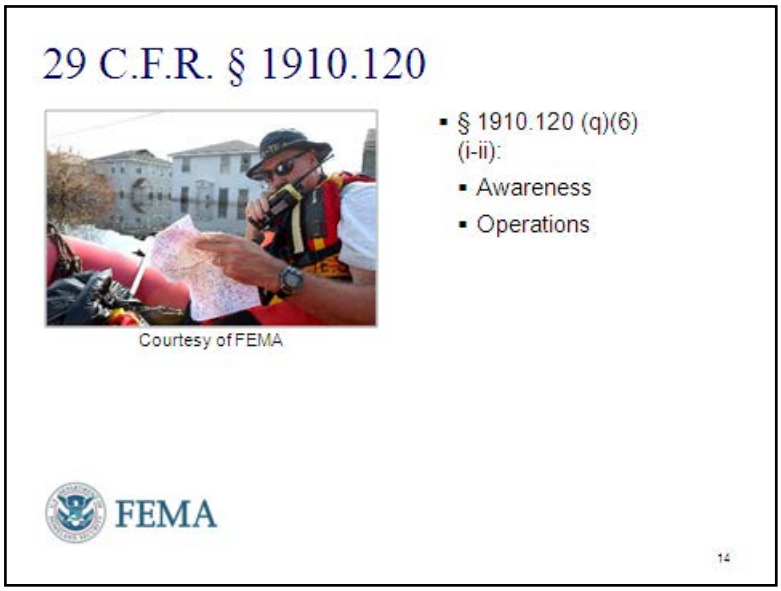
40 C.F.R. § 311

An excerpt of Worker Protection, 40 C.F.R. § 311 (2012) is located in Tab 6, page 2. Within Tab 6, § 311.1 (2012) refers to Hazardous Waste Operations and Emergency Response (HAZWOPER), 29 C.F.R. § 1910.120(a) (2013). In order for § 311.1 to apply, there should be an association of text from § 1910.120(a) (2013) to emergency response actions. Review § 1910.120(a)(1)(i-v) (2013), and note that, at a minimum, § 1910.120(a)(1)(v) addresses emergency response to releases or to the threat of releases, regardless of the location. Section 311.2 applies to responders who are compensated or uncompensated (paid or volunteer).

Tab 3, pages 3 and 4, provides the scope, application, and definitions associated with § 1910.120 (2013). Review Tab 3, page 4, § 1910.120(a)(1)(v) (2013), which explains how application is made to the emergency response community, which makes § 311.1 apply; thus, § 311.2 is applicable as well.

Tab 3, page 5, provides the definition of emergency response, which is "…a response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid agreement groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance" (HAZWOPER, 29 C.F.R. § 1910.120[a][3], 2013).

Notes:



29 C.F.R. § 1910.120

Tab 3, pages 44 – 53, describes § 1910.120(q) (2010), which discusses an emergency response program to hazardous substance releases. In § 1910.120(q)(6)(i) (2013), including paragraphs A–F, an explanation is given about how PPE and respiratory protection is applicable at the awareness and operations levels.

Notes:

Regulations, Laws, and Standards

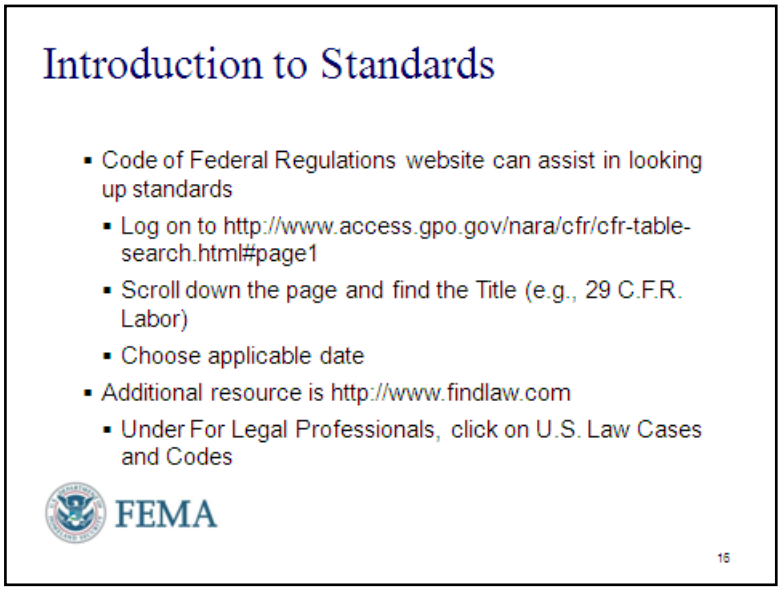
Regulatory standards are based on laws. In this context, employers and employees are held accountable for violating a regulation or standard, founded under law, and could possibly be penalized. Consensus standards typically are not cited, unless placed within a regulation or official standard. These standards can fall under OSHA, the EPA, or other Federal, state, or local laws or regulatory requirements. Consensus standards contain important information on procedures and practices that enhance responders' ability to safely react and respond to CBRN hazards. However, published references are from people who have researched and written about hazards, and while valuable, they are not regulatory law.

✔ **Knowledge Check:**

What regulations, laws, and standards must responders consider when responding to a CBRN hazard?

Notes:

Enabling Learning Objective 1-5: Locate the appropriate standard given a title from the C.F.R. using the OSHA website.



Introduction to Standards

To look up regulations in the C.F.R., use the following steps:

- Log on to http://www.access.gpo.gov/nara/cfr/cfr-table-search.html#page1.
- Scroll down the page and find the Title (e.g., 29 C.F.R. Labor).
- Choose the most recent date for the standard.
- Follow the links to get to the standard.

An additional resource to find C.F.R. regulations is www.findlaw.com.

- Log on to http://www.findlaw.com.
- Under For Legal Professionals, click on U.S. Law Cases and Codes.

Notes:

Within Tab 2, pages 4 and 5, the C.F.R. website can perform a search to locate particular regulations.

Tab 2, pages 6–9, explain the paragraph numbering system of the Occupational Safety and Health Standards. The numbering system assists in understanding how to read the regulations used throughout this course.

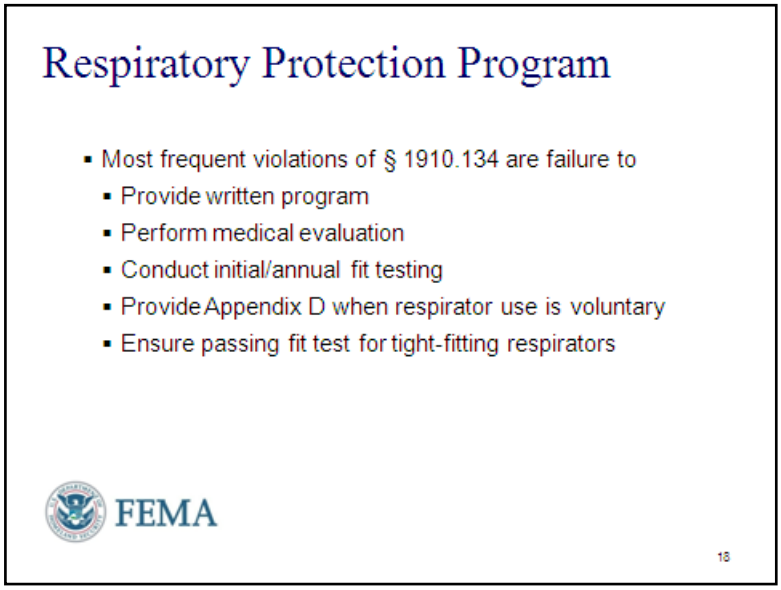
Occupational Safety and Health Administration Website

There are several ways to access OSHA's laws and regulations, such as Respiratory Protection, 29 C.F.R. § 1910.134 (2013). The following steps illustrate one approach to finding laws and regulations:

- Log on to http://www.osha.gov.
- Click on the A to Z Index on the top of the screen.
- Scroll down to Regulations and Laws, or click on R and then on Regulations and Laws.
- Finally, choose the applicable Part.

Notes:

Enabling Learning Objective 1-6: Identify lessons learned based on a case study.



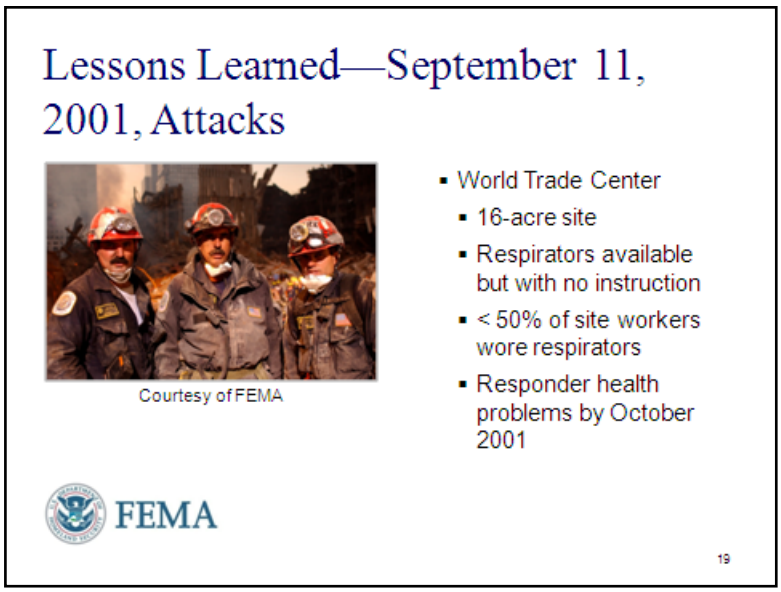
Respiratory Protection Program

A written respiratory protection program is vital to ensuring the safety of responders. The Respiratory Protection Standard is also in the "Top 10 Most Cited" standards by OSHA. In 2009, there were 3,803 total violations of § 1910.134 (Walter, 2009). The five most frequent violations were lack of a written program, failure to perform medical evaluations, failure to conduct initial/annual fit testing, failure to provide (Mandatory) Information for Employees Using Respirators When not Required Under Standard, Appendix D to § 1910.134, when respirator use is voluntary, and failure to ensure that employees using a tight-fitting facepiece respirator pass a qualitative or quantitative fit test (Risk Control Services, n.d.). In 2009, the Respiratory Protection Standard had moved to fourth place in OSHA's top industry violations (Walter, 2009).

A key element in a respiratory protection program is the involvement of the employees. When there is a good relationship between management and the workers, the program will succeed. A 2003 survey from the U.S. Bureau of Labor Statistics concluded that a large percentage of companies may not comply with § 1910.134. The survey found that in nearly half of the

Notes:

companies where respirator use was required, the workers had not had a medical assessment to determine their fitness to wear a respirator. According to Dr. Roy McKay, the Director of Occupational Pulmonary Services at the University of Cincinnati, it is not uncommon for small- and medium-size organizations to have inadequacies in their respiratory protection programs. Worker participation is vital for the most fundamental reasons: If a respirator is not comfortable, a worker will not use it, and if the respirator does not fit well, it will not be effective. It is important to keep workers actively involved in the respiratory protection program, and a good way to do this is through fit testing and annual training required by OSHA regulations (Nash, 2003).



Notes:

Lessons Learned—September 11, 2001, Attacks (continued)

Courtesy of FEMA

- Pentagon
  - Smaller, tightly controlled site
  - Required proper protection
  - Workers removed if not properly protected
  - HAZMAT guidelines used
  - No known health problems

20

Notes:

Case Study: Lessons Learned—September 11, 2001, Attacks

The September 11, 2001, terrorist attacks created an occupational health and safety challenge for both the city of New York and the Pentagon. Both sites required firefighters and rescue workers to respond to the disaster. In the early days of the attack, there were immediate respiratory hazards, including explosions, fire, falling debris, and dust clouds that contained pulverized building materials. The particulate matter in the air persisted for weeks after the initial attacks. New York City and the Pentagon responded to the respiratory protection issues facing the workers in different ways. As a result, lessons were learned regarding behavior modifications in order to protect workers' respiratory health during a large-scale terrorist attack.

The rescue and recovery operations at the World Trade Center were more complex and involved than any previous disaster of that type. Because of the destruction, firefighters, police officers, emergency workers, and volunteers rushed to the 16-acre site to assist. Ground Zero was filled with a toxic mixture of asbestos particles, shards of fiberglass, and other toxins from the collapse of the Twin Towers. During the rescue operations, many firefighters, volunteers, and cleanup workers did not wear their respirators or were wearing the equipment improperly. Many reasons were given for the lack of respiratory protection, including that the respirators were uncomfortable and interfered with communications or visual acuity (Loiy & Gochfeld, n.d.).

Respirators were made available on site to workers; however, making the respirators available was not enough. During the first weeks after the attack, OSHA issued 4,000 respirators per day (Miles, n.d.). While there were respirators available at the supply depot on the World Trade Center site, there were no instructions provided, and response personnel coming in for protective equipment were left to determine which respirators were appropriate. By the second week, a respirator fit testing program was introduced. As the response phase turned into the recovery phase, the work population changed from volunteers to contract workers. As a result, most of the contract workers were required to be a part of the respiratory protection program. Studies show that the percentage of site workers who actually wore respirators did not exceed 50% and even the trained firefighters on the scene did not achieve full use of respirators (Loiy & Gochfeld, n.d.).

Notes:

Case Study (continued): Loiy and Gochfeld's (n.d.) study concluded that there were three perceptions that caused respiratory protection to be underutilized in the World Trade Center response: protecting oneself was somehow inappropriate; the environment was only irritating and not really hazardous to health; and the discomfort, inconvenience, and interference by the respirator exceeded any benefit.

The Pentagon site was smaller and more contained than the World Trade Center. Like the World Trade Center, the Pentagon also had hazardous residues, including byproducts of combustion, lead, asbestos, and other toxins as well as dust particles. Because of toxic substances, full-body protective suits and respiratory protection were used. It was also necessary to periodically assess whether the previously contaminated area was safe to enter without PPE. Days after the attack, Navy industrial hygienists were assigned to the Pentagon recovery operation. The duties of the hygienists were to collect environmental samples and continually assess the site for health hazards ("Industrial Hygienists Clear the Air," n.d.).

The Pentagon site required all workers to wear proper protective gear. If a worker did not adhere to wearing the proper protective equipment, they were escorted off the site and not allowed to work. The workers abided by the hazardous materials (HAZMAT) guidelines, and the site was tightly controlled. Due to this policy, workers at the Pentagon site suffered no documented long-term health problems. However, those who worked at the World Trade Center have not been so fortunate. Hundreds of responders and contractors have developed long-term health problems as a result of their work at Ground Zero. Doctors began seeing responders develop health problems related to the dust at the World Trade Center site as early as October 2001 (Torres, 2006).

✔ **Knowledge Check:**

What was the difference between the Ground Zero response and the Pentagon response in relation to respiratory protection measures?

How do the procedures in your jurisdiction relate (similar or dissimilar) to the Ground Zero and Pentagon procedures?

Notes:

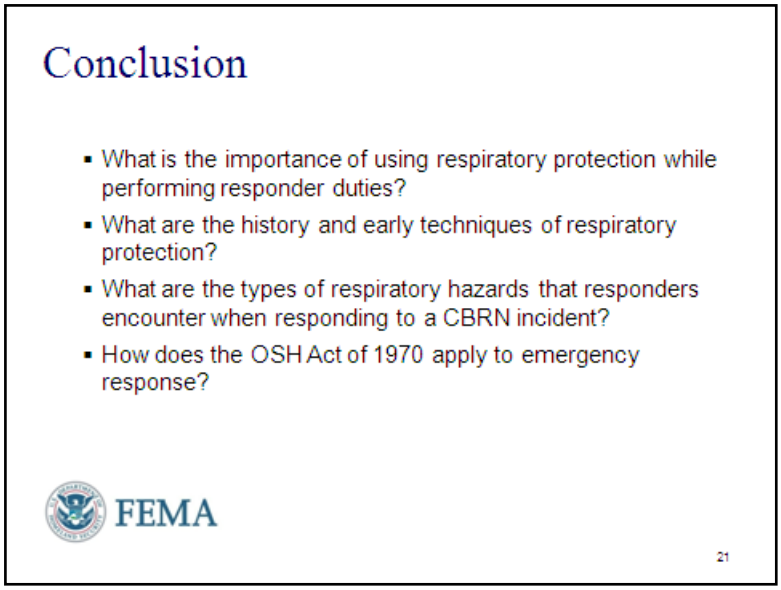
Activity:

In a group discussion, answer the following questions using the "placemat":

Which laws and regulations apply to you and your agency? How do those laws apply?

Each person's responses are included in one of the sections on the "placemat." Use the "placemat" to organize your group's answers. Each group collectively decides on the top five most important responses and records them in the center of the placemat. At the end of the activity, each group presents its answers to the larger group for review and discussion. In the outer spaces of the Placemat Handout, each participant writes down his or her answers to the questions. The circle, in the middle of the diagram, is where to write down similar points of each participant.

Each group presents its common points to the class.



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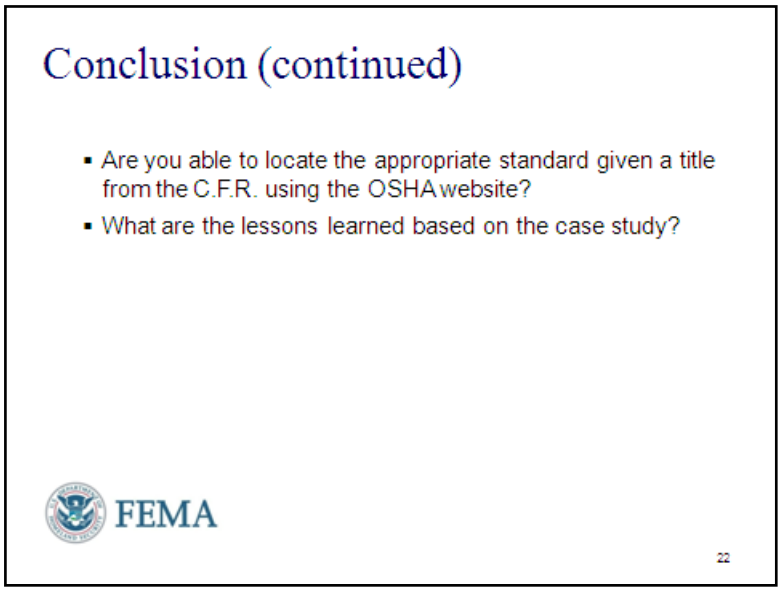

Conclusion

A respirator is designed to prevent inhalation of harmful airborne substances and has two general fit types: tight-fitting and loose-fitting. The use of respirators is guided by the § 1910.134 standard.

Regulatory standards are based on laws and guided by Federal, state, and local laws and regulatory requirements. Consensus standards are guidelines that typically are not cited, unless placed within a regulation or official standard. Two regulatory standards that apply to respiratory protection are § 1910.120, HAZWOPER, which establishes important requirements for both industry and public safety agencies, and § 1910.134, Respiratory Protection.

Responders should be able to recognize and protect themselves from hazards. These hazards include thermal, radiological, asphyxiation, chemical, etiological, and mechanical. These hazards can enter the body through four routes: inhalation, absorption, contact, and ingestion (NFPA, 2007; 2008 edition). Inhalation is the most common exposure route and can be the most damaging.

A key element of a respiratory protection program is the involvement of employees. A good way to achieve this involvement is through fit testing and annual training.

Notes:

The September 11, 2001, terrorist attacks created occupational health and safety challenges to New York City and the Pentagon. Each site handled the respiratory protection of responders and workers differently. The lessons learned from each site will help better prepare responders and workers for future challenges of working in hazardous environments. Not only can these lessons be applied to working in a post-attack environment but also in other hazardous emergencies that require worker and responder protection.

Notes:

References

Note: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

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Industrial hygienists clear the air after Pentagon terrorist attack. (n.d.). Retrieved from http://www.safetycenter.navy.mil/success/stories/51-100/0079.pdf

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U.S. Department of Labor. (n.d.b). *Safety and health standards: Occupational safety and health*. Retrieved from http://www.dol.gov/compliance/guide/osha.htm

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Worker Protection, 40 C.F.R. § 311 (2012).

Hazardous Waste Operations and Emergency Response

Duration: 2.00 Hours

Summary: Participants review employer and employee issues concerning working with hazardous materials (HAZMAT) per Hazardous Waste Operations and Emergency Response (HAZWOPER), 29 *Code of Federal Regulations* (C.F.R.) § 1910.120 (2013). The information in this module provides an overview of the standard and appendices and how to apply the standard to the emergency response program to hazardous substance releases. The five types of operations in regards to HAZMAT are reviewed. Participants identify personal protective equipment (PPE), site control, training, employee protection, decontamination, and other issues. Additionally, participants identify emergency response by employees at uncontrolled hazardous waste sites, new technology programs, operations conducted under the Resource Conservation and Recovery Act (RCRA), medical surveillance and consultation, and the procedures of an emergency response program for hazardous substance release per § 1910.120(q). Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate document provided to participants, as § 1910.120 is reviewed. Participants are divided into two groups that are approximately equal in size. Module 2 and Module 3, "CNC Fit Testing Technology Exercise," are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions. The second group attends the "CNC Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Terminal Learning Objective: At the conclusion of this module, participants will be able to apply applicable § 1910.120 standards during an emergency response.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

2-1 Identify the five operations that HAZWOPER applies according to § 1910.120(a)(i–v).

2-2 Identify the requirements of an emergency response program for hazardous substance releases according to § 1910.120(q).

2-3 Explain how the § 1910.120 appendices are applied prior to a response.

Practical Exercise: Participants take part in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. In small groups, participants answer questions pertaining to § 1910.120 in order to identify the five operations that employers and employees may be engaged in, the requirements of an emergency response program for hazardous substance releases, and how appendices are applied. Additionally, the activity allows participants to explain the requirements of an emergency response program for hazardous substance releases. The time for this activity is approximately 15 minutes.

Risk Assessment: Low

Methods of Instruction: Instructors use a facilitated lecture format supported by presentation visuals. Reflective questioning challenges participants' critical thinking skills and reinforces module content. Participants take part in instructor-guided and collaborative knowledge checks throughout the module in which participants identify the five types of operations that employers can be engaged in, the procedures of an emergency response

program for hazardous substance releases, and how appendices are applied. Participants take part in a small-group activity in which they read a statement and locate where in the standard it applies, allowing participants to identify key module concepts.

Instructor-to-Participant Ratio: 1:15

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participant comprehension based upon their presentation of key points from their small group's discussions. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: Participants are divided into two groups that are approximately equal in size. Module 2 and Module 3, "CNC Fit Testing Technology Exercise," are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions using a case study. The second group attends the "CNC Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Objectives

- Identify the five operations that employers and employees may be engaged in
- Identify the procedures of an emergency response program for hazardous substance releases
- Explain how the § 1910.120 appendices are applied prior to a response

FEMA

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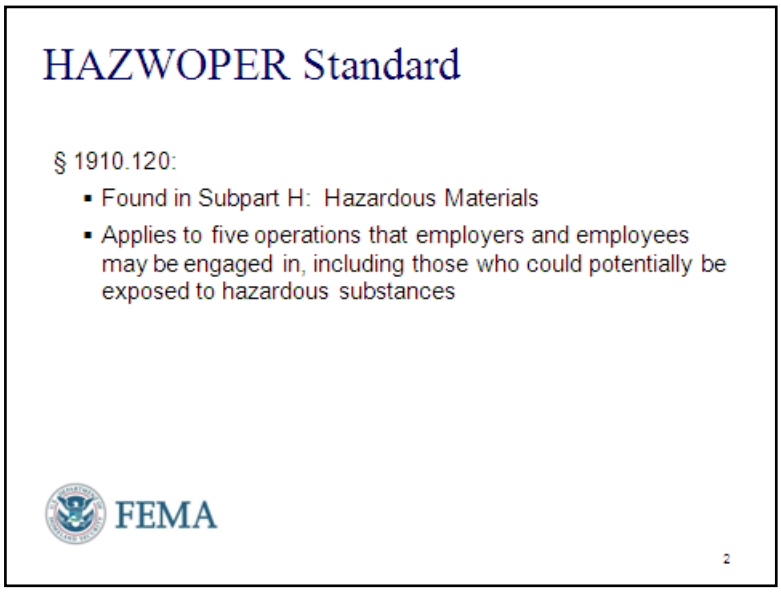
Notes:

Enabling Learning Objective 2-1: Identify the five operations that HAZWOPER applies according to § 1910.120(a)(i–v).



HAZWOPER Standard

NOTE: In the following sections, the *Reference Manual* and associated tabs are referenced.

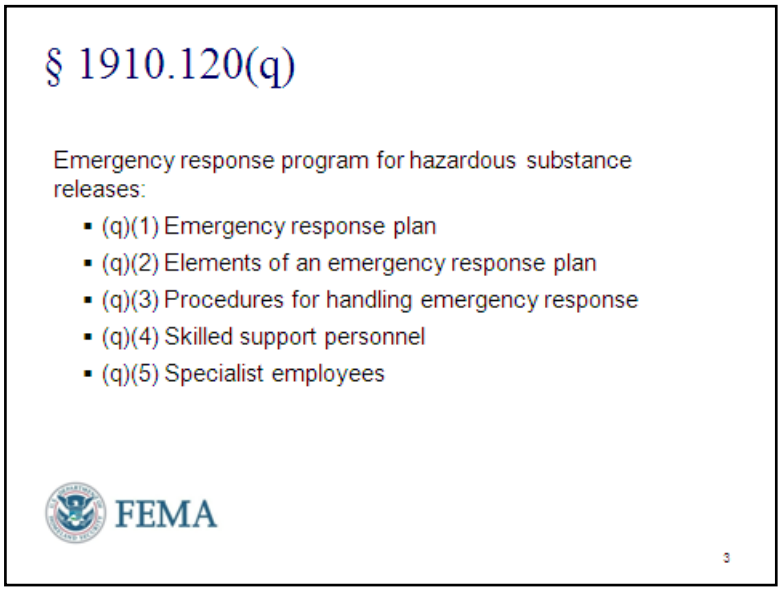
HAZWOPER applies to five types of employers and their employees, including those who are exposed or could potentially be exposed to hazardous substances in one of the following functions, as stated in § 1910.120(a)(1)(i-v):

- Cleanup operations required by a governmental body, whether Federal, state, local, or other, involving hazardous substances that are conducted at uncontrolled hazardous waste sites. . .;
- Corrective actions involving cleanup operations at sites covered by the RCRA as amended (42 U.S.C. 6901 et. seq.)
- Voluntary cleanup operations at sites recognized by Federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites

Notes:

- Operations involving hazardous wastes that are conducted at treatment, storage, and disposal facilities regulated by 40 C.F.R. Parts 264 and 265 pursuant to RCRA, or by agencies under agreement with the U.S. Environmental Protection Agency to implement RCRA regulations
- Emergency response operations for releases of, or substantial threats of release of, hazardous substances (2013)

Enabling Learning Objective 2-2: Identify the requirements of an emergency response program for hazardous substance releases according to § 1910.120(q).



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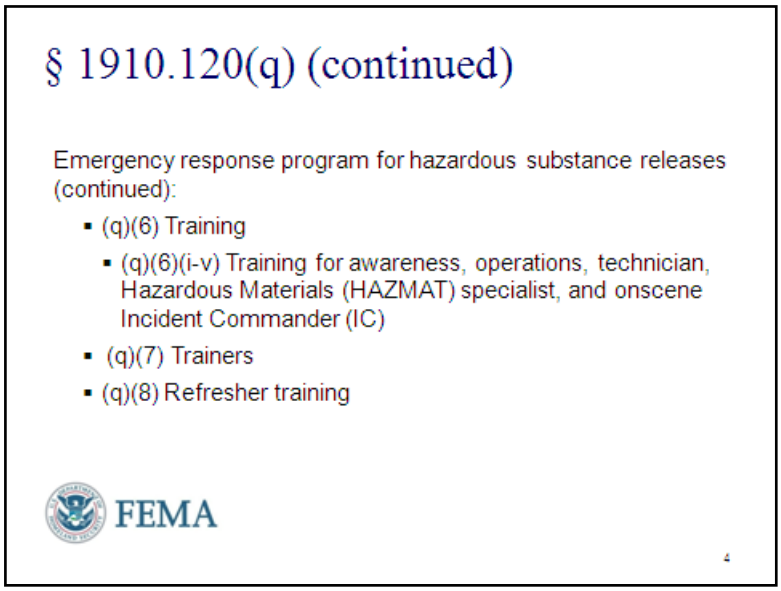


§ 1910.120(q)

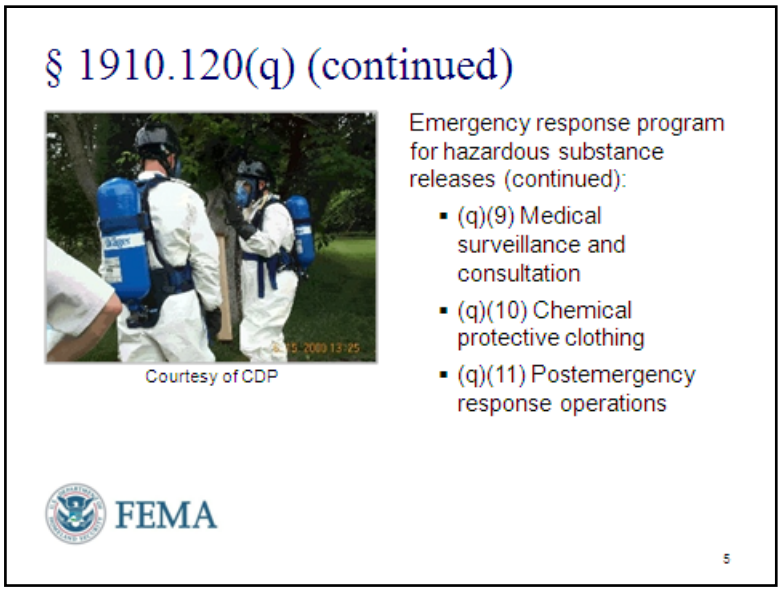
Tab 3, pages 44–53, covers § 1910.120(q) (2013), which provides requirements of an emergency response program for hazardous substances and releases. Review § 1910.120(q)(1–5), located in Tab 3, pages 44–48. Topics located in § 1910.120(q)(1–5) (2013) include the emergency response plan and its components, procedures for managing an emergency response, skilled support personnel, and specialist employees. In § 1910.120(q)(4) (2010), note that an administrator may be called to provide instruction to skilled support personnel on how to use PPE.

Review Tab 3, pages 48–52, which cover § 1910.120(q)(6)(i–v) (2013). These standards contain information on the different responder certification levels of training (awareness, operations, technician, hazardous materials [HAZMAT] specialist, and onscene Incident Commander [IC]).

Section 1910.120(q)(7–11), located on pages 52–53 in Tab 3, provides information on trainers, refresher training, medical surveillance and consultation, chemical-protective clothing, and post-emergency response operations (HAZWOPER, 29 C.F.R. § 1910.120, 2013). Additionally, medical surveillance is directed back to § 1910.120(f) (2013). Section 1910.120(q)(9)(1) (2013)

Notes:

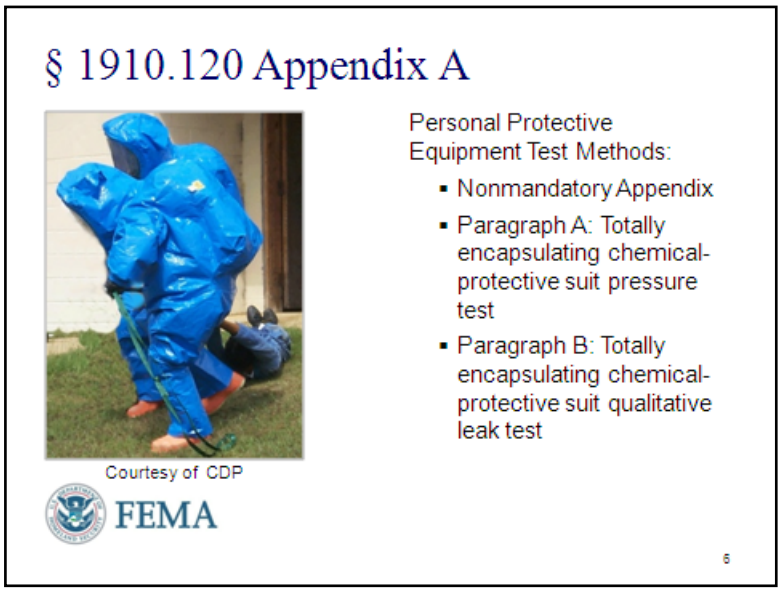
states, “Members of an organized and designated HAZMAT team and hazardous materials specialist shall receive a baseline physical examination and be provided with medical surveillance as required in paragraph (f) of this section.”



Section 1910.120(q) (2013) also states that a responder qualified to use respiratory protection does not have to stop assisting in the response to an emergency to train those who are unqualified. If a mutual aid agreement is utilized for a response, responders under the agreement are held under the same standard as the responders in that jurisdiction.

Notes:

Enabling Learning Objective 2-3: Explain how the § 1910.120 appendices are applied prior to a response.



§ 1910.120 Appendix A

Personal Protective Equipment Test Methods, Appendix A to § 1910.120 (2013) is located on pages 55–63 in Tab 3. This "sets forth the non-mandatory examples of tests which may be used to evaluate compliance with paragraphs § 1910.120(g)(4)(ii) and (iii)" (Personal Protective Equipment Test Methods, Appendix A to 29 C.F.R. § 1910.120, 2013).

Section 1910.120 (2013), Appendix A, Paragraphs A and B provide the scope, term descriptions, test method summaries, required supplies, safety precautions, test and retest procedures, and reports for the totally encapsulated chemical-protective suit pressure test and qualitative leak test (Personal Protective Equipment Test Methods, Appendix A to 29 C.F.R. § 1910.120, 2013). Paragraph A is specific to the suit pressure test while Paragraph B is specific to the qualitative leak test.

Notes:

§ 1910.120 Appendix B

Appendix B: General Description and Discussion of the Levels of Protection and Protective Gear:

- Part A, I: Level A
- Part A, II: Level B
- Part A, III: Level C

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§ 1910.120 Appendix B (continued)

Appendix B: General Description and Discussion of the Levels of Protection and Protective Gear (continued):

- Part A, IV: Level D
- Part B: Describes the types of hazards for which Levels A, B, C, and D protection are appropriate

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Notes:

§ 1910.120 Appendix B

General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to § 1910.120 (2013), located on pages 65–69 in Tab 3, provides guidelines on selecting the appropriate level of PPE (A, B, C, or D). Section 1910.120 (2013), Appendix B, Part B, describes the types of hazards for which PPE Levels A, B, C, and D are appropriate. The following is excerpted from § 1910.120 (2013), Appendix B, Part B and is located on pages 68–69 of Tab 3.

> As an aid in selecting suitable chemical protective clothing, it should be noted that the National Fire Protection Association (NFPA) has developed standards on chemical protective clothing. The standards that have been adopted by include:
>
> NFPA 1991—Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies (EPA Level A Protective Clothing)
>
> NFPA 1992—Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies (EPA Level B Protective Clothing)
>
> NFPA 1993—Standard on Liquid Splash-Protective Suits for Non-emergency, Non-flammable Hazardous Chemical Situations (EPA Level B Protective Clothing)
>
> These standards apply documentation and performance requirements to the manufacture of chemical protective suits. Chemical protective suits meeting these requirements are labeled as compliant with the appropriate standard. It is recommended that chemical protective suits that meet these standards be used.

The following are guidelines an employer can use to begin the selection of the appropriate PPE, which are located in § 1910.120 (2013), Appendix B, Part A. The site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A, B, C, or D) to suit different hazards. Take into consideration that the listing below does not fully address the performance of the specific PPE in relation to the specific hazards at the job site and that PPE selection, evaluation, and reselection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

The following is excerpted from § 1910.120 (2013), Appendix B, Part A and is located on pages 66–67 of Tab 3.

I. Level A—is to be selected when the greatest level of skin, respiratory, and eye protection is required.

Notes:

The following constitute Level A equipment; it may be used as appropriate;

1. Positive-pressure, full-facepiece Self-Contained Breathing Apparatus (SCBA), or positive-pressure Supplied Air Respirator (SAR) with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally encapsulating chemical-protective suit.
3. Coveralls. (1)
4. Long underwear. (1)
5. Gloves, outer, chemical resistant.
6. Gloves, inner, chemical resistant.
7. Boots, chemical resistant, steel toe and shank.
8. Hard hat (under suit). (1)
9. Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally encapsulating suit).

   Footnote (1) Optional, as applicable.

II. Level B—The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.

The following constitute Level B equipment; it may be used as appropriate.

1. Positive-pressure, full-facepiece SCBA, or positive-pressure SAR with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls. (1)
4. Gloves, outer, chemical resistant.
5. Gloves, inner, chemical resistant.
6. Boots, outer, chemical resistant steel toe and shank.
7. Boot covers, outer, chemical resistant (disposable). (1)
8. Hard hat. (1)

Notes:

9. [Reserved]
10. Face shield. (1)

    Footnote (1) Optional, as applicable.

III. Level C—The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met.

The following constitute Level C equipment; it may be used as appropriate.

1. Full-face or half-mask, air purifying respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls. (1)
4. Gloves, outer, chemical resistant.
5. Gloves, inner, chemical resistant.
6. Boots (outer), chemical resistant steel toe and shank. (1)
7. Boot covers, outer, chemical resistant (disposable). (1)
8. Hard hat. (1)
9. Escape mask. (1)
10. Face shield. (1)

    Footnote (1) Optional, as applicable.

IV. Level D—A work uniform affording minimal protection: used for nuisance contamination only.

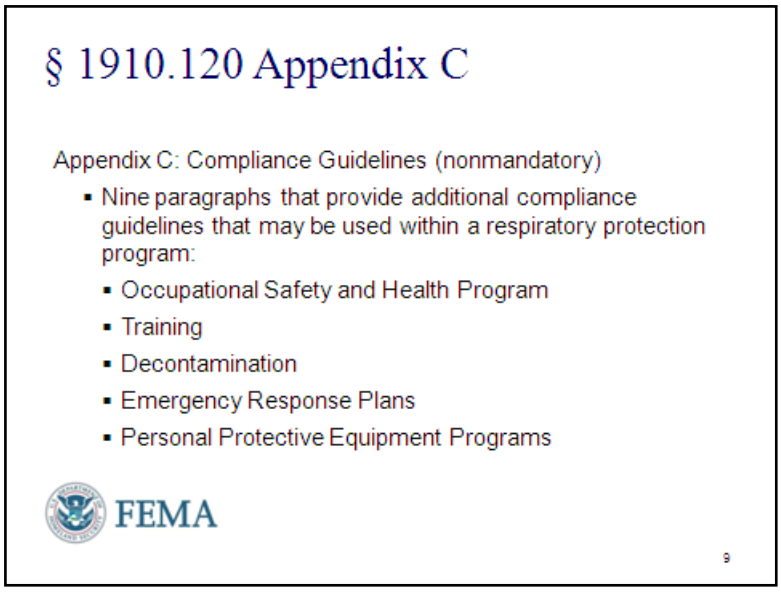
The following constitute Level D equipment; it may be used as appropriate:

1. Coveralls.
2. Gloves. (1)
3. Boots/shoes, chemical resistant steel toe and shank.
4. Boots, outer, chemical resistant (disposable). (1)
5. Safety glasses or chemical splash goggles. (1)

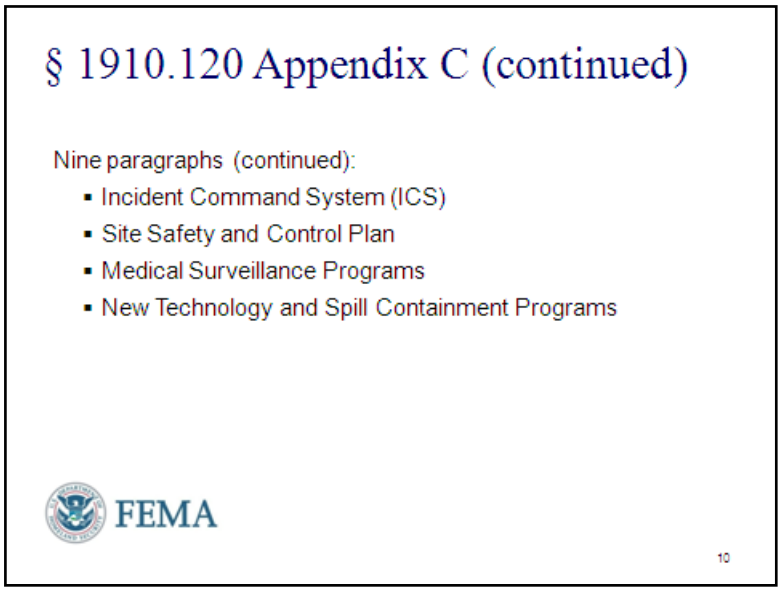
Notes:

6. Hard hat. (1)
7. Escape mask. (1)
8. Face shield. (1)

Footnote (1) Optional, as applicable. (para. Part A)



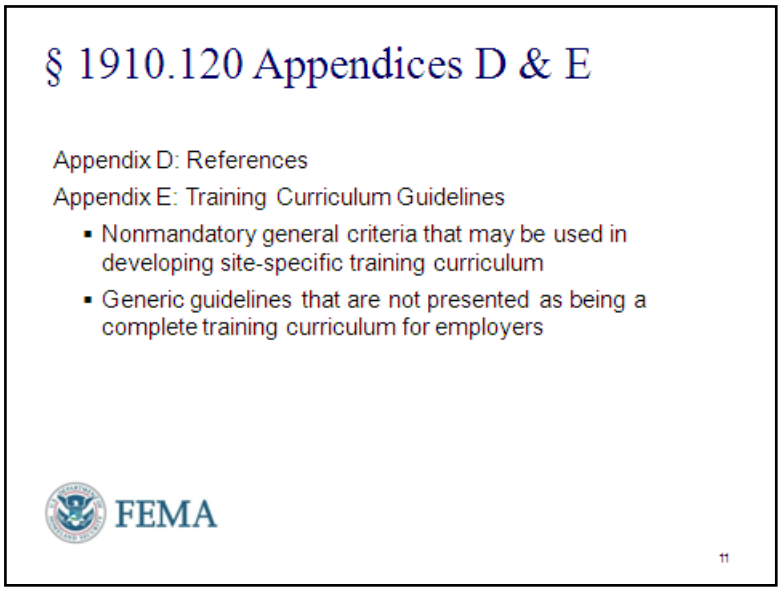
Notes:



§ 1910.120 Appendix C

Compliance Guidelines, Appendix C to § 1910.120 (2013) is located on pages 71–77 in Tab 3. Section 1910.120 (2013), Appendix C lists additional compliance guidelines that may be used within a respiratory protection program. Section 1910.120 (2013), Appendix C has nine paragraphs with the following topics: Occupational Safety and Health Program, training, decontamination, emergency response plans, PPE programs, Incident Command System (ICS), site safety and control plans, medical surveillance programs, and new technology and spill containment programs. If § 1910.120 (2013), Appendix C is used in a plan or program, then these may become compliance requirements, and, if violated, citations may be issued.

Notes:



§ 1910.120 Appendices D and E

References, Appendix D to § 1910.120 (2013) provides references that may be used to find further information about the standard; it is located on pages 78–79 in Tab 3. References 13 and 20 are sustainable references up to this point in using an air-purifying respirator (APR). Training Curriculum Guidelines, Appendix E to § 1910.120 (2013) discusses nonmandatory general criteria that may be used to develop site-specific training curriculum; it is located on pages 80–98 in Tab 3. This provides generic guidelines and is not presented as a complete training curriculum for any specific employer that may be used as supplemental information.

Activity:

Individually, read each statement and find within § 1910.120 (2013) where it applies. Working in small groups or the person next to you, answer as specifically as possible; an example is provided.

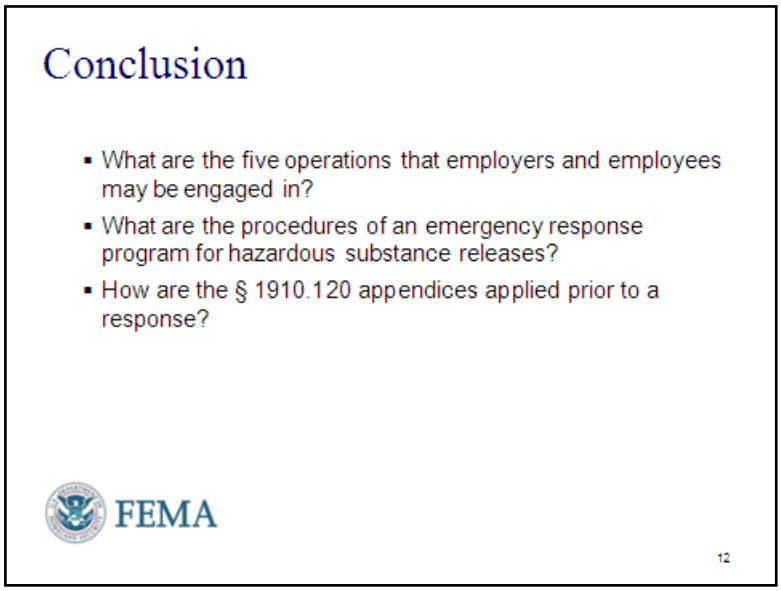
Example: A medical surveillance program shall be created by the employer for members of the HAZMAT teams.

Answer: § 1910.120(f)(2)(iv)

Notes:

1. PPE Level C is selected when the concentration(s) and type(s) of airborne substance(s) is known and the criteria for using APRs are met.
2. First responders at the operational level shall have received at least 8 hours of training, or have had sufficient experience, to objectively demonstrate competency in how to select and use proper PPE provided to the first responder at the operational level.
3. PPE Level B is selected when the highest level or respiratory protection is necessary but a lesser level of skin protection is needed.
4. Emergency responders are required to wear respirators due to emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the located of hazard.
5. First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances in a defensive fashion.
6. PPE Level D may be selected when a work uniform affording minimal protection is used for nuisance contamination only.
7. PPE Level A is selected when the greatest level of skin, respiratory, and eye protection is required.
8. Skilled support personnel shall be given an initial briefing at the site prior to their participation in any emergency response and provided instruction in the wearing of appropriate personal protective equipment.
9. First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and have an understanding of the U.S. Department of Transportation's *Emergency Response Guidebook* (*ERG*).
10. Hazardous materials specialists perform duties parallel to a HAZMAT technician; however, they are more specialized towards knowledge of various substances.

Notes:



Conclusion

It is imperative for employees to understand how wearing PPE affects their job functions, just like responders must understand how PPE affects their response. The employer and employee must also understand the importance of selecting the proper level of PPE to perform the specific tasks. Section 1910.120 (2010) provides this type of information for employees and employers to abide. All equipment should be continuously checked and maintained prior to any incident.

Notes:

References

Note: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Compliance Guidelines, Appendix C to 29 C.F.R. § 1910.120 (2013).

General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R. § 1910.120 (2013).

Hazardous Waste Operations and Emergency Response, 29 C.F.R. § 1910.120 (2013).

Personal Protective Equipment Test Methods, Appendix A to 29 C.F.R. § 1910.120 (2013).

References, Appendix D to 29 C.F.R. § 1910.120 (2013).

Training Curriculum Guidelines, Appendix E to 29 C.F.R. § 1910.120 (2013).

CNC Fit Testing Technology Exercise

Duration: 2.00 Hours

Summary: Participants are introduced to the Condensation Nuclei Counter (CNC) equipment (i.e., PortaCount® machine) and conduct an inventory check. Participants demonstrate how to use the CNC equipment in computer-assisted mode. Participants follow the manufacturer's instructions, included in the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], as they learn the fit testing technology. The computer captures the data from the testing and provides a record of training. Participants perform a Quantitative Fit Test (QNFT) using CNC technology. Instructors divide participants into two approximately equal-sized groups. Module 2, "Hazardous Waste Operations and Emergency Response," and Module 3 are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions. The second group attends the "CNC Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Terminal Learning Objective: At the conclusion of this module, participants will be able to complete a QNFT in accordance with Fit Testing Procedures (Mandatory), Appendix A, Part I to 29 *Code of Federal Regulations* (C.F.R.) § 1910.134, using the CNC fit testing technology.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

3-1 Conduct an inventory of the CNC equipment to ensure that all necessary parts are present.

3-2 Demonstrate use of the CNC technology in computer-assisted mode.

3-3 Complete a QNFT using CNC fit testing technology.

Practical Exercise: Participants take part in small-group activities and discussions as well as instructor-facilitated collaborative knowledge checks throughout the module. Participants begin the module by conducting an inventory of the CNC equipment to ensure that all necessary parts are present. If participants identify any missing parts, they are to notify the instructors. Approximate time for this activity is 10 minutes. Participants then demonstrate use of the CNC technology in computer-assisted mode. Specifically, participants perform the setup for the CNC (i.e., PortaCount machine) technologies and operate the computer software. Approximate time for this activity is 20 minutes. Working in small groups, with one participant performing as the test administrator and one as the test subject, each participant performs a QNFT, uses the information from the fit test, and determines the results based on the fit test process. The participant, under the direction of an instructor, completes a QNFT using CNC fit testing technology in accordance with § 1910.134, Appendix A, Part I (2013). Approximate time for this exercise is 30 minutes.

Risk Assessment: Low

Methods of Instruction: Participants take part in facilitated and demonstrated hands-on exercise supported by presentation visuals in a classroom environment. The instructor directs and coaches participants in performing a fit test, using the information from the fit test, and determining the results based on the fit test process. Reflective questioning challenges

participants' critical thinking skills and reinforces module content. Participants take part in instructor-guided and collaborative knowledge checks.

Instructor-to-Participant Ratio: 1:5 (The class is divided in two. One class works on Module 2 while the other works on Module 3.)

Required Reading: *Reference Manual*

Evaluation Strategies: In this hands-on exercise, participants self-assess and participate in peer-to-peer evaluations using the CNC (PortaCount) Participant Performance Checklist handout prior to assessment by the instructor. The performance checklist assesses participants' knowledge and skills in the identified operation of fit testing equipment. In addition, participants take part in instructor-guided and collaborative knowledge checks. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and answer any additional participant questions.

Special Instructions: Participants are divided into two groups that are approximately equal in size. Module 2 and Module 3, "CNC Fit Testing Technology Exercise," are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions using a case study. The second group attends the "CNC Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Objectives

- Conduct an inventory of the Condensation Nuclei Counter (CNC) equipment to ensure that all necessary parts are present
- Demonstrate use of the CNC technology in computer-assisted mode
- Complete a QNFT using CNC fit testing technology.

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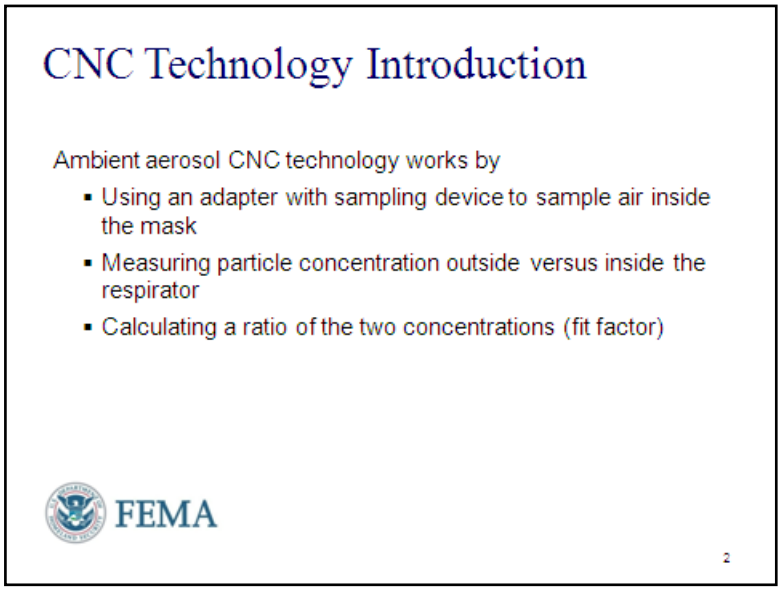
Notes:

Enabling Learning Objective 3-1: Conduct an inventory of the CNC equipment to ensure that all necessary parts are present.

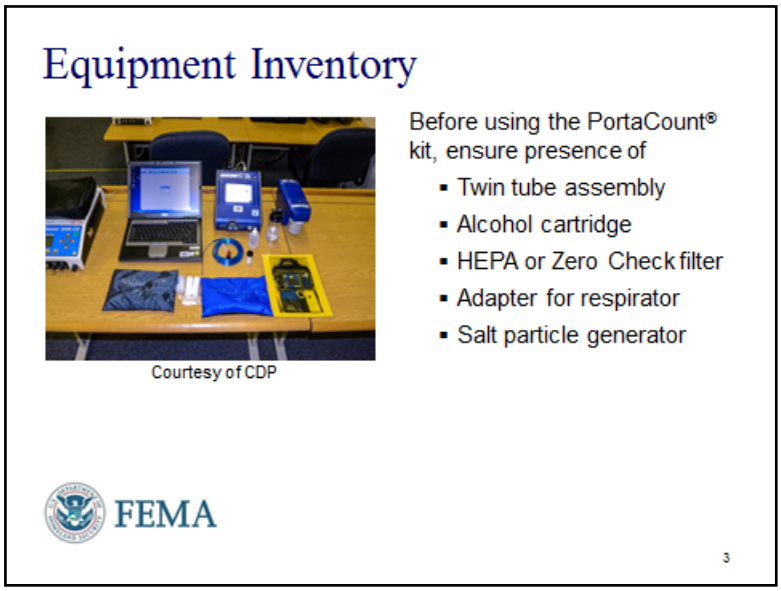


CNC Technology Introduction

Ambient aerosol CNC technology uses an adapter with a special sampling device that allows the adapter to sample air from inside the mask. An adapter is required for each make, style, and model of respirator that the employer uses. These probes may be obtained from the respirator manufacturer or distributor. The CNC technology measures the particle concentration outside the respirator against the particle concentration inside the respirator. The ratio of the two particle concentrations is the fit factor. A minimum fit-factor pass level of at least 100 is necessary for a half-mask respirator while a minimum fit-factor pass level of at least 500 is necessary for a full-facepiece, negative-pressure respirator. The PortaCount machine is an example of this technology.

NOTE: When the symbols < > appear in this module, this signifies that the participant will perform an action.

Notes:



Equipment Inventory

Before using the PortaCount machine, it is important to inspect the items needed to operate the equipment. They include a twin tube assembly, alcohol cartridge, plastic High-Efficiency Particulate Air (HEPA) or Zero Check filter, and the appropriate adapter for the respirator. Additionally, the PortaCount machine needs a power supply cable, data cable, and a computer with the FitPlus™ software.

The twin tube assembly is a pair of tubes approximately 5½ feet long. The sample tube is clear and has the word “SAMPLE” marked on it in several places along the tube. The ambient tube is blue and has the word “AMBIENT” marked on it in several places along the tube. Inspect the tube assembly for splits or cracks, and, if found, trim the tube with scissors. This ensures a good connection for the instrument and attachments.

The alcohol cartridge is stored in the alcohol fill capsule. This cartridge contains a porous wick that is soaked with reagent grade (99.5% or better) isopropyl alcohol. The alcohol level should remain at the fill line on the capsule to ensure that the wick stays saturated. A salt particle generator or candle is used to ensure that the ambient air is sufficient. However, if a candle is used, it should be kept away from the alcohol cartridge.

Notes:

The HEPA filter, also called the Zero Check filter, is used to perform the Zero Check on the PortaCount machine. In addition to the HEPA filter, the machine requires the correct adapter for the respirator used.

Enabling Learning Objective 3-2: Demonstrate use of the CNC technology in computer-assisted mode.

PortaCount Machine Instructions in Computer-Assisted Mode

Courtesy of CDP

1. Configure the PortaCount as follows:
   - Ensure the HEPA filter is not connected to the PortaCount
   - Turn the black storage cap counterclockwise and remove it

FEMA

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Notes:

PortaCount Machine Instructions in Computer-Assisted Mode (continued)

Courtesy of CDP

- Remove the alcohol cartridge
- Place the alcohol cartridge in the PortaCount machine and turn clockwise until it fits snugly
- Recap the alcohol fill capsule
- Place back in bag (in designated area)

FEMA

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PortaCount Machine Instructions in Computer-Assisted Mode (continued)

Courtesy of CDP

- Place the clear tube of the twin assembly tube on the sample port (silver port)
- Place the blue tube of the twin assembly tube on the ambient port (blue port)
- Push the tubes on tightly

FEMA

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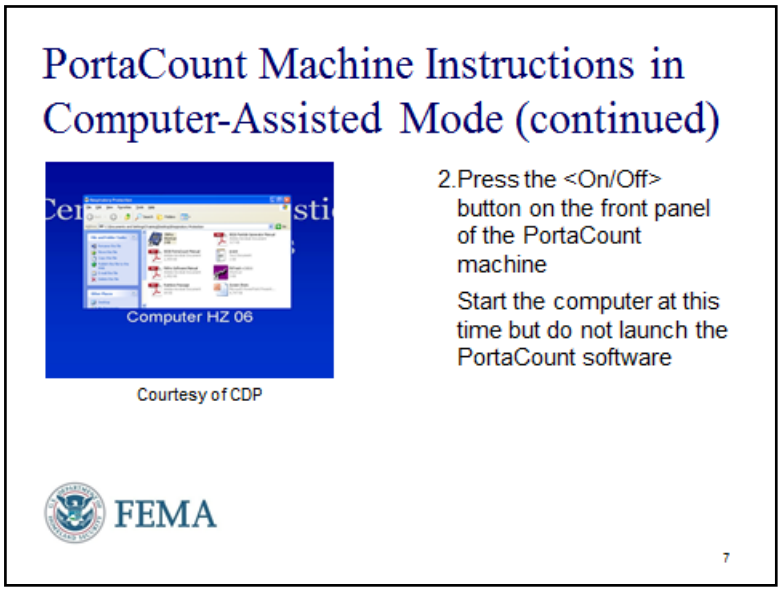
Notes:

PortaCount Machine Instructions in Computer-Assisted Mode

The following instructions for operating the PortaCount machine are based on the *PortaCount Pro 8030 and PortaCount Pro+ 8038 Respirator Fit Testers: Operations and Service Manual* (TSI, Incorporated, 2013). This manual is located on the iPad with the course materials.

1. Configure the PortaCount using the power cord, alcohol cartridge, data cable connecting the computer to the PortaCount machine, and the color-coded ambient and sample tubes.
   - Make sure the HEPA filter is not connected to the PortaCount at this time. Turn the black storage cap counterclockwise and remove it from the PortaCount machine.
   - Remove the alcohol cartridge from the alcohol fill capsule and gently shake off the excess alcohol, allowing it to drain back into the alcohol fill capsule.
   - Place the alcohol cartridge in the PortaCount machine and turn clockwise until it fits snugly.
   - Recap the alcohol fill capsule with the black storage cap, turning it clockwise until it fits snugly. Set the capsule to the side.
   - Place the clear tube of the twin assembly tube on the sample port (silver port).
   - Place the blue tube of the twin assembly tube on the ambient port (blue port).
   - Make sure to push the tubes on tightly; otherwise, if there is air leaking around the tube seal, it will affect the test.

Notes:



2. Press the <On/Off> button on the front panel to turn on the PortaCount machine.
   - Start the computer during this time, but do not launch the PortaCount software.

Notes:

PortaCount Machine Instructions in Computer-Assisted Mode (continued)

Courtesy of CDP

3. Launch the FitPro and USB icon to connect PortaCount and press<save> from the desktop icon

FEMA

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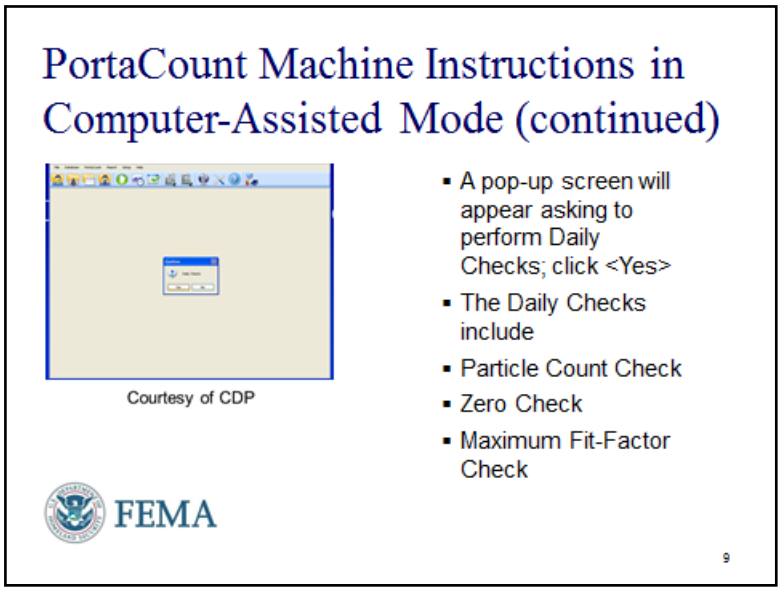
3. Launch the PortaCount software (see above) from the desktop icon.

Notes:



- When the program opens, a pop-up screen will appear asking to perform the Daily Checks; click <Yes>.
- The Daily Checks include the following:
  - Particle Count Check
  - Zero Check
  - Maximum Fit-Factor Check

Notes:

PortaCount Machine Instructions in Computer-Assisted Mode (continued)

Courtesy of CDP

4. Perform Particle Count Check. It takes approximately 10 seconds to complete

   If ambient air is not >1,000 particulates

   - Open a door
   - Use a salt particle generator

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PortaCount Machine Instructions in Computer-Assisted Mode (continued)

5. Attach the HEPA filter and perform the Zero Check. This exercise takes approximately 72 seconds to complete
6. Perform Maximum Fit-Factor Check. The computer will automatically conduct this check

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Notes:

4. Follow the directions on the screen. The computer will link with the PortaCount machine, obtaining required information and the PortaCount serial number. The message box will display to disconnect the HEPA filter or mask from the sample tube and click the <Start> button. This is the Particle Count Check; it takes about 10 seconds to complete. A message will display indicating the pass or fail of that particular test.

NOTE: The Particle Count Check is performed to determine if the concentration of the particles in the ambient air is sufficient to conduct fit testing. If the ambient air is not a minimum of 1,000 particulates, the test administrator should open a door, use a salt particle generator, or light a candle. Keep the lit candle away from the alcohol fill capsule.

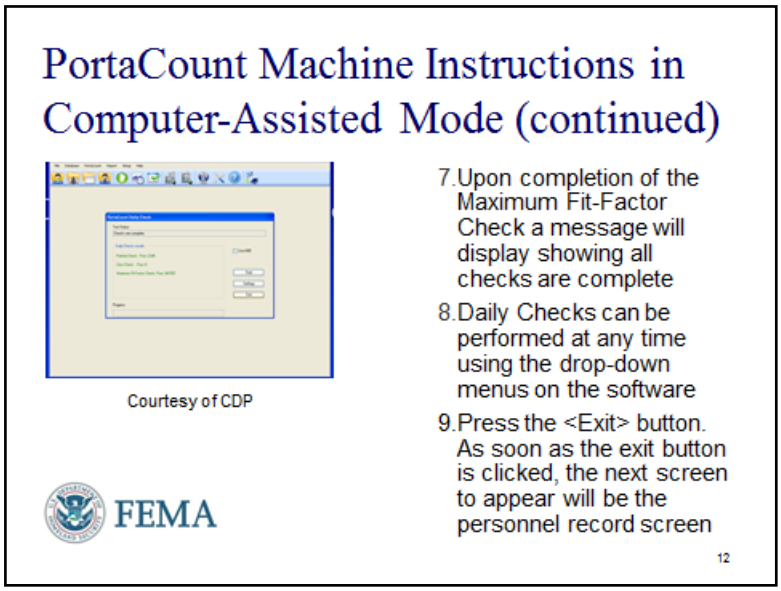
5. The next check is the Zero Check. Follow the directions on the message box. Connect the HEPA filter to the sample tube and click the <Start> button. This exercise takes approximately 72 seconds to complete. A message will display indicating the pass or fail of that particular test.

NOTE: The Zero Check ensures that there are no leaks in the system.

6. Upon completion of the Zero Check, the computer will automatically conduct the Maximum Fit-Factor Check. The HEPA filter will still be connected to the sample tube of the twin tube assembly. A message will display indicating the pass or fail of that particular test.

NOTE: The Maximum Fit-Factor Check determines if the PortaCount is capable of measuring high fit factors and if the internal switching valve is functioning properly. This is basically a fit test for the HEPA filter, which simulates a perfectly fitting respirator.

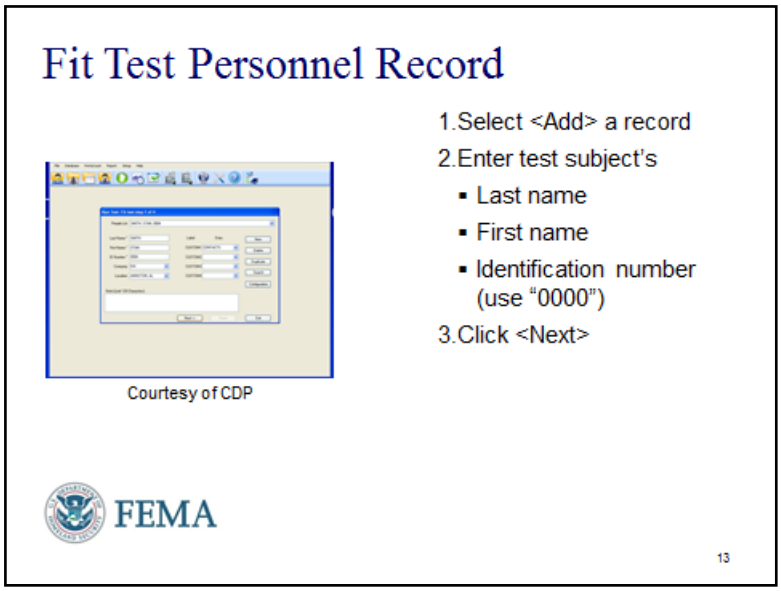
Notes:



7. Upon completion of the Maximum Fit-Factor Check, a message will display showing all checks are complete.
8. The Daily Checks are now complete and fit tests of individuals can begin. Daily Checks can be performed at any time using the drop-down menus in the FitPlus v3 software.
9. Press the <Exit> button to exit the Daily Checks screen. As soon as the Exit button is clicked, the next screen to appear will be the personnel record screen.

NOTE: The fit-test box should open. This is the location to begin entering data on the individual being fit tested. The box will have an Identification (ID) number, Last and First Name, etc. (Step 1 of 4.)

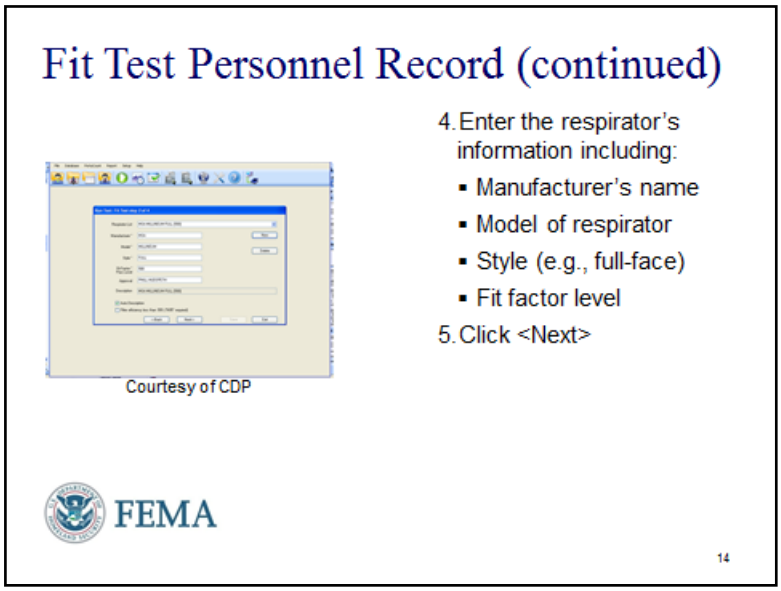
Notes:



Fit Test Personnel Record

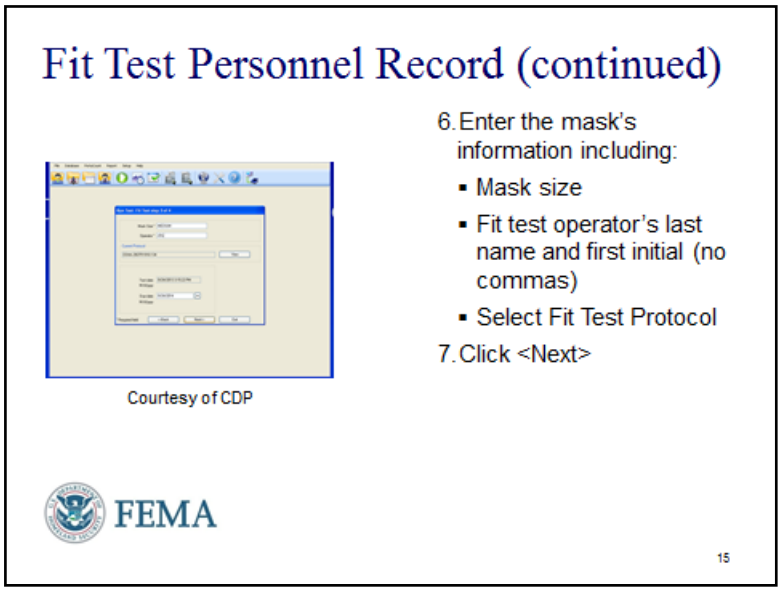
1. Select <Add> a record.
2. Type in the information about the test subject, including the following:
   - Test subject's last name
   - Test subject's first name
   - Identification number—For this course, use "0000" as the identification number.
3. Click <Next>.

Notes:



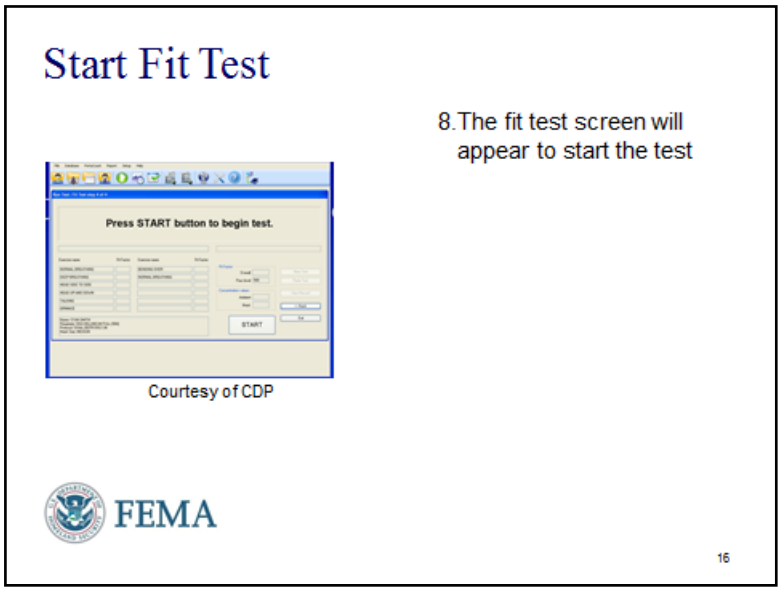
4. Type in the information about the respirator that will be used, including the following:
   - Manufacturer's name
   - Model of respirator
   - Style (e.g., full-face)
   - Fit factor level—OSHA requires a fit factor of 100 for half masks and 500 for full-face masks.
5. Click <Next>.

Notes:



6. Enter or select the information about the mask that will be used, including the following:
   - Mask size
   - Fit test operator's last name and first initial with no commas
   - Fit Test Protocol—Pay special attention to the current default fit test exercise protocol to make sure that the protocol is the one required by the jurisdiction to use.
7. Click <Next>.

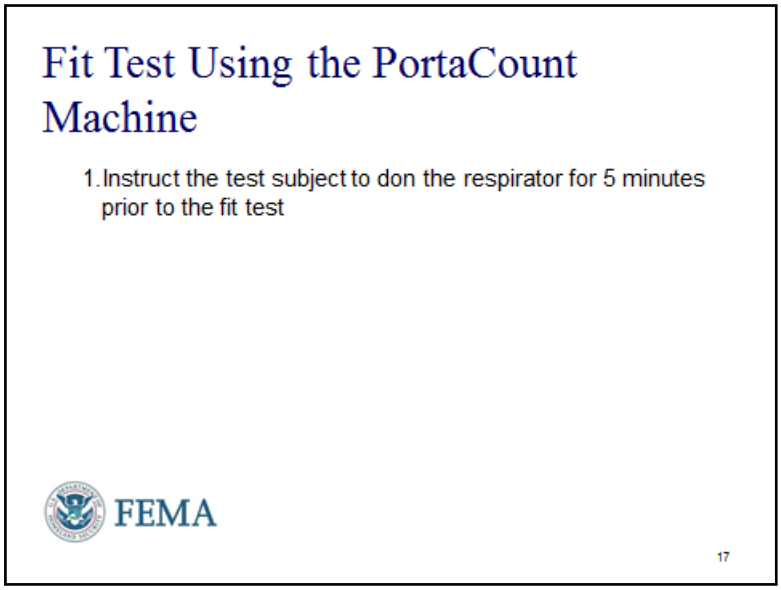
Notes:



8. The fit test screen will appear to start the test.

Notes:

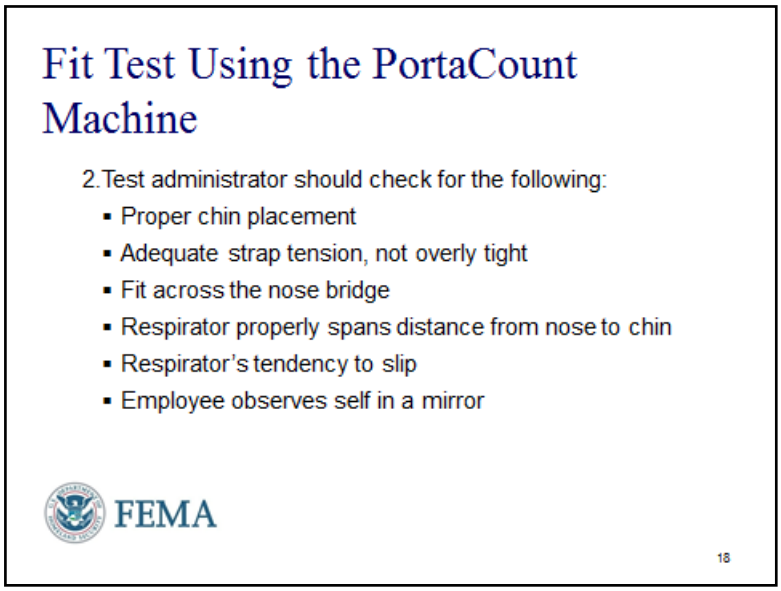
Enabling Learning Objective 3-3: Complete a QNFT using CNC fit testing technology.



Fit Test Using the PortaCount Machine

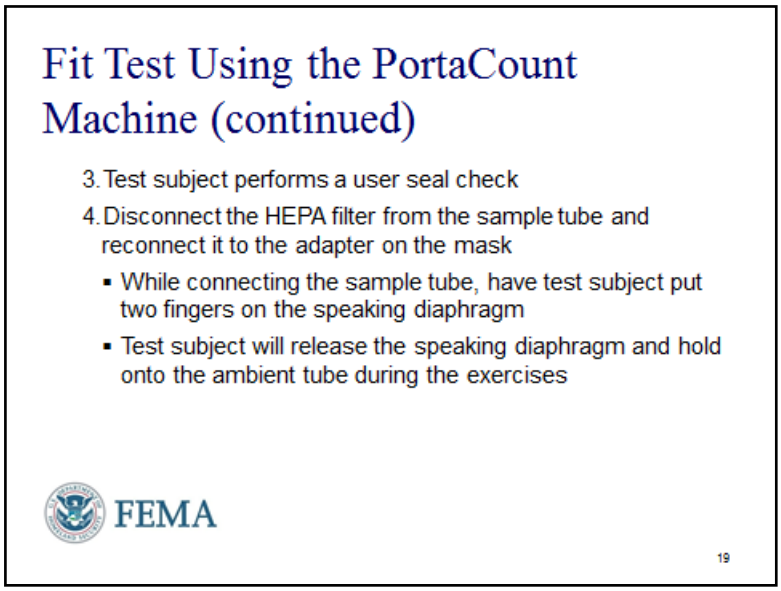
1. Instruct the test subject to don the respirator for 5 minutes before the fit test starts. This purges the ambient particles inside the respirator and allows the test subject to make certain that the respirator is comfortable.

Notes:



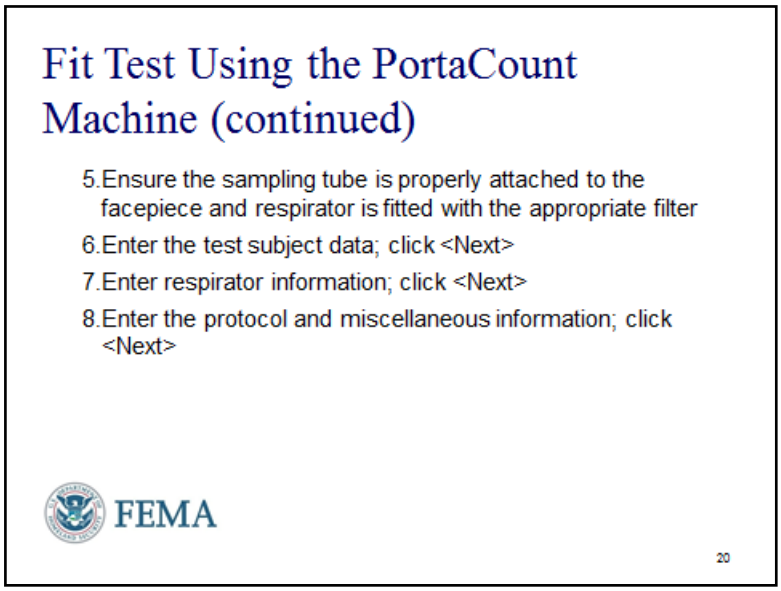
2. When ensuring that the test subject observes himself/herself in a mirror to evaluate respirator fit and position, the test administrator should check for the following:
   - Whether the chin is properly placed in the respirator
   - If strap tension is adequate (e.g., not overly tight)
   - If the respirator fits correctly across the nose bridge
   - Whether the respirator properly spans the distance from nose to chin
   - Whether the respirator tends to slip
   - The employee observes self in a mirror to evaluate the fit and respirator position.

Notes:



3. Have the test subject perform a user seal check.
4. Disconnect the HEPA filter from the sample tube and reconnect it to the adapter on the mask.
   - While connecting the sample tube, have the test subject put two fingers on his/her speaking diaphragm.
   - The test subject is to then release the two-finger hold on the speaking diaphragm and hold onto the ambient tube during the exercises.

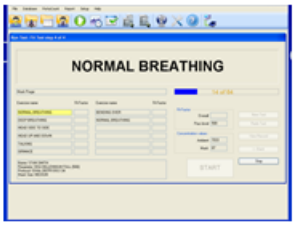
Notes:



5. Check the respirator to ensure that the sampling tube is properly attached to the facepiece and the respirator is fitted with the appropriate filter.
6. Begin entering data on the test subject. The first screen is the people information screen. Fill out the individual's information and click the <Next> button.
7. The next pop-up screen is for entering the respirator information. Select the appropriate respirator or press the <Next> button to enter information on a new respirator. Click the <Next> button.
8. The next pop-up screen is for entering the protocol and miscellaneous information. The information entered onto this screen includes the mask size (and administrative number, if assigned) and the operator conducting the fit test (first initial and last name). The right side of the screen contains the protocol information. This should read "29 C.F.R. 1910.134." Click the <Next> button.

Notes:

Fit Test Using the PortaCount Machine (continued)



Courtesy of CDP

9. Click on <Start> to begin the test

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9. A large pop-up screen appears to start the test. Click on the <Start> button to begin the fit test.

Notes:

Fit Test Using the PortaCount Machine (continued)

10. Perform the CNC test exercises
    - Normal Breathing
    - Deep Breathing
    - Turning the Head Side to Side
    - Moving the Head Up and Down

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Fit Test Using the PortaCount Machine (continued)

10. Perform the CNC test exercises (continued)
    - Talking
    - Grimace
    - Bending Over
    - Normal Breathing

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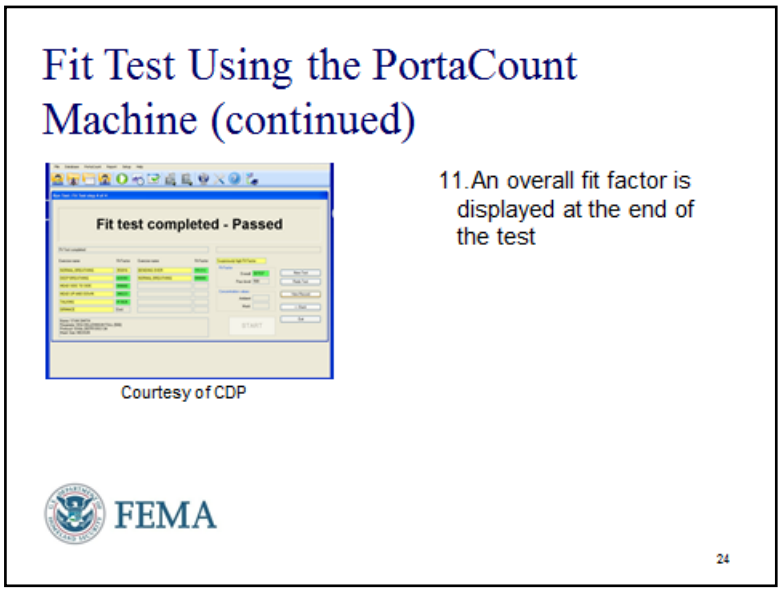
Notes:

10. Instruct the test subject to perform the CNC test exercises in § 1910.134 (2013), Appendix A, Part I.A.14.



11. Wait until all exercises are complete. Following each exercise, there will be a display of the score for the previous exercise and a beep will sound. All exercises should have a green background, indicating that the participant passed that particular test, but of primary importance is the Overall Fit Factor displayed indicating the end of the test.

NOTE: A test subject can fail test exercise(s) and still pass the overall fit test.

Notes:

Fit Test Using the PortaCount Machine (continued)

12. Upon completion, the test administrator questions the test subject regarding the comfort of the respirator
13. Disconnect the sample tube from the adapter and the test subject removes mask
14. Information is recorded in the computer
15. <Print> data

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12. After completing the test exercises, the test administrator questions the test subject regarding the comfort of the respirator upon completion of the protocol.
13. Disconnect the sample tube from the adapter and have the test subject remove mask.
14. Record the individual's name and fit test score data on a separate paper. The information is also saved on the computer, but a paper backup copy is always a good idea, in case of computer malfunction.
15. <Print> data.

Notes:

PortaCount Machine Instructions for Shutdown

1. Press the PortaCount machines' <On/Off>
2. Remove the alcohol cartridge and re-install the black storage cap. Place the alcohol cartridge into the alcohol fill capsule and replace in PortaCount kit

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PortaCount Machine Instructions for Shutdown (continued)

3. Disconnect the twin assembly tube, power cord, and data cable. Place the PortaCount machine and its associated items in the case
4. Power down the computer

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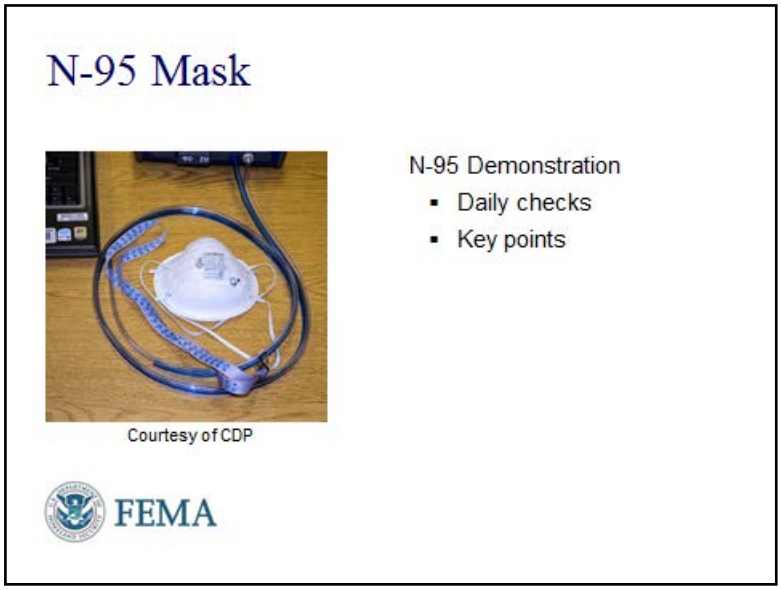
Notes:

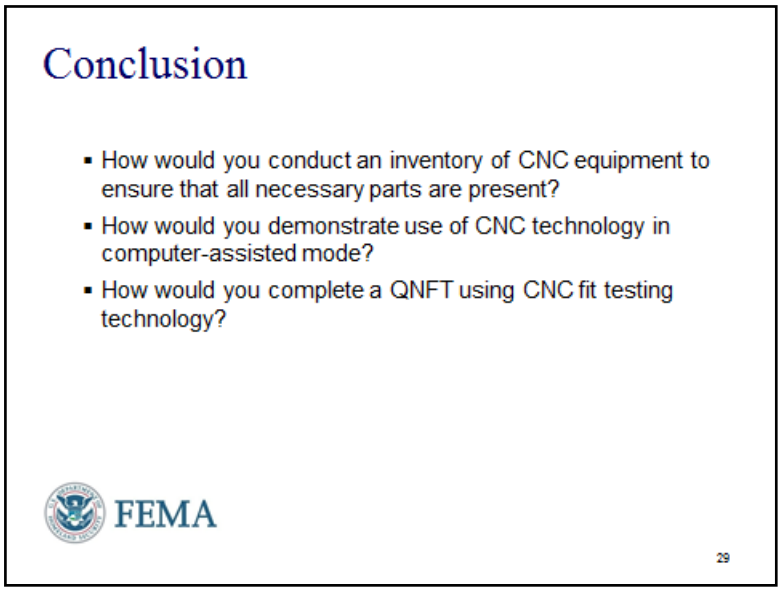
PortaCount Machine Instructions for Shutdown

1. Press the <On/Off> button to turn off the PortaCount machine.
2. Remove the alcohol cartridge from the alcohol cavity and re-install the black storage cap into the PortaCount machine. Place the alcohol cartridge into the alcohol fill capsule.
3. Disconnect the twin assembly tube, power cord, and data cable from the machine and the computer. Place the PortaCount machine and its associated items in the PortaCount case.
4. Power down the computer.

N-95 Mask



Notes:



Conclusion

In this module, participants reviewed the application of CNC technology in a QNFT, an equipment inventory, and a demonstration of the CNC technology in a computer-assisted mode. Additionally, this module reviewed starting up/shutting down procedures of CNC equipment and using CNC technology for a QNFT.

In addition, guidelines in § 1910.134 (2013), Appendix A were used to perform a QNFT. Because respirator fit testing is ultimately a matter of life safety, it is important not only to be aware of the requirements but also to practice the procedure.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Fit Testing Procedures (Mandatory), Appendix A to 29 C.F.R. § 1910.134 (2013).

TSI Incorporated. (2013). *PortaCount pro 8030 and PortaCount pro+ 8038 respirator fit testers: Operations and service manual*. Shoreview, MN: Author.

Personal Protective Equipment—General Requirements

Duration: 0.50 Hour

Summary: Participants refer to the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*] as they discuss General Requirements, Personal Protective Equipment, 29 *Code of Federal Regulations* (C.F.R.) § 1910.132 (2013) and its uses (e.g., when to apply personal protective equipment [PPE] and how to make that determination) are reviewed. This *Reference Manual* is a separate document provided to participants with the course materials. Participants identify the PPE requirements of the employer in selecting PPE as well as the assessment of environmental hazards within the workplace. Additionally, the employee's responsibilities while wearing PPE are discussed.

Terminal Learning Objective: At the conclusion of this module, participants will be able to identify the requirements for PPE in accordance with § 1910.132.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

4-1 Discuss the items needed to ensure adequacy, maintenance, and cleanliness of PPE according to § 1910.132(a–d).

4-2 Describe defective and damaged equipment, training, and payment responsibilities for the employer according to § 1910.132(e–h).

Practical Exercise: In small-group discussions, participants answer questions concerning § 1910.132(a–h). Collectively, participants examine the answers and where in the standard it is located. This activity is approximately 10 minutes. In small-group discussions, participants discuss how their departments or jurisdictions apply § 1910.132 in the determination of the items needed to ensure PPE adequacy, maintenance, and cleanliness. Participants also describe employer PPE responsibilities according to § 1910.132(e–h).

Risk Assessment: Low

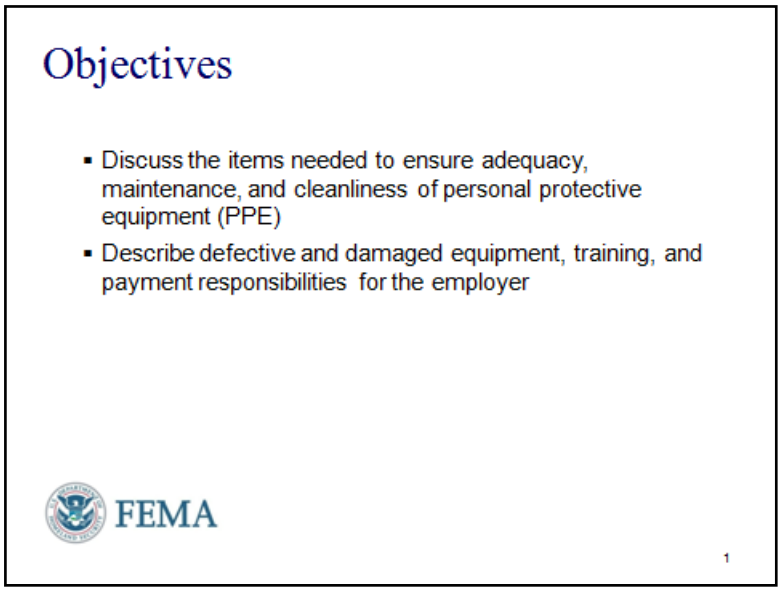
Methods of Instruction: Instructors use a facilitated lecture format supported by presentation visuals. Reflective questioning challenges participants' critical thinking skills and reinforces course content. Participants take part in instructor-facilitated collaborative knowledge checks. Participants also participate in small-group discussions.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group discussion

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participant comprehension based upon their presentation of key points from their small group's discussions. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, instructors review § 1910.132 using the *Reference Manual*.

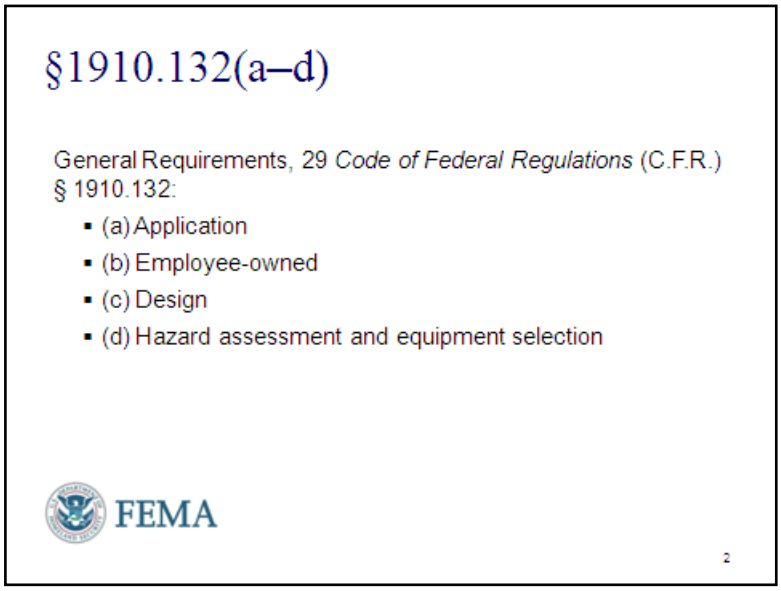


Introduction

Section 1910.132 (2013) describes the employer's responsibility to provide PPE to employees and maintain and clean the equipment. Section 1910.132 is located in Tab 4 in the *Reference Manual*. The following information discusses each of the pertinent areas of § 1910.132.

Notes:

Enabling Learning Objective 4-1: Discuss the items needed to ensure adequacy, maintenance, and cleanliness of PPE according to § 1910.132(a–d).



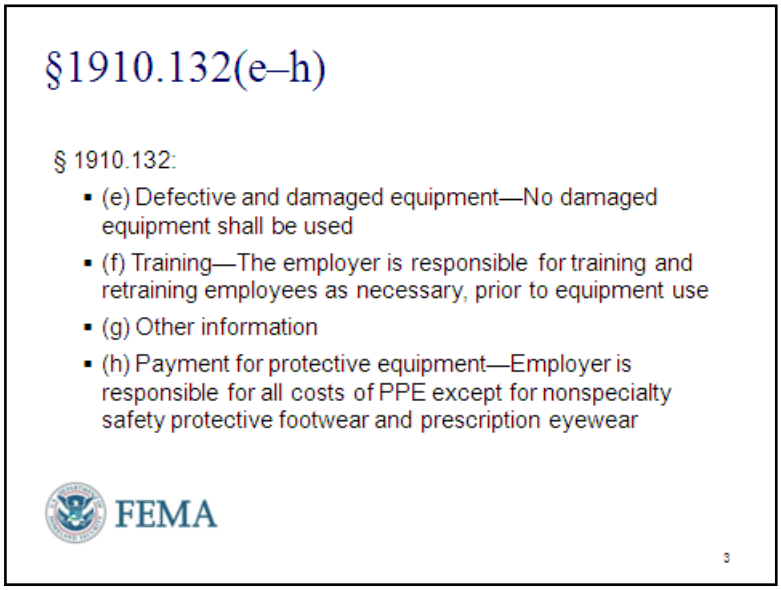
§ 1910.132(a–d)

- (a)—Application. Discusses the application of PPE in the workplace. This section states that all protective equipment will be issued, used, maintained, and cleaned whenever necessary by reason of potential hazards that could be capable of injury or illness. Protective equipment includes "…eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers…" (General Requirements, 29 C.F.R. § 1910.132, 2013).
- (b)—Employee-owned equipment. If an employee provides his or her own protective equipment, employers are responsible for keeping up the adequacy, maintenance, and cleanliness of that equipment.
- (c)—Design. Protective equipment "shall be of safe design and construction for the work to be performed." (General Requirements, 29 C.F.R. § 1910.132, 2013).

Notes:

- (d)—Hazard assessment and equipment selection. Employers are responsible for determining workplace hazards that require PPE and perform a workplace hazard assessment. If hazards do exist in the workplace, employers are responsible for selecting appropriate PPE, have personnel use the PPE, and make sure that the PPE fits each employee adequately.

Section 1910.132(a–d) provides descriptions about how workplace PPE should be properly designed, maintained, and cleaned by the employer, even if it is employee-owned equipment. If PPE is required to be worn in the workplace, it is up to the employer to select the appropriate PPE and provide it to the affected employees (General Requirements, 29 C.F.R. § 1910.132, 2013).



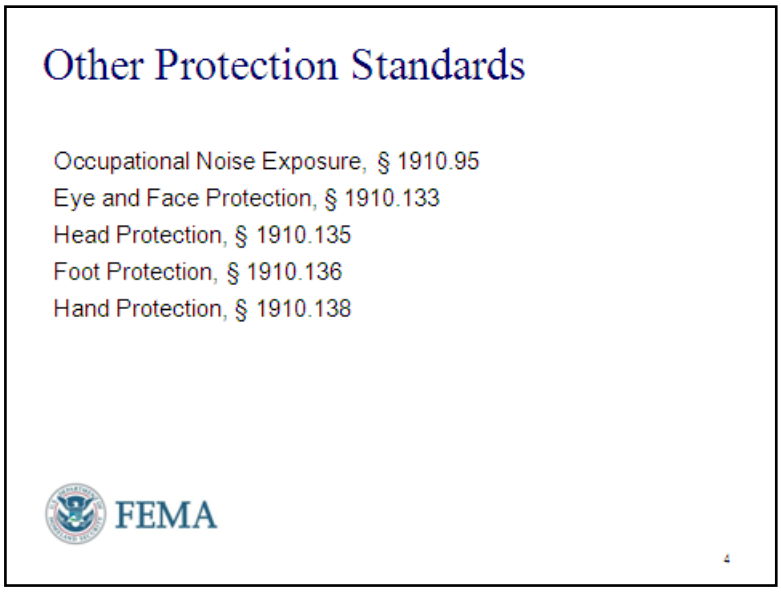
Enabling Learning Objective 4-2: Describe defective and damaged equipment, training, and payment responsibilities for the employer according to § 1910.132(e–h).

§ 1910.132(e–h)

- (e)—Defective and damaged equipment. The employer has the responsibility to protect the employee from defective or damaged equipment.

Notes:

- (f)—Training. The employer has the responsibility to train employees on the PPE required for the workplace. Additionally, § 1910.132(f)(3) requires the employer to retrain the employee if the employee does not have the understanding or skill required by § 1910.132(f)(2), which states that employees must have an understanding of the protective equipment prior to working in PPE.
- (g)—Other Information.
- (h)—Payment for protective equipment. All protective equipment shall be provided by the employer at no cost to the employee. An exception is § 1910.132(h)(2), which states that the employer is not required to pay for nonspeciality safety-toe protective footwear and prescription eyewear (General Requirements, 29 C.F.R. § 1910.132, 2013),



Other Protection Standards

- Occupational Noise Exposure, 29 C.F.R. § 1910.95 (2013), provides examples of the types of hearing protection available:
  - Ear plugs—These are inserted to block the ear canal. They may be premolded (preformed) or moldable (foam ear plugs). Ear plugs are sold as disposable products or reusable plugs. Custom molded ear plugs are also available.

Notes:

- Semi-insert ear plugs—Consist of two ear plugs held over the ends of the ear canal by a rigid headband.
- Ear muffs—Consist of sound-attenuating material and soft ear cushions that fit around the ear and hard outer cups; they are held together by a headband.

Employees should wear hearing protection if the noise or sound level at the workplace exceeds 85 decibels (A-weighted) or dB(A). When effective hearing protectors are worn properly, they can reduce the risk of damaging one's hearing. Ear plugs can be mass-produced or individually molded to fit the ear, and can be reusable or disposable. On the positive side, they are simple to use, less expensive than muffs, and more comfortable in hot or damp work areas. On the negative side, they provide less protection than some muffs and should not be used in areas with noise levels over 105 dB(A) (A-weighted decibels; Occupational Noise Exposure, 29 C.F.R. § 1910.95, 2013).

Ear muffs can vary with respect to the material and depth of the dome, and the force of the headband. The deeper and heavier the dome, the greater the low-frequency attenuation provided by the protector. The headband must fit tightly enough to maintain a proper seal yet not be too tight for comfort. On the positive side, ear muffs can usually provide greater protection than plugs, although this is not always true. Ear muffs are easier to fit, are generally more durable than plugs, and have replaceable parts; however, they are more expensive and often less comfortable than plugs—especially in hot work areas. In areas where noise levels are very high, muffs and plugs can be worn together to give better protection (Occupational Noise Exposure, 29 C.F.R. § 1910.95, 2013).

- Eye and Face Protection, 29 C.F.R. § 1910.133 (2013)
- Head Protection, 29 C.F.R. § 1910.135 (2013)
- Foot Protection, 29 C.F.R. § 1910.136 (2013)
- Hand Protection, 29 C.F.R. § 1910.138 (2013)

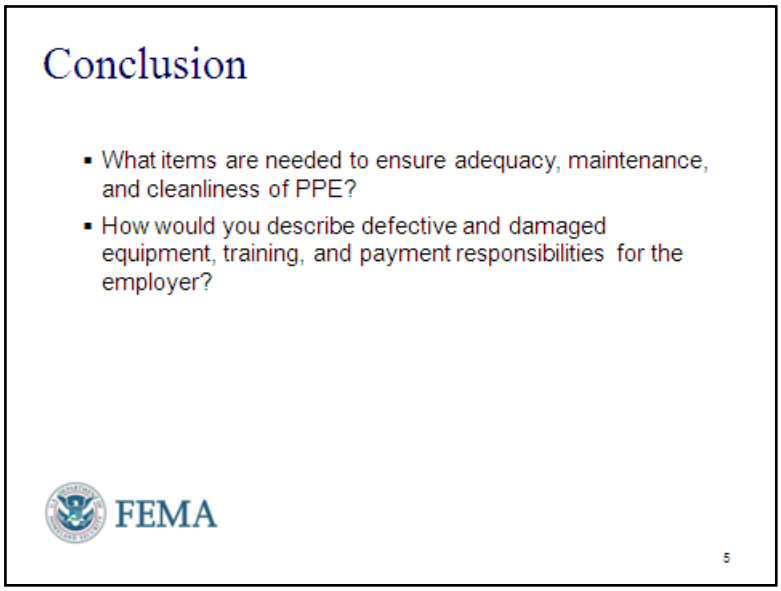
Notes:

Activity:

Within a small group, refer to § 1910.132(a–h) and discuss the answers to the following questions:

1. What protective equipment is the employer responsible for providing?
2. Are employees responsible for paying for their protective equipment? If not, who is? If so, what specific equipment are they responsible for?
3. From your own experiences, what are some examples of defective and/or damaged equipment?
4. Who is responsible for equipment maintenance and cleanliness?

Notes:



Conclusion

In this module, § 1910.132 was discussed to provide information on how the employer is responsible for providing protective equipment to appropriate employees. Employers must meet the standards for protective equipment to include design, maintenance, cleaning, and training. Additional protection standards were also provided.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Eye and Face Protection, 29 C.F.R. § 1910.133 (2013).

Foot Protection, 29 C.F.R. § 1910.136 (2013).

General Requirements, 29 C.F.R. § 1910.132 (2013).

Hand Protection, 29 C.F.R. § 1910.138 (2013).

Head Protection, 29 C.F.R. § 1910.135 (2013).

Occupational Noise Exposure, 29 C.F.R. § 1910.95 (2013).

Respiratory Protection

Duration: 1.75 Hours (divided into 2 days)

Summary: Participants engage in a detailed study of the permissible practice, terms, respiratory protection program, selection of respirators, and medical evaluation per Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(a–e) (2013). Additionally, participants discuss information regarding the requirements per § 1910.134(c)(2) concerning the voluntary use of respirators by employees or individuals. During this module, participants discuss the purpose of a respiratory protection plan. In addition, the Occupational Safety and Health Administration (OSHA) Respirator Medical Evaluation Questionnaire (Mandatory), Appendix C to § 1910.134 is identified and discussed. Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate document provided to participants, as § 1910.134(a–e) and Appendix C and (Mandatory) Information for Employees Using Respirators When Not Required Under Standard, Appendix D to § 1910.134 are reviewed.

Terminal Learning Objective: At the conclusion of this module, participants will be able to discuss the important elements of respiratory protection in accordance with § 1910.134(a–e), including voluntary use of respirators and medical evaluations.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

5-1 Identify the permissible practice of using a respirator to protect employees according to § 1910.134(a).

5-2 Define selected respiratory protection terms according to § 1910.134(b).

5-3 Identify the nine components of a written respiratory protection program according to § 1910.134(c).

5-4 Explain the voluntary use of respirators according to § 1910.134, Appendix D.

5-5 Describe the requirements necessary for the respirator selection process according to § 1910.134(d).

5-6 Explain the proper administration of medical evaluations according to § 1910.134(e).

5-7 Identify the minimum requirements for employee medical evaluations according to § 1910.134, Appendix C.

Practical Exercise: Participants take part in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. Working within a small group, participants define selected respiratory protection terms found in § 1910.134(b) using the matching activity handout, entitled “Key Respiratory Protection Terms.” Approximate time for the matching activity is 10 minutes, which includes time for each group to collaboratively review their answers. Participants identify the nine components of a written respiratory protection program by locating them in the standard and reviewing each component with their small group. Approximate time for this activity is 10 minutes, which includes time for the instructor to review participants’ responses. In small groups, review four different scenarios and answer associated questions that require participants to describe respirator selection requirements for each scenario. The instructor randomly selects a group to answer different questions. Total

approximate time for this activity is 20 minutes; each group reports its answers to the larger group (2–3 minutes per group).

Risk Assessment: Low

Methods of Instruction: Instructors use a facilitated lecture format supported by presentation visuals. Reflective questioning challenges participants' critical thinking skills and reinforces module content. Participants take part in instructor-guided and collaborative knowledge checks throughout the module, where they explain the voluntary use of respirators and identify the minimum requirements for employee medical evaluations. Individually, participants complete a respiratory protection terms handout in which they match key respiratory protection terms with their definitions and review their answers with their small group. Additionally, participants participate in a small-group activity to review provided scenarios and describe respiratory selection requirements.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group discussion

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participants comprehension based upon their presentation of key points and/or answers from their small-group discussions and activities. At the conclusion of the module, the instructor/participant leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134(a–e) and Appendices C and D are reviewed using the *Reference Manual*.

Objectives

- Identify the permissible practice of using a respirator to protect employees
- Define selected respiratory protection terms
- Identify the nine components of a written respiratory protection program
- Explain the voluntary use of respirators
- Describe the requirements necessary for the respirator selection process

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Objectives (continued)

- Explain the proper administration of medical evaluations
- Identify the minimum requirements for employee medical evaluations

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Notes:

Enabling Learning Objective 5-1: Identify the permissible practice of using a respirator to protect employees according to § 1910.134(a).

§ 1910.134

Courtesy of FEMA

This standard

- Took effect on April 23, 1998
- Is located in Subpart I PPE

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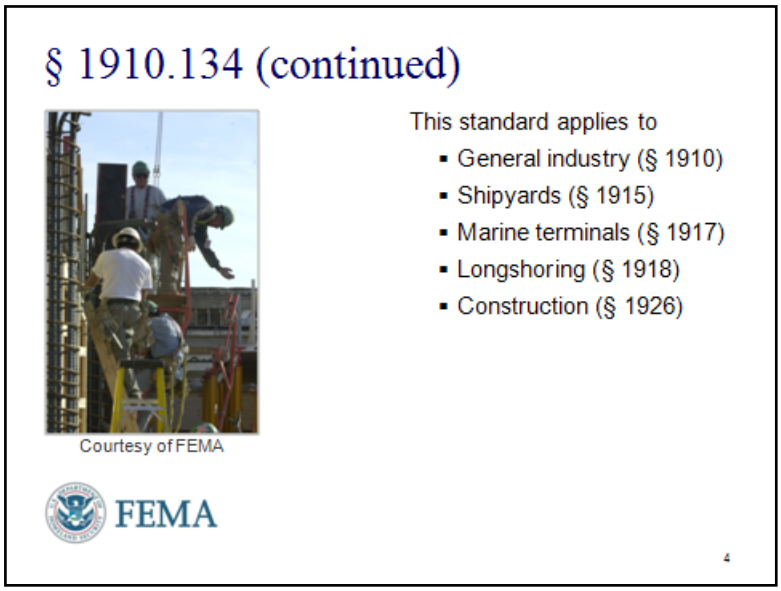
Notes:



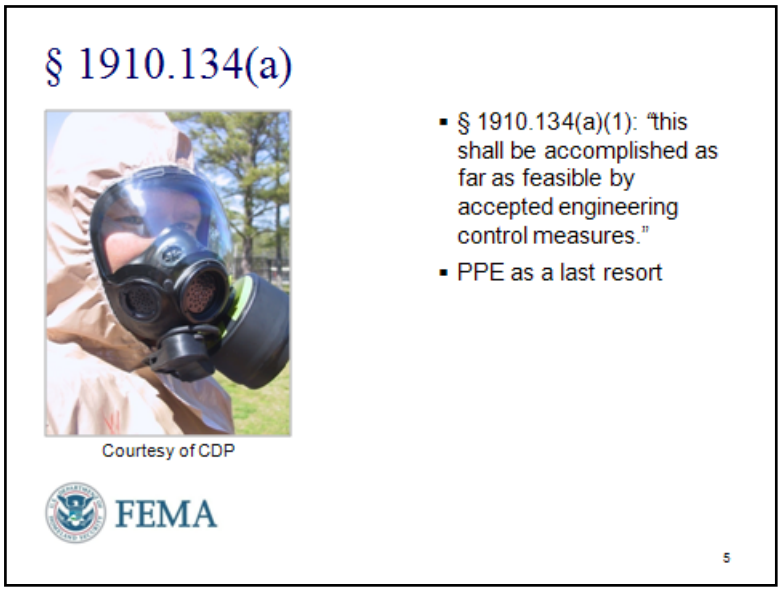
§ 1910.134

Key Point:

Section 1910.134 became effective on April 23, 1998, and is the standard for all respiratory protection.

The standard is located in Subpart I, personal protective equipment (PPE) of the Occupational Safety and Health Standards and can also be located in Tab 5 of the *Reference Manual*. Section 1910.134 applies to General Industry (§ 1910), Shipyards (§ 1915), Marine Terminals (§ 1917), Longshoring (§ 1918), and Construction (§ 1926; Respiratory Protection, 29 C.F.R. § 1910.134, 2013).

Notes:



§ 1910.134(a)

Employers should make every effort to protect their workers through administrative and engineering controls; however, this may not always be possible. Paragraph (a) addresses permissible practice of using a respirator to protect employees. Section 1910.134(a)(1) states that, "this shall be accomplished as far as feasible by accepted engineering control measures" (2013). This statement identifies that employees were never intended to wear PPE but that the employer should keep employees in a safe environment and that PPE is meant as a last resort. Given that sometimes effective engineering controls are not available, the standards allow for the use of appropriate respirators. Multiple agencies within a jurisdiction can coordinate in the development of a productive respiratory protection program.

Notes:

Enabling Learning Objective 5-2: Define selected respiratory protection terms according to § 1910.134(b).

§ 1910.134(b)

§ 1910.134(b) defines the following terms:

- APR
- APF
- Atmosphere-supplying respirator
- Canister or cartridge
- Emergency situation
- Employee exposure
- Escape-only respirator

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Notes:

§ 1910.134(b) (continued)

§ 1910.134(b) defines the following terms (continued):

- Filtering facepiece (dust mask)
- Fit factor
- Fit test
- HEPA filter
- IDLH
- Loose-fitting facepiece
- MUC

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§ 1910.134(b) (continued)

§ 1910.134(b) defines the following terms (continued):

- Negative-pressure respirator (tight-fitting)
- Oxygen-deficient atmosphere
- PLHCP
- Positive-pressure respirator
- PAPR
- QLFT

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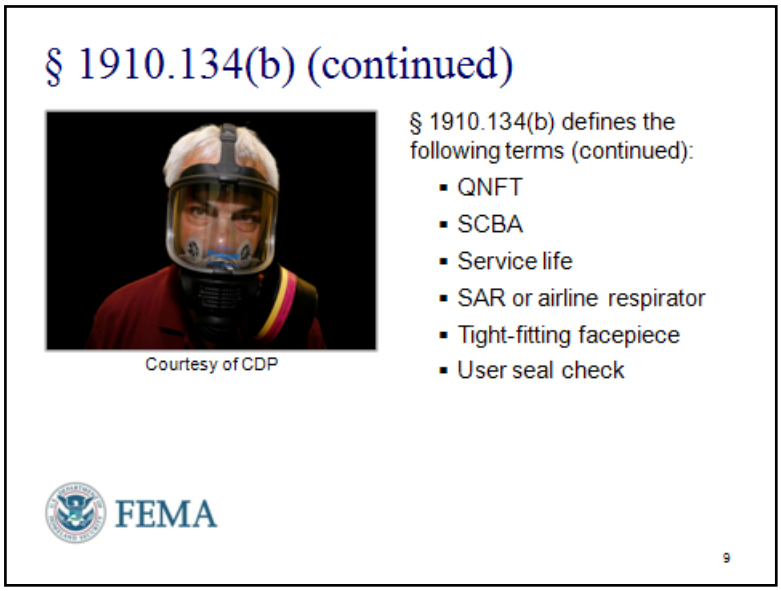
Notes:



§ 1910.134(b)

Key Point:

Section 1910.134(b), starting on page 2 in Tab 5, defines important terms used in the respiratory protection standard in the section, including:

- Air-purifying respirator (APR)
- Assigned Protection Factor (APF)
- Atmosphere-supplying respirator
- Canister or cartridge
- Emergency situation
- Employee exposure
- Escape-only respirator
- Filtering facepiece (dust mask)

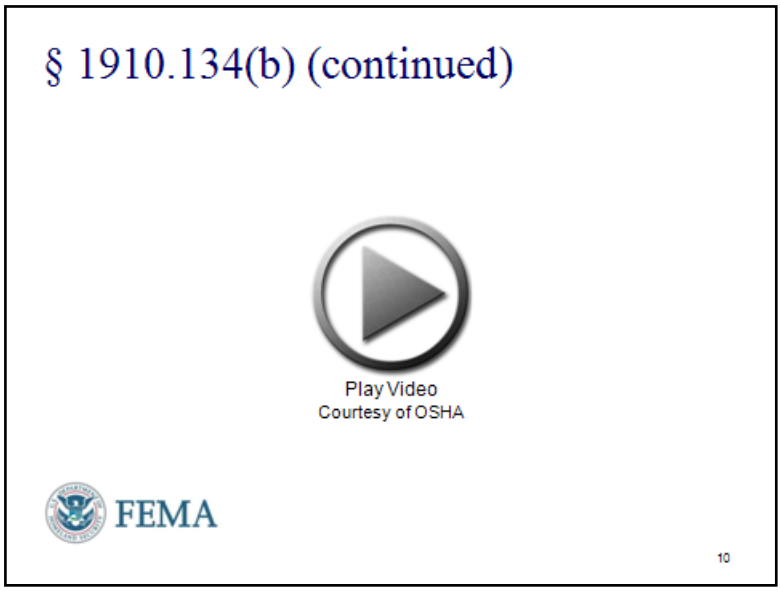
Notes:

- Fit factor
- Fit test
- High-Efficiency Particulate Air (HEPA) filter
- Immediately Dangerous to Life or Health (IDLH)
- Loose-fitting facepiece
- Maximum Use Concentration (MUC)
- Negative-pressure respirator (tight-fitting)
- Oxygen-deficient atmosphere
- Physician or other licensed health care professional (PLHCP)
- Positive-pressure respirator
- Powered air-purifying respirator (PAPR)
- Qualitative Fit Test (QLFT)
- Quantitative Fit Test (QNFT)
- Self-contained breathing apparatus (SCBA)
- Service life
- Supplied-air respirator (SAR) or airline respirator
- Tight-fitting facepiece
- User seal check

Activity:

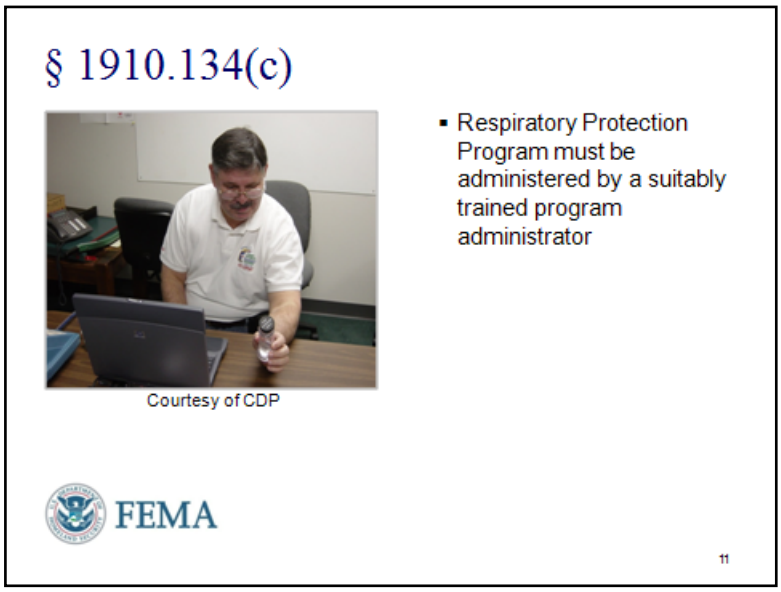
In small groups, complete the Key Respiratory Protection Terms Handout without referring to Section 1910.134(b).

Notes:



Notes:

Enabling Learning Objective 5-3: Identify the nine components of a written respiratory protection program according to § 1910.134(c).



§ 1910.134(c)

The responsibilities of a respiratory protection program is explained in § 1910.134(c).

Key Point:

It is important to remember that the “written program . . . must be administered by a suitably trained program administrator” (Respiratory Protection, 29 C.F.R. § 1910.134[c], 2013).

Notes:

§ 1910.134(c) (continued)

Courtesy of CDP

Components of a respiratory protection program include:

- Procedures for selecting respirators
- Medical evaluations of employees required to use respirators

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§ 1910.134(c) (continued)

Components of a respiratory protection program include (continued):

- Fit testing procedures for tight-fitting respirators
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations
- Procedures and schedules for maintaining respirators
- Procedures ensuring air quality, quantity, and flow of air for atmosphere-supplied respirators

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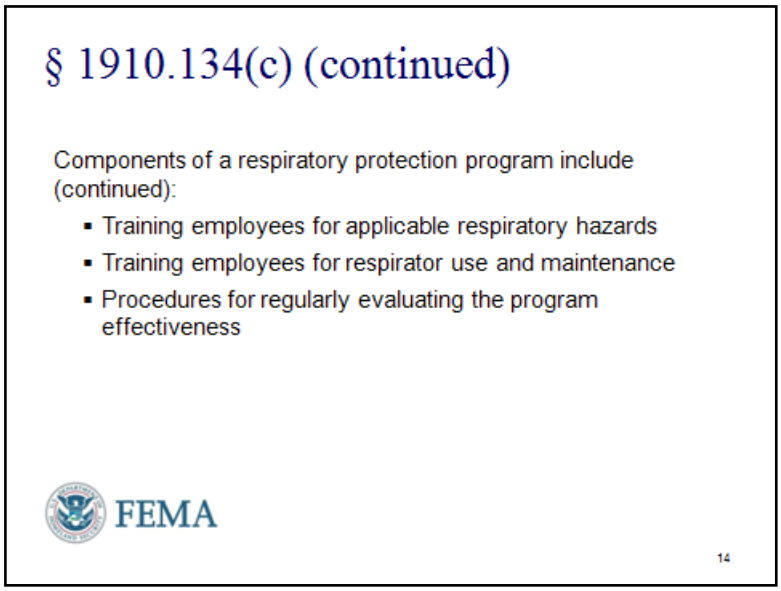
Notes:



Section 1910.134(c)(1) describes the nine components of a written respiratory protection program that include the following:

- Procedures for selecting respirators for use in the workplace
- Medical evaluations of employees required to use respirators
- Fit testing procedures for tight-fitting respirators
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators
- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators
- Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations

Notes:

- Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance
- Procedures for regularly evaluating the effectiveness of the program (Respiratory Protection, 29 C.F.R. § 1910.134[c][1][i-ix], 2013)

Section 1910.134(c)(2)(i) contains information about respirators when not required by the standard or the employer. Paragraph (c)(2)(ii) describes the employer requirement of establishing and implementing elements of a written respiratory protection program. It is important that any employee who uses a respirator is medically able and that all respirators are properly maintained and cleaned. In a written respiratory protection program, employers are not required to include ". . . those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks)" (Respiratory Protection, 29 C.F.R. § 1910.134[c][2][ii], 2013).

The following visual from OSHA provides information concerning the need for respirator-use requirements.

Notes:

Respirator-Use Requirements
29 C.F.R. 1910.134(c)

Are respirators
- Necessary to protect the health of the employee; or
- Required by the employer?

YES → Must establish and implement a written respirator program with worksite-specific procedures.

NO → Does the employer permit voluntary use of respirators?

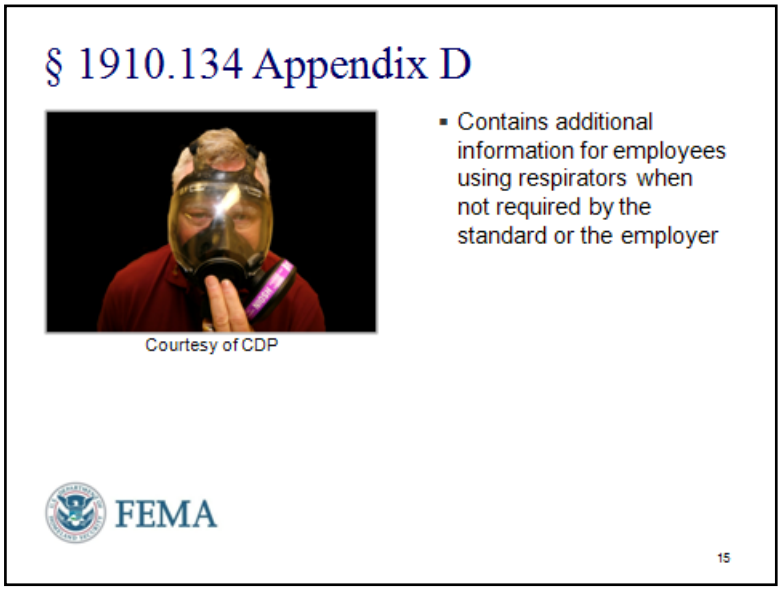
- NO → STOP
- YES → Does the only use of respirators involve the voluntary use of filtering facepieces (dust masks)?

  - YES →
    - Employer determines that the respirator itself does not create a hazard.
    - Must provide users with information contained in Appendix D.
    - No respirator program required.
  - NO →
    - Employer determines that the respirator itself does not create a hazard.
    - Must provide users with information contained in Appendix D.
    - Must establish and implement those elements of a written respirator program necessary to ensure that employee is medically able to use that respirator.

Notes:

Section 1910.134(c)(3) states that the employer shall designate a program administrator who is qualified and capable of conducting the required program evaluations. Section 1910.134(c)(4) states that "the employer shall provide training, respirators, and medical evaluations at no cost to the employee" (2013).

Enabling Learning Objective 5-4: Explain the voluntary use of respirators according to § 1910.134, Appendix D.



§ 1910.134 Appendix D

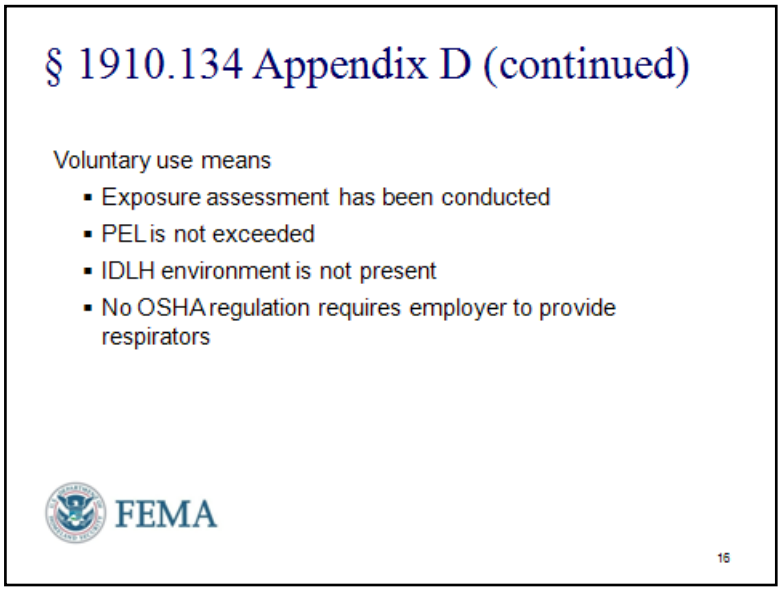
NOTE: "OSHA establishes Permissible Exposure Limits (PEL) to protect workers against the health effects of exposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a toxic substance in the air . . . OSHA PELs are based on an 8-hour Time-Weighted Average (TWA) of exposure" (OSHA, n.d., para. 1). OSHA enforces the PELs.

Section 1910.134 (2013), Appendix D, located on page 57 in Tab 5, also contains additional information concerning employees using respirators when not required by the standard or the employer. If an employer provides respirators for a voluntary use, it is important to keep the respirator properly cleaned and stored. Additionally, do not wear the respirator in environments

Notes:

for which your respirator is not qualified or fit to be used (Information for Employees Using Respirators When Not Required Under This Standard [Mandatory], Appendix D to 29 C.F.R. § 1910.134, 2013).

It is also important to understand clearly what constitutes voluntary use. All of the following conditions shall apply for respirator use to be deemed voluntary.



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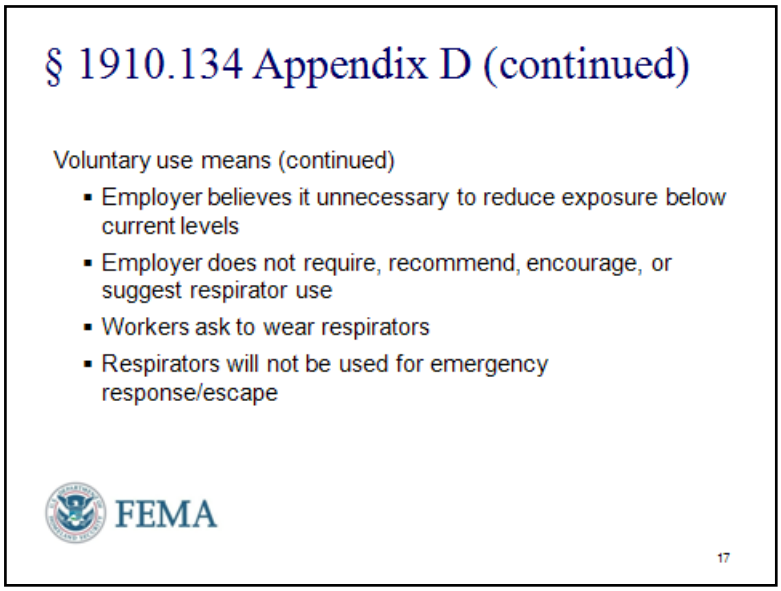
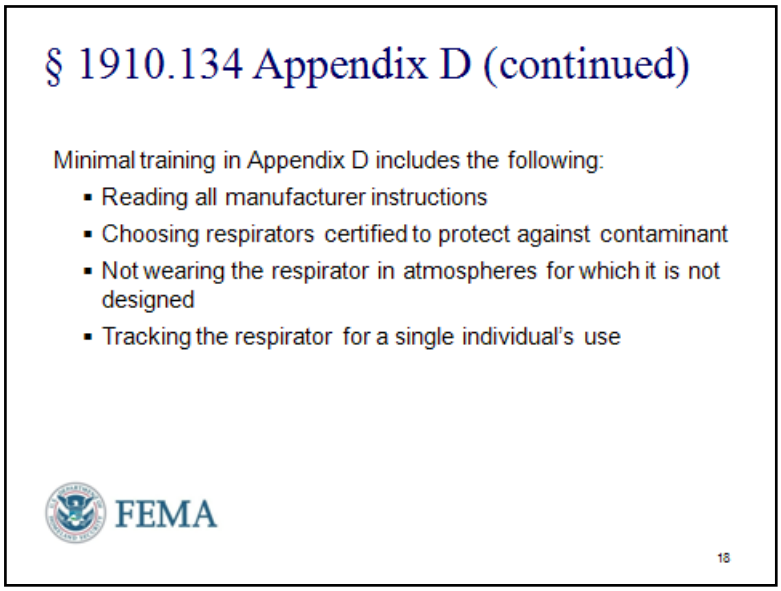


Voluntary use means

- An exposure assessment has been conducted,
- The PEL is not exceeded,
- An IDLH environment is not present,
- No OSHA regulation requires that respirators be provided by the employer (e.g., § 1910.1025 requires employers to provide respirators upon request to employees that are exposed to any lead concentrations),
- The employer does not believe it is necessary to reduce exposures below their current levels,
- The employer does not require, recommend, encourage, or suggest that respirators be used,
- Employees ask to wear respirators, and
- Respirators will not be used for emergency response or escape (Janssen, 2000).

Notes:



In a voluntary-use situation, OSHA requires a limited respiratory protection program. The only program elements specified are medical evaluation; cleaning, storage, and maintenance; and minimal training.

The minimal training includes the following:

- Read and follow all instructions provided by the manufacturer.
- Choose respirators certified for use to protect against the contaminant of concern.
- Do not wear the respirator in atmospheres containing contaminants for which the respirator is not designed.
- Keep track of the respirator so as not to mistakenly use someone else's respirator (Information for Employees Using Respirators When Not Required Under This Standard [Mandatory], Appendix D to 29 C.F.R. § 1910.134, 2013).

Notes:

Employees who voluntarily use filtering-facepiece respirators (i.e., dust masks) need to be provided with information from Appendix D (Janssen, 2000) only. Janssen (2000) states that additional program elements should be considered to avoid potential misuse. Fit testing is not required for voluntary use. However, employers who believe that exposures should be reduced to the lowest possible level will include fit testing in their voluntary-use programs (Janssen, 2000).

Notes:

Enabling Learning Objective 5-5: Describe the requirements necessary for the respirator selection process according to § 1910.134(d).

§ 1910.134(d)

Courtesy of CDP

Employer Responsibilities

- Select and provide appropriate respirators for the workplace
- Select NIOSH-certified respirators and use in compliance with certification conditions
- Provide respirators for employees to use in IDLH atmospheres

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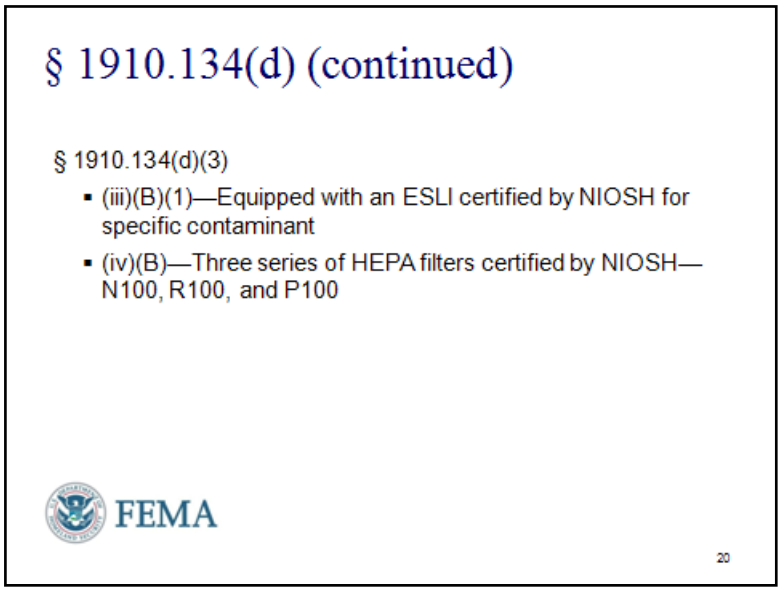
Notes:



§ 1910.134(d)

Key Point:

Section 1910.134(d) "requires the employer to evaluate respiratory hazards in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors" (2013).

The general requirements of respirator selection are found in § 1910.134(d)(1). Under paragraph (d)(1)(i), it is the employer's responsibility to select and provide an appropriate respirator based on the hazards that employees are exposed (Respiratory Protection, 29 C.F.R. § 1910.134, 2013). The general requirements further state that employers shall select a respirator certified by the National Institute for Occupational Safety and Health (NIOSH). The respirator shall be used in compliance with the conditions of its certification. A list of approved respirators can be found at the following NIOSH website: http://www.cdc.gov/niosh/npptl/.

The employer is responsible for identifying and evaluating the respiratory hazards in the workplace. When the respiratory hazard cannot be identified, or exposure to the employee

Notes:

cannot be reasonably estimated, then the employer shall consider the atmosphere to be IDLH (Respiratory Protection, 29 C.F.R. § 1910.134[d][1][iii], 2013).

Section 1910.134(d)(1)(iv) states, “The employer shall select respirators from a sufficient number of respirator models and sizes so the respirator is acceptable to, and correctly fits, the user” (2013). The more comfortable the fit is, the more likely a user will comply with the respiratory protection program.

The employer is responsible for providing respirators for employee use in IDLH atmospheres. The acceptable respirators for this environment are either “a full-facepiece pressure-demand self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of 30 minutes, or a combination full-facepiece pressure-demand Supplied Air-Respirator (SAR) with auxiliary self-contained air supply” (Respiratory Protection, 29 C.F.R. § 1910.134[d][2][1][A-B], 2013).

Section 1910.134(d)(2)(ii) notes, “Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used” (2013). A NIOSH-certified escape mask for chemical, biological, radiological, nuclear, and explosive (CBRNE) contaminants is referred to as an air-purifying escape respirator (APER).

According to paragraph (d)(2)(iii), “All oxygen-deficient atmospheres shall be considered IDLH” (2013). The only exception is if the employer can demonstrate that the oxygen concentration can be sustained within the variables of Table II in paragraph (d)(3)(iv)(C), and then any atmosphere-supplying respirator may be used (Respiratory Protection, 29 C.F.R. § 1910.134[d][2][iii], 2013).

Paragraph (d)(3)(i) states, “The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations” (2013). Respirator selection is based on the Assigned Protection Factor (APF) and the MUC.

According to OSHA (2009), the APF is the workplace level of respiratory protection that a respirator is expected to provide to employees. For example, a respirator with an APF of 10 means that the wearer would only inhale 1/10 of the airborne contaminant.

OSHA (2009) defines MUC as “the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator. . .” (p. 11). The MUC is determined by multiplying the APF of the respirator by the exposure limit of the hazardous substance (OSHA, 2009). According to the definition of MUC found in § 1910.134(b), when there is no exposure limit available, an employer shall determine an MUC

Notes:

based on the relevant available information and informed professional judgment. Under paragraph (d)(3)(i)(B)(2), employers shall not apply MUC to conditions that are IDLH; instead they shall use respirators listed for IDLH conditions in paragraph (d)(2).

Section 1910.134(d)(3)(ii) discusses the importance of how the selected respirator shall be appropriate for the chemical state and physical form of the contaminant (2013). Chemical state and physical forms of contaminants include vapors, gases, liquids, solids, and powders.

For protection against gases and vapors, the employer shall provide either an atmosphere-supplying respirator or an APR (Respiratory Protection, 29 C.F.R. § 1910.134[d][3][iii][A-B], 2013). Section 1910.134(d)(3)(iii)(B)(1) states that “respirators are equipped with an End-of-Service-Life Indicator (ESLI) certified by NIOSH for the contaminant” (2013). Section 1910.134(d)(3)(iii)(B)(2) states that “if there is no ESLI appropriate for the conditions in the workplace, then the employer implements a change in schedule that ensures the canisters and cartridges are changed before their end-of-services life” (2013). Entities are encouraged to be proactive with maintenance of their equipment. For example, some law enforcement tactical teams change canisters every time they respond to an incident.

For protection against particulates, the employer shall provide either an atmosphere-supplying respirator or an APR equipped with a filter certified by NIOSH under Public Health, 42 C.F.R. Part 84 (Respiratory Protection, 29 C.F.R. § 1910.134[d][3][A-B], 2013). Section 1910.134(d)(3)(iv)(B) explains that there are three series of HEPA filters certified by NIOSH; these are N100, R100, and P100 (2013).

Notes:

NIOSH Selection Logic

Courtesy of CDP

Procedures for selecting respirators for use in the workplace

- Respiratory hazards in the workplace
- Workplace and user factors that affect respirator performance and reliability

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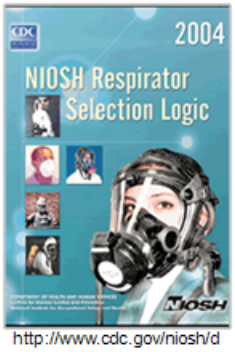
NIOSH Selection Logic (continued)



http://www.cdc.gov/niosh/docs/2005-100/

Being NIOSH-approved, means having a certificate or formal document issued stating that an individual respirator or combination of respirators has met the minimum requirements of 42 C.F.R. § 84 and 30 C.F.R. § 11.

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Notes:

NIOSH Selection Logic

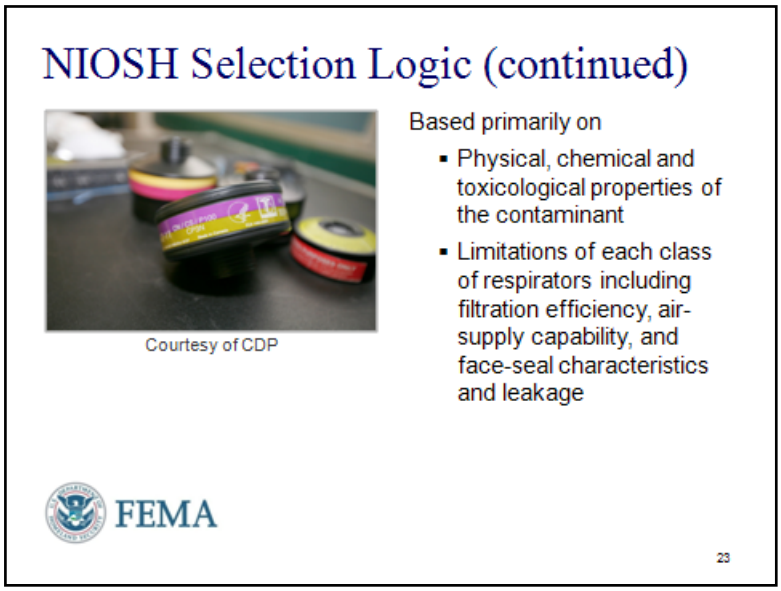
NOTE: The Respiratory Protection Program Template provided within Tab 10 of the *Reference Manual* is an example provided by the Center for Domestic Preparedness (CDP). The template can be used to create a Respiratory Protection Program within a responder's jurisdiction. It is not the only template that can be used and is only provided as an example. It is not an endorsement by the CDP.

As stated previously, the employer is responsible for identifying and evaluating workplace respiratory hazards to include the contaminant's chemical state and physical form. If the employer cannot identify possible employee exposure, the employer shall consider the atmosphere to be IDLH. The employer shall provide a respirator based on the workplace respiratory hazards.

The employer shall select a NIOSH-certified respirator that shall be used in compliance with the conditions of that certification. A list of NIOSH-certified respirators and the conditions of their certifications can be obtained from NIOSH at the following website: http://www.cdc.gov/niosh/npptl/. The employer shall select a respirator that is acceptable and correctly fits the user (Respiratory Protection, 29 C.F.R. § 1910.134[d][1], 2013).

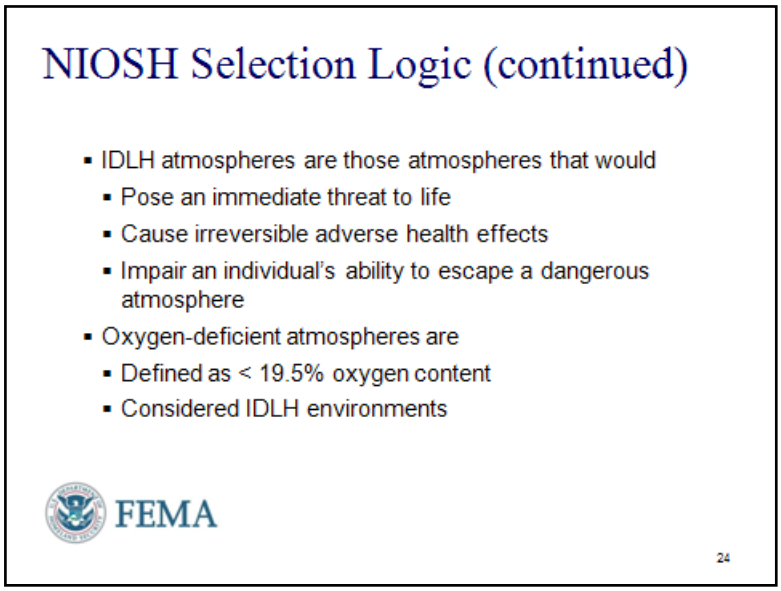
Obtaining NIOSH approval means a certificate or formal document was issued by NIOSH stating that an individual respirator or combination of respirators has met the minimum requirements of Public Health, 42 C.F.R. Part 84 (2012). In 1995, 42 C.F.R. Part 84 replaced 30 C.F.R. § 11 and upgraded the requirements for particulate filters (Centers for Disease Control and Prevention, 2010).

Notes:



The *NIOSH Respirator Selection Logic* is a process that administrators can use to select the proper respirators for the protection of workers in specific workplace locations; however, it is not intended to be used in selecting respirators for protection against infectious disease or CBRN exposures associated with a terrorist incident. Recommendations in the *NIOSH Respirator Selection Logic* for respirator selection "are based primarily on the physical, chemical, and toxicological properties of the contaminant and on the limitations of each class of respirator, including filtration efficiency, air supply capability, and face seal characteristics and leakage" (NIOSH, 2004, p. 1).

Notes:

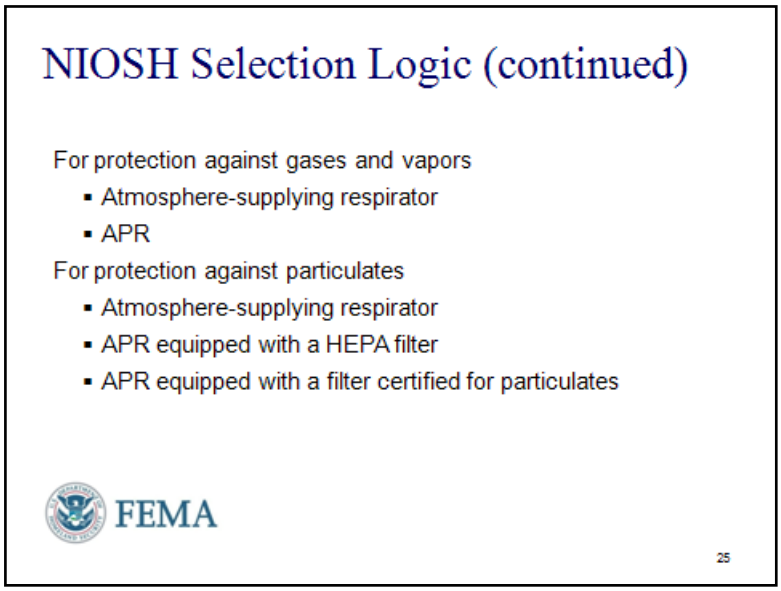


IDLH atmospheres are those atmospheres "that pose an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere" (Respiratory Protection, 29 C.F.R. § 1910.134[b], 2013). Oxygen-deficient atmospheres (less than 19.5% oxygen) shall be considered IDLH. The exception to this rule includes an employer's ability to demonstrate that under all foreseeable conditions the oxygen concentration can be maintained within the ranges specified in Table II (altitude and oxygen concentration) of § 1910.134. If the oxygen concentration can be maintained, then the atmosphere-supplying respirator may be used.

The employer shall provide either of the following respirators for employees in IDLH atmospheres as defined in § 1910.134(d)(2):

- A full-facepiece pressure-demand SCBA certified by NIOSH for a minimum service life of 30 minutes
- A combination full-facepiece pressure-demand SAR with auxiliary self-contained air supply

Notes:



For protection against gases, vapors, and particulates, the employer shall provide an atmosphere-supplying respirator or an APR; however, for particulates, the APR shall be equipped with either a HEPA filter or a NIOSH-certified filter, as stated by NIOSH under Public Health, 42 C.F.R. Part 84.

Nonpowered air-purifying particulate respirators are classified into three series: N-, R-, and P-series. In addition to the series requirement, they are also classified according to the efficiency level of the filter(s) as tested according to the requirements of 42 C.F.R. § 84.170. According to 42 C.F.R. § 84.170, the following are classification of filters:

- The N-series filters are restricted to use in those workplaces free of oil aerosols.
- The R- and P-series filters are intended for removal of any particulate that includes oil-based liquid particulates.
- N100, R100, and P100 filters demonstrate a minimum efficiency level of 99.97%.
- N99, R99, and P99 filters demonstrate a minimum efficiency level of 99%.

N95, R95, and P95 filters demonstrate a minimum efficiency level of 95% (Public Health, 42 C.F.R. § 84.170, 2012).

Notes:

Activity:

Within your small group, read each scenario and answer the associated question, refering back to the standard when applicable. At the conclusion of the activity, the instructor randomly selects a group to answer at least one scenario question.

Scenario 1:

Your law enforcement personnel are currently on the scene of a clandestine laboratory incident with a hazardous materials (HAZMAT) team and a bomb squad.

The bomb squad personnel have swept the area for booby traps and/or secondary devices and declared it free from explosives. HAZMAT team personnel have established zones and made an initial entry into the lab area. Their findings were as follows:

- Five containers of unknown liquid(s) (approximately 5–10 gallons total)
- Six containers of a white and red powder-type substance
- Multiple empty vials and containers

The HAZMAT team reported the following atmospheric monitoring results from the area:

- Oxygen level—19.1%
- Carbon monoxide (CO)—2 parts per million (ppm)
- Lower Explosive Limit (LEL)—0%
- Hydrogen sulfide (H_2S)—0 ppm

The Incident Commander (IC) and HAZMAT team are requesting law enforcement personnel to process and inventory the evidence in the area.

Question: What type of respiratory protection is appropriate for this type of situation and environment? Explain.

Notes:

Scenario 2:

You are responding to an explosion at a local mall. While responding, dispatch informs you that there are multiple injuries, and people are reportedly trapped.

Upon arrival, you find many casualties exiting the mall through numerous mall entrance doors. Many casualties are coughing, tearing, and having difficulty breathing. Some casualties inform you that it smells like bleach inside.

Question: You are equipped with an APR. Can you enter the mall to assist casualties?

Scenario 3:

You have responded to a suspicious package incident. Upon arrival, a tenant informs you that she received an envelope by mail and, upon opening it, a white powdery substance leaked out. She placed the envelope on a counter and exited the room. The woman was breathing well prior to and following the opening of the envelope.

Question: As the IC, what type of respiratory protection is required to enter the area?

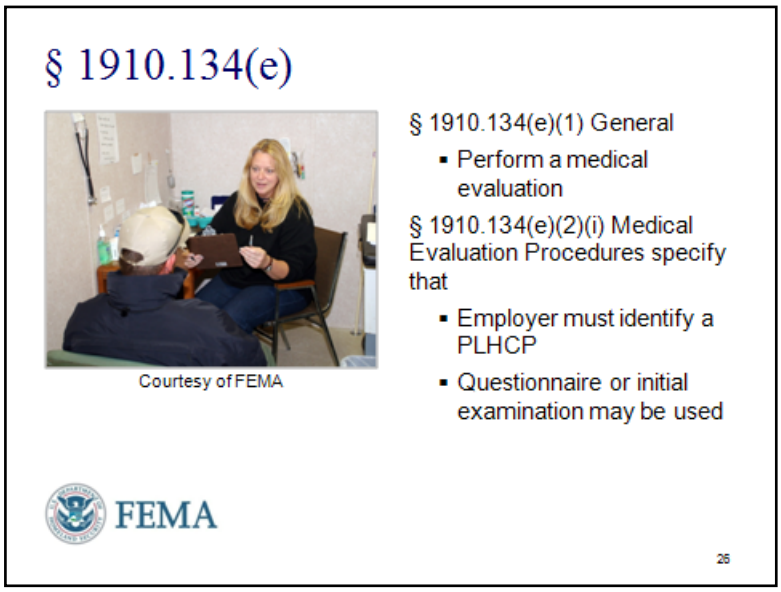
Scenario 4:

You have responded to a call concerning a suspicious odor in a dwelling. Upon arrival, a tenant informs you that she and her family are experiencing tearing, drooling, and burning of the eyes and throat. She asks you to investigate the odor. You don an SCBA to enter the dwelling to take meter readings. Detection devices indicate an irritant and the O_2 level is 20.8%.

Question: As the IC, what type of respiratory protection is required to work in the area?

Notes:

Enabling Learning Objective 5-6: Explain the proper administration of medical evaluations according to § 1910.134(e).



1910.134(e)

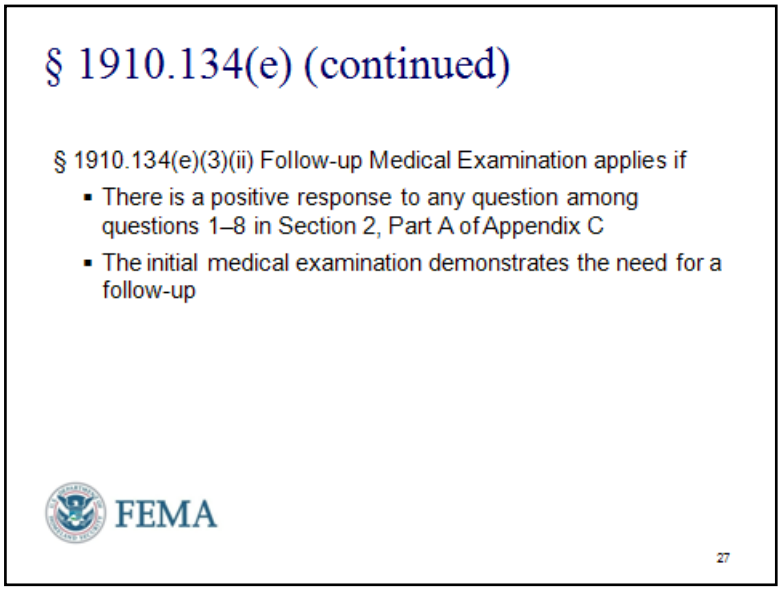
Key Point: Section 1910.134(e)(1) addresses the medical evaluation that is provided by the employer to determine the employee's ability to use a respirator prior to fit testing or required use in the workplace.

This clause also discusses the fact that an employer can discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

Section 1910.134(e)(2)(i) states, "The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire" (2013). This clause allows the use of an initial medical examination that obtains the same information as the medical questionnaire found in Appendix C. *NIOSH Respirator Selection Logic* recommends that other licensed healthcare professionals should be limited to

Notes:

nurse practitioners and physicians assistants in states where they are licensed for independent practice (NIOSH, 2004).



Section 1910.134(e)(3)(i) states that an employer shall ensure that a follow-up examination is provided under two circumstances:

1. If the employee gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C
2. If the employee's initial medical examination demonstrates the need for a follow-up examination (2013)

The § 1910.134(e)(3)(ii) standard states that the "follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination" (2013).

Notes:

Medical Evaluation

Courtesy of FEMA

§ 1910.134(e)(4) Administration of the Medical Questionnaire and Examinations specifies

- Questionnaire and examinations will be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee

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Medical Evaluation (continued)

§ 1910.134(e)(4) Administration of the Medical Questionnaire and Examinations specifies

- Questionnaire must be administered in a manner that ensures the employee understands its content

FEMA

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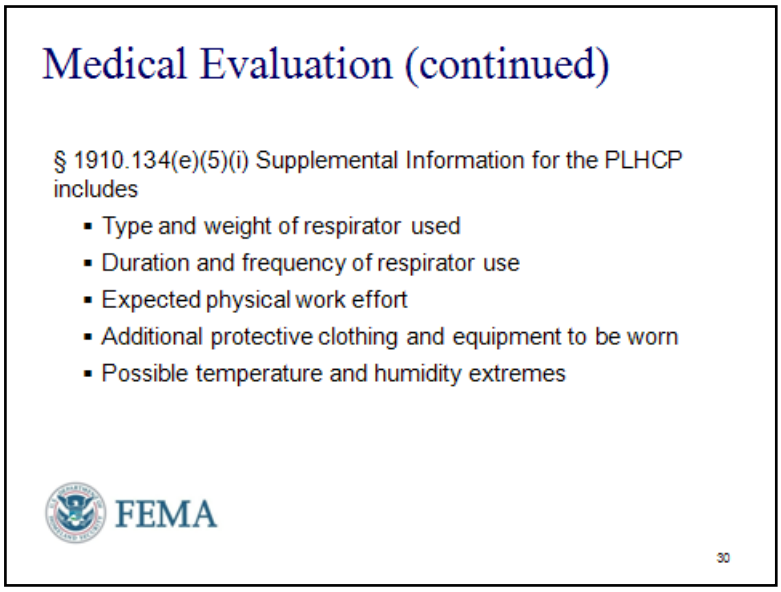
Notes:

Medical Evaluation

Section 1910.134(e)(4) addresses the administration of the medical questionnaire and examinations. The medical questionnaire and examinations are "administered confidentially during the employee's normal working hours or at a time and place convenient to the employee at no cost" and shall be administered in a manner that ensures that the employee understands its content (Respiratory Protection, 29 C.F.R. § 1910.134[e][4][i], 2013). Paragraph (e)(4)(ii) also allows the employee the opportunity to discuss the questionnaire and examination results with the PLHCP.



Supplemental information for the PLHCP is addressed in § 1910.134(e)(5). Before a PLHCP can make a recommendation concerning an employee's ability to use a respirator, the following information shall be provided, according to § 1910.134(e)(5)(i)(A–E):

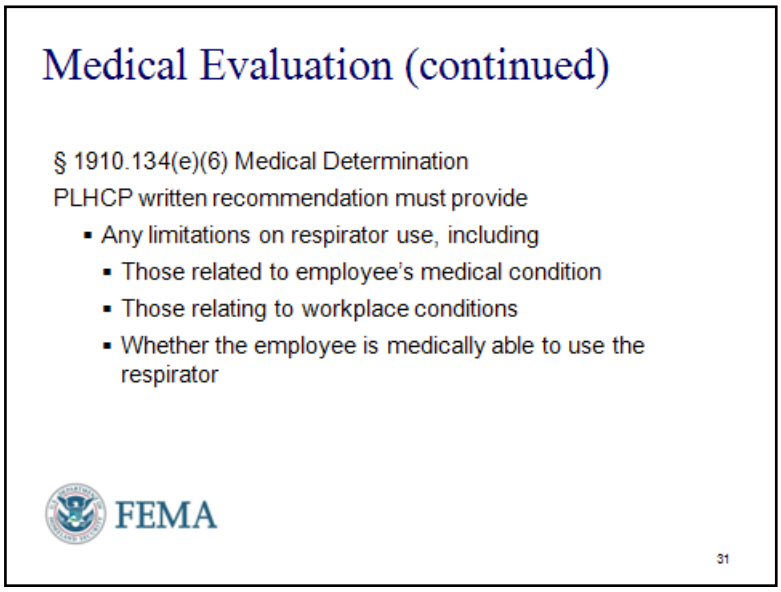
- Type and weight of the respirator
- Duration and frequency of respirator use (including use for rescue and escape)
- Expected physical work effort
- Additional protective clothing and equipment to be worn

Notes:

- Temperature and humidity extremes that may be encountered (2013)

If the information and the PLHCP remain the same, any supplemental information provided previously to the PLHCP regarding an employee does not need to be provided for a subsequent medical evaluation (Respiratory Protection, 29 C.F.R. § 1910.134[e][5][ii], 2013). The employer is to provide the PLHCP a copy of the written respiratory protection program and a copy of the § 1910.134(e) section of the standard.

NOTE: OSHA does not expect employers to re-evaluate employees when the PLHCP has been replaced. However, the information (i.e., the respiratory protection program and a copy of the § 1910.134[e] section) must be given directly to the new PLHCP or transferred from the old PLHCP to the new PLHCP.



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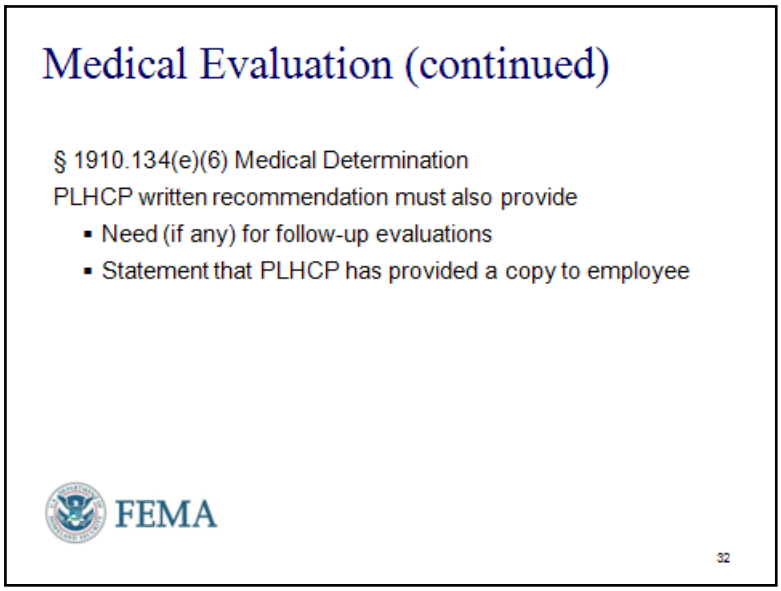

Under § 1910.134(e)(6), in order to determine the employee's ability to use a respirator, the employer shall obtain a written recommendation from the PLHCP. The written recommendation shall provide only the following information:

- Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator
- The need (if any) for follow-up medical evaluations
- A statement that the PLHCP has provided the employee with the copy of the PLHCP's written recommendation (Respiratory Protection, 29 C.F.R. § 1910.134[e][6][i][A-C], 2013)

Section 1910.134(e)(6)(ii) states,

> If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the

Notes:

employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR. (2013)

Medical Evaluation (continued)

§ 1910.134(e)(7) Additional Medical Evaluations

Administered if

- Employee reports medical signs or symptoms related to the ability to use a respirator
- PLHCP, supervisor, or respirator program administrator informs the employer that the employee needs to be re-evaluated

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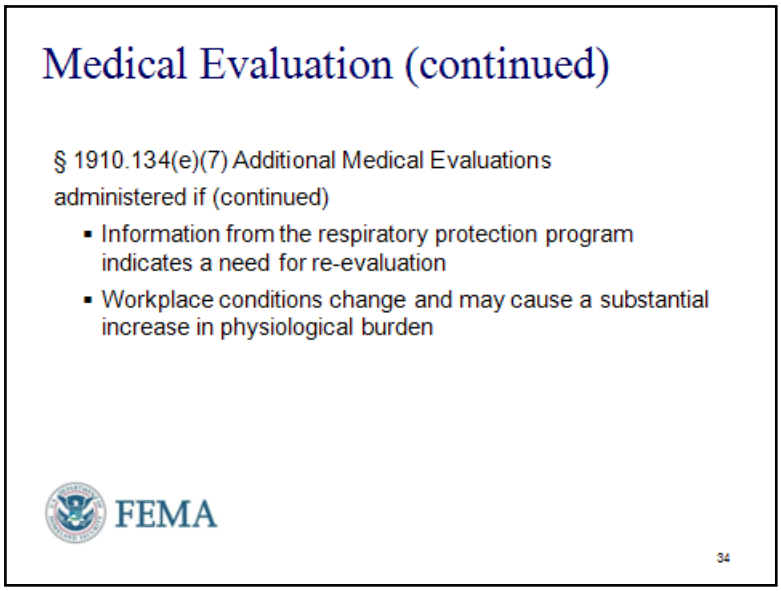
Notes:



According to § 1910.134(e)(7), additional medical evaluations shall be administered if one of the following conditions is met:

- An employee reports medical signs or symptoms that are related to the ability to use a respirator
- A PLHCP, supervisor, or the respirator program administrator informs the employer that the employee needs to be re-evaluated
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee re-evaluation
- A change occurs in workplace conditions such as physical work effort, protective clothing, or temperature that may result in a substantial increase in the physiological burden placed on the employee (2013)

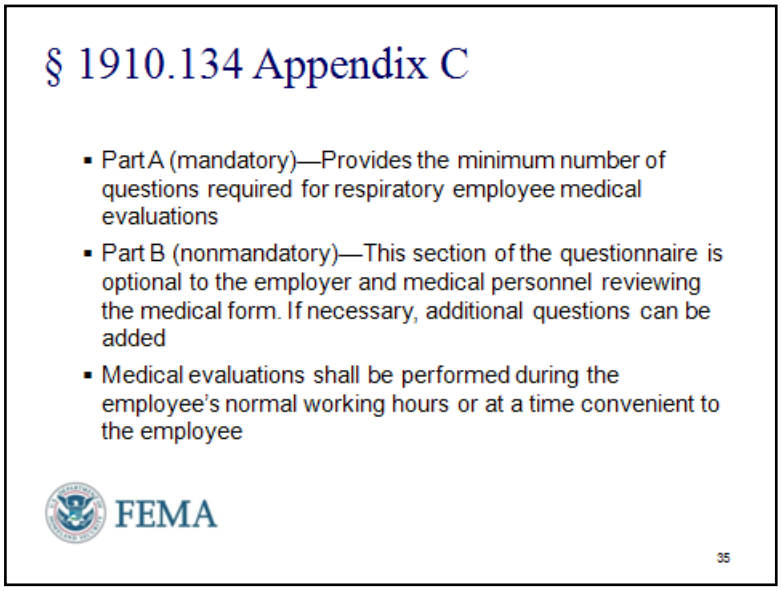
Notes:

Knowledge Check:

- Who can perform medical evaluations?
- Why would a follow-up examination be necessary?
- What information does the PLHCP need from the employer?
- Why additional medical evaluations might be administered?

Notes:

Enabling Learning Objective 5-7: Identify the minimum requirements for employee medical evaluations according to § 1910.134, Appendix C.



§ 1910.134 Appendix C

Section 1910.134 (2013), Appendix C starts on page 50 in Tab 5 in the *Reference Manual*. Section 1910.134 Appendix C, Questionnaire, Part A is mandatory and has the minimum requirements for employee medical evaluations. Part B of the questionnaire is optional to the employer and medical personnel reviewing the form. Additional questions can be added if necessary.

The medical evaluation shall be performed during normal working hours, or at a time and place that is convenient to the employee. The evaluation shall be confidential and shall be at no cost to the employee.

Notes:

§ 1910.134 Appendix C (continued)

Questions in Part A, Section 2 include the following:

- Have you ever had any of the following conditions?
  - Seizures
  - Diabetes
  - Allergic reactions that interfere with your breathing

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§ 1910.134 Appendix C (continued)

Questions in Part A, Section 2 include the following:

- Have you ever had any of the following pulmonary or lung problems?
  - Asbestosis
  - Asthma
  - Chronic bronchitis

Medical questions are Yes or No answers

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Notes:

As stated previously, the employer shall ensure that a follow-up examination is provided if the employee gives a positive response to 1 through 8 in Part A, Section 2 or if the medical evaluation determines a need for a follow-up examination (Respiratory Protection, 29 C.F.R. § 1910.134[e][3][i], 2013).

The mandatory questions in Section 2 of Part A have Yes and No answers and include the following:

- Have you ever had any of the following conditions?
  - Seizures
  - Diabetes
  - Allergic reactions that interfere with your breathing
  - Claustrophobia
  - Trouble smelling odors
- Have you ever had any of the following pulmonary or lung problems?
  - Asbestosis
  - Asthma
  - Chronic bronchitis
  - Emphysema
  - Pneumonia
  - Tuberculosis
  - Silicosis
  - Pneumothorax
  - Lung cancer
  - Broken ribs
  - Any chest injuries or surgeries
  - Any other lung problem that you have been told about

Notes:

Conclusion

- Identify the permissible practice of using a respirator to protect employees
- Define selected respiratory protection terms
- Identify the nine components of a written respiratory protection program
- Explain the voluntary use of respirators
- Describe the requirements necessary for the respirator selection process

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Conclusion (continued)

- Explain the proper administration of medical evaluations
- Identify the minimum requirements for employee medical evaluations

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Notes:

Conclusion

Section 1910.134 is the standard of respiratory protection. The standard applies to General Industry (§ 1910), Shipyards (§ 1915), Marine Terminals (§ 1917), Longshoring (§ 1918), and Construction (§ 1926). Employers should make every effort to protect their workers through engineering controls; however, this is not always feasible. A respirator is the last option for protection, and the permissible practice of using a respirator is addressed in paragraph (a) of the respiratory protection standard.

Paragraph (b) of § 1910.134 addresses the definitions of key terms used in respiratory protection. Some of the essential terms associated with respiratory protection are quantitative fit test, qualitative fit test, fit factor, PLHCP, as well as the main types of respirators. These terms are vital to understanding the respiratory protection standard and how it protects the respirator wearer.

Under paragraph (c), a suitably trained program administrator shall administer the respiratory protection program. Responders are guided through the nine subcomponents of a written respiratory protection program. This paragraph also contains information about respirators not required by the standard or the employer.

An employee may choose to wear a respirator voluntarily. Appendix D addresses the information for voluntary use of a respirator when it is not required under § 1910.134. In a voluntary-use situation, OSHA requires a limited respiratory protection program. Elements of a limited program include the medical condition of the user; cleaning, storage, and maintenance; and minimal training. Employees who use a respirator voluntarily only need to be provided with the information in Appendix D.

Section 1910.134(d) addresses respirator selection. Employers are required to evaluate the respiratory hazards of the workplace, identify relevant workplace and user factors, then base respirator selection on these factors. The employer is responsible for selecting and providing an appropriate respirator based on respiratory hazard exposure. Employers shall select a respirator certified by NIOSH, and that respirator shall be used in compliance with conditions of its certification. Respirator selection is based on the APF and the MUC.

Respiratory protection program administrators should understand the purpose of the proper administration of a medical evaluation or physical examination. The employer is required to identify a PLHCP to perform the medical evaluations. This evaluation/examination shall contain the same information as the OSHA questionnaire provided for the employee. Follow-up

Notes:

examinations may be required. The employer shall provide respiratory protection training and medical evaluations at no cost to the employee.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Centers for Disease Control and Prevention. (2010, January 21). *42 C.F.R. part 84 respiratory protective devices*. Retrieved from http://www.cdc.gov/niosh/pt84abs2.html

Information for Employees Using Respirators When Not Required Under This Standard (Mandatory), Appendix D to 29 C.F.R. § 1910.134 (2013).

Janssen, L. (2000, January 18). What constitutes voluntary use of respirators? *EHS Today*. Retrieved from http://ehstoday.com/news/ehs_imp_32902/

National Institute for Occupational Safety and Health. (2004, October). *NIOSH respirator selection logic* (NIOSH Publication No. 2005-100). Retrieved from http://www.cdc.gov/niosh/docs/2005-100/pdfs/05-100.pdf

Occupational Safety & Health Administration. (n.d.). *Permissible exposure limits*. Retrieved from http://www.osha.gov/SLTC/pel/

Occupational Safety and Health Administration. (2006, December). *Major requirements of OSHA's respiratory protection standard 29 C.F.R. 1910.134.* Retrieved from http://www.osha.gov/dte/library/respirators/major_requirements.html

Occupational Safety and Health Administration. (2009). *Assigned protection factors for the revised respiratory protection standards*. Retrieved from http://www.osha.gov/Publications/3352-APF-respirators.pdf

Occupational Safety and Health Administration (Producer). (2009, December). *The difference between respirators and surgical masks* [Video]. Available from http://63.234.227.130/SLTC/respiratoryprotection/index.html

OSHA Respirator Medical Evaluation Questionnaire (Mandatory), Appendix C to 29 C.F.R. § 1910.134 (2013).

Public Health, 42 C.F.R. Part 84 (2012).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

Qualitative and Quantitative Fit Testing

Duration: 2.00 Hours

Summary: Participants take part in an in-depth study of the protocols, checklists, and best practices in accordance with Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(f) (2013) and Fit Testing Procedures (Mandatory), Appendix A to § 1910.134. In addition, the mandatory fit testing procedures are outlined and demonstrated. Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate manual provided to participants, as § 1910.134(f) and Appendix A are reviewed. Participants are divided into two groups that are approximately equal in size. Module 6 and Module 7, "CNP Fit Testing Technology Exercise," are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions. The second group attends the "CNP Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Terminal Learning Objective: At the conclusion of this module, participants will be able to describe fit testing requirements in accordance with § 1910.134(f).

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

6-1 Identify the types of fit tests allowed according to § 1910.134(f).

6-2 Describe the procedures for conducting fit testing according to § 1910.134, Appendix A.

6-3 Perform a proper inspection of an air-purifying respirator (APR).

Practical Exercise: Participants participate in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. Additionally, participants participate in a hands-on activity in which they perform an inspection of an APR following the manufacturer's guidelines. Time for this hands-on activity is approximately 20 minutes.

Risk Assessment: Low

Methods of Instruction: Instructors use a facilitated lecture format supported by presentation visuals and videos. Reflective questioning challenge participants' critical thinking skills and reinforce module content. Participants participate in instructor-guided and collaborative knowledge checks throughout the module, where they identify the types of fit tests allowed and describe the procedures for conducting fit testing. The two videos used in this module reinforce the content and provide additional opportunities for instructors to assess comprehension via reflective questioning at the end of each. The first video illustrates how a Qualitative Fit Test (QLFT) is performed by the Center for Domestic Preparedness (CDP; approximately 8:41) and the second video is entitled "Respirator Safety. Donning (Putting on) and Doffing (Taking off) and User Seal Checks" and is produced by the Occupational Safety and Health Administration (OSHA; approximately 9:16). In the small-group discussion, participants discuss how their departments or jurisdictions apply the § 1910.134(f) and Appendix A. Individually, participants inspect an APR according to the manufacturer's guidelines. In addition, there is a video demonstration of a qualitative fit test and small-group discussion to reinforce module content.

Instructor-to-Participant Ratio: 1:15 for lecture; 1:5 for small-group discussion

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participant comprehension based upon their presentation of key points from the small group discussions. In addition, participants take part in instructor-guided and collaborative knowledge checks. Instructors informally assess participants on inspecting the APR. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134(f) and Appendix A are outlined using the *Reference Manual*. Participants are divided into two groups that are approximately equal in size. Module 6 and Module 7, "CNP Fit Testing Technology Exercise," are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions. The second group attends the "CNP Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Objectives

- Identify the types of fit tests allowed
- Describe the procedures for conducting fit testing
- Perform a proper inspection of an air-purifying respirator (APR)

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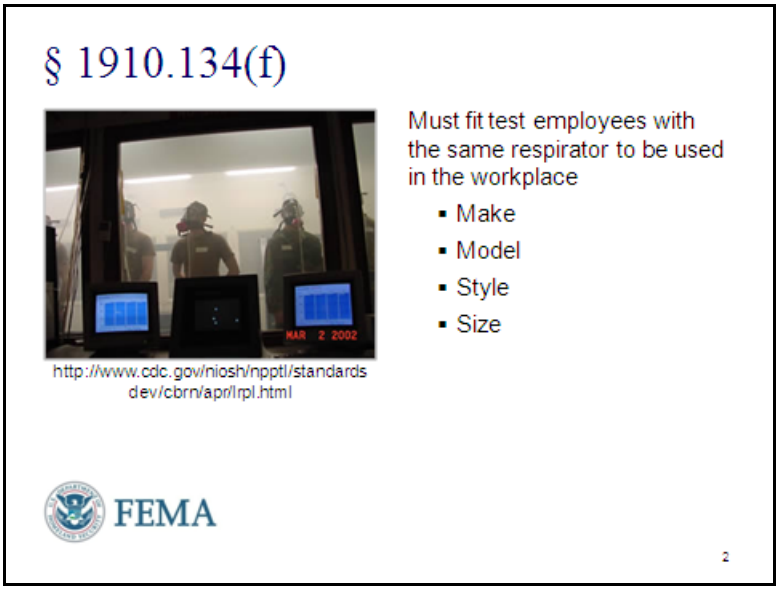
Notes:

Enabling Learning Objective 6-1: Identify the types of fit tests allowed according to § 1910.134(f).



§ 1910.134(f)

Section 1910.134(f) discusses fit testing. This paragraph requires that before an employee may be required to use any respirator with a negative- or positive-pressure, tight-fitting facepiece, the employee shall be fit tested with the same make, model, style, and size of respirator that will be used in the workplace (Respiratory Protection, 29 C.F.R. § 1910.134, 2013).

Key Point:

Paragraph (f)(1) states that “the employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate Qualitative Fit Test (QLFT) or Quantitative Fit Test (QNFT)” (2013).

Notes:

§ 1910.134(f) (continued)

Courtesy of CDP

§ 1910.134(f)(1) Employees using tight-fitting facepiece respirator must pass

- Qualitative Fit Test (QLFT)—Pass/fail test relying on the subject's response to an agent.
- Quantitative Fit Test (QNFT)—Direct numerical measurement of the respirator face-seal performance.

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§ 1910.134(f) (continued)

QLFT

- No results documentation
- Limited to a negative-pressure APR requiring a fit factor ≤ 100
- Can be imprecise
- Easy to perform incorrectly

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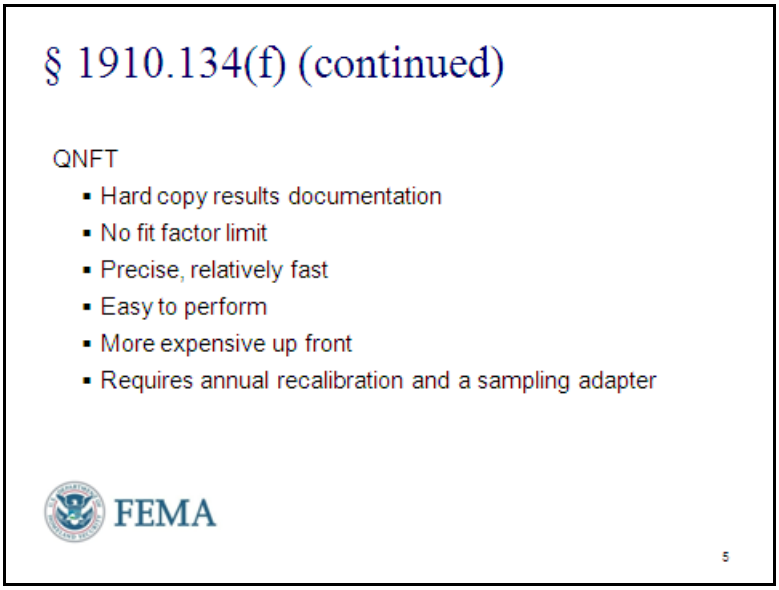
Notes:

A QLFT is a pass/fail test that relies on the subject's voluntary or involuntary response to an agent. If the subject detects the agent (through taste, smell, or irritation) at any time during the test, it is a fail. A QLFT is inexpensive with the upfront cost and requires low maintenance; however, these tests can be imprecise, easy to perform incorrectly, subject to deception, and slow. QLFTs provide no documentation of results and are limited to negative-pressure APRs requiring a fit factor of 100 or less (TSI Incorporated, 2003).



A QNFT involves a direct numerical measurement (i.e., fit factor) of the respirator's face-seal performance. QNFTs are more expensive initially, and they require annual recalibration plus a sampling adapter. However, they offer no fit factor limit; are precise, faster, and easy to perform with no chance of deception; and provide a hard copy documentation of results (TSI Incorporated, 2003).

Notes:

§ 1910.134(f) (continued)

Courtesy of CDP

- § 1910.134(f)(2)—Addresses when fit testing is obligatory
- § 1910.134(f)(3)—Addresses the need for additional fit testing

FEMA

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§ 1910.134(f) (continued)

Courtesy of CDP

- § 1910.134(f)(4)—States the employee can ask for a different respirator if the current one does not fit
- § 1910.134(f)(5)—Discusses the type of protocol for the fit test

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Notes:

§ 1910.134(f) (continued)

- § 1910.134(f)(6)—States the QLFT may only be used to test negative-pressure APR that must achieve a fit factor of ≤ 100
- § 1910.134(f)(7)—States for QNFT the fit factor must be ≥ 100 for tight-fitting half facepieces, or ≥ 500 for tight-fitting full facepieces

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§ 1910.134(f) (continued)

Courtesy of CDP

- § 1910.134(f)(8)—SCBA, SAR, and PAPR must be fit tested in the negative-pressure mode regardless of the operation mode used for respiratory protection

Note: Paragraphs (f)(8)(i)–(f)(8)(iii) outline appropriate respirator configurations for the fit test

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Notes:

The following are major points within § 1910.134(f):

- Section 1910.134(f)(2)—"The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter" (2013). This paragraph addresses when fit testing is obligatory. "The employer shall ensure that the employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (i.e., size, style, model, or make) is used and at least annually thereafter" (Respiratory Protection, 29 C.F.R. § 1910.134[f][2], 2013).
- Section 1910.134(f)(3)—"The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight" (2013).

  This paragraph addresses the need for additional fit testing. Because this paragraph deals with the personal appearance of the employee, the sensitive nature of the situation could cause offense to the wearer. It is important the employer understand the sensitivity of the situation and address it in an appropriate manner with the employee.
- Section 1910.134(f)(4)—This paragraph states that the employee can ask, based on the respirator being unacceptable, the employer for a different respirator. The employee must state that the respirator no longer fits. The employer is then obligated to give the employee a reasonable opportunity to select another respirator for retesting.
- Section 1910.134(f)(5)—This paragraph discusses the type of protocol used for the fit test. The test shall be administered using an Occupational Safety and Health Administration (OSHA)-accepted QLFT or QNFT protocol. These protocols and procedures are contained in Appendix A.
- Section 1910.134(f)(6)—This paragraph states that the "QLFT may only be used to fit test negative-pressure air-purifying respirators that must achieve a fit factor of 100 or less" (2013).
- Section 1910.134(f)(7)—This paragraph states that for the respirator to pass QNFT, "the fit factor shall be equal to or greater than 100 for tight-fitting half facepieces or equal to or greater than 500 for tight-fitting full facepieces" (2013).

Notes:

- Section 1910.134(f)(8)—This paragraph requires that Self-Contained Breathing Apparatus (SCBA), Supplied-Air Respirator (SAR), and Powered Air-Purifying Respirators (PAPR) be fit tested in the negative-pressure mode regardless of the operation mode used for respiratory protection. Appropriate configurations of the respirator for the fit test are outlined in paragraphs (f)(8)(i) through (f)(8)(iii).

✔ **Knowledge Check:**

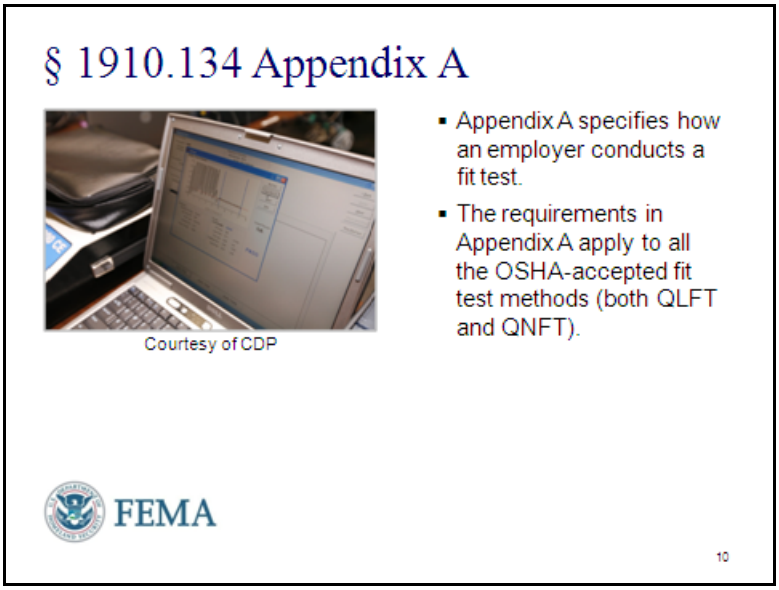
What are the two types of allowable fit tests according to § 1910.134(f)?

What type of respirator should an employee use in a fit test?

What are the advantages and disadvantages of each type of fit test?

Notes:

Enabling Learning Objective 6-2: Describe the procedures for conducting fit testing according to § 1910.134, Appendix A.



§ 1910.134 Appendix A

Key Point:

Section 1910.134 (2013), Appendix A specifies how employers should conduct fit testing.

The requirements in this Appendix apply to all the OSHA-accepted fit test methods, both QLFT and QNFT.

Notes:

§ 1910.134 Appendix A (continued)

§ 1910.134, Appendix A, Part I, General Requirements

- I.A.1—Employer is obligated to provide a sufficient number of respirator models from which to choose
- I.A.2—Use a mirror to assist in the fitting of the respirator
- I.A.3—Addresses comfort issues
- I.A.4—Hold each facepiece up to the face and eliminate those that obviously do not give an acceptable fit

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§ 1910.134 Appendix A (continued)

Courtesy of CDP

- I.A.5—Wear the selected mask for at least 5 minutes to determine the proper fit and comfort
- I.A.6—Addresses assessment of the comfort of the respirator

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Notes:

§ 1910.134 Appendix A (continued)

- I.A.7—Addresses the criteria to determine the adequacy of the respirator fit
- I.A.8—After donning the mask, the test subject will conduct a user seal check

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§ 1910.134 Appendix A (continued)

- I.A.9—Any hair between the skin and facepiece-sealing surface or any type apparel that interferes with a satisfactory fit shall be altered or removed
- I.A.10—Health of the test subject
- I.A.11—If there is an unacceptable fit, the test subject may select a different respirator and be retested

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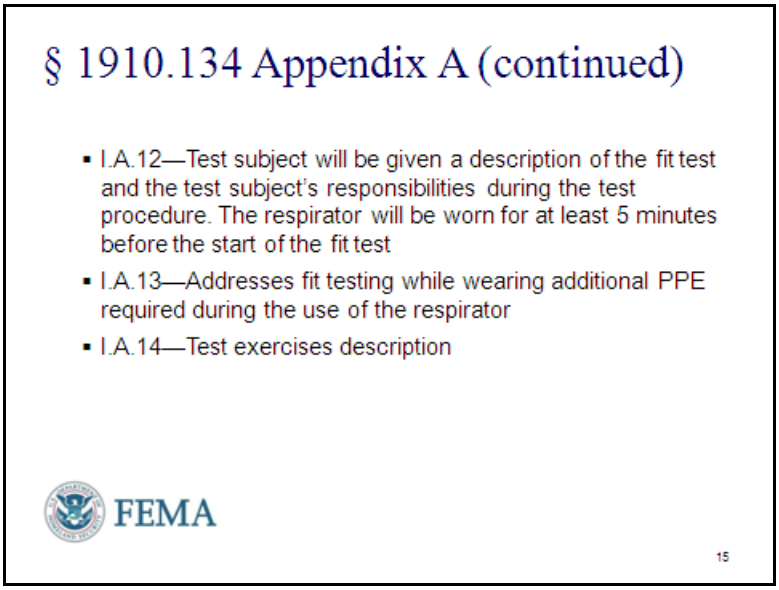
Notes:



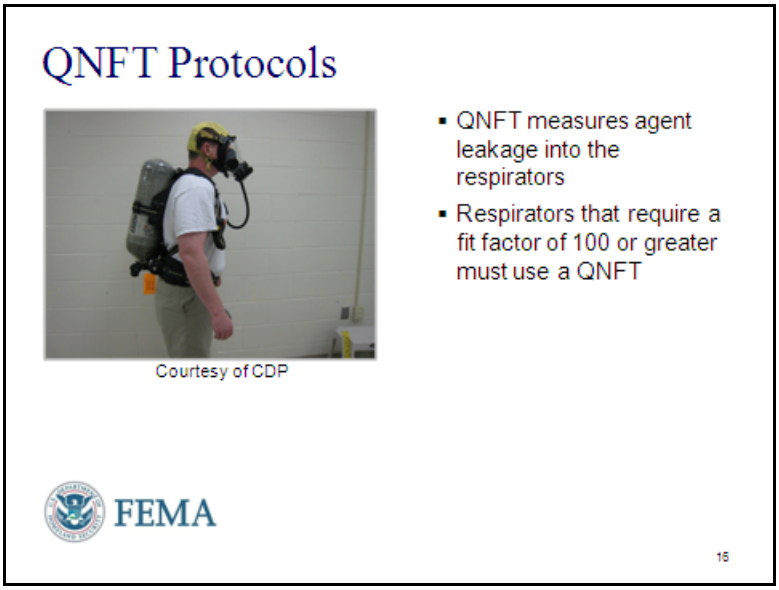
General requirements located in § 1910.134 (2013), Appendix A, Part I.A is as follows:

- I.A.1—The employer is obligated to provide the employee with a sufficient number of respirator models from which to choose.
- I.A.2—A mirror will be available to assist in the fitting of the respirator.
- I.A.3—This paragraph addresses comfort issues. The operative words are sizing and comfort. The mask should not pinch the face.
- I.A.4—The employee "shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit" (2013).
- I.A.5—The employee should wear the selected mask for at least 5 minutes to determine proper fit and comfort.
- I.A.6—This paragraph addresses the assessment of comfort for the test subject. The test subject should be given adequate time to determine the comfort of the respirator. The following points shall be reviewed with the test subject: position of the mask on the nose, room for eye protection, room to talk, and position of the mask on the face and cheeks.

Notes:

- I.A.7—This paragraph addresses the criteria used to determine the adequacy of the respirator fit. The criteria include whether the chin is properly placed, if strap tension is adequate, the respirator's fit across the nose bridge, whether the respirator of proper size spans the distance from nose to chin, whether the respirator tends to slip, and finally, self-observation in a mirror to evaluate fit and respirator position.
- I.A.8—The test subject shall conduct a user seal check. The steps for this check are located in Appendix B-1 of this standard. If the test subject fails the user seal check tests, another facepiece shall be selected and retested.
- I.A.9—This paragraph discusses hair growth on the face. The fit test shall not be conducted if there is any hair between the skin and the facepiece-sealing surface. Any type of apparel that interferes with a satisfactory fit shall be altered or removed.
- I.A.10—This paragraph addresses the health of the test subject. "If the test subject exhibits difficulty in breathing during the tests, he or she is referred to a Physician or other licensed health care professional (PLHCP) to determine whether the test subject can wear a respirator" (2013).
- I.A.11—"If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and be retested" (2013).
- I.A.12—"The test subject will be given a description of the fit test and the test subject's responsibilities during the test procedure" (2010). This process includes a description of the test exercises that the subject is performing. "The respirator to be tested shall be worn for at least five minutes before the start of the fit test" (2013).
- I.A.13—This paragraph addresses additional personal protective equipment (PPE) the test subject may require as part of his or her job. The fit test shall be performed while the test subject wears any PPE that may be worn during actual respirator use and that could interfere with respirator fit.
- I.A.14—This paragraph address the exercises to be performed during the fit test.

Notes:

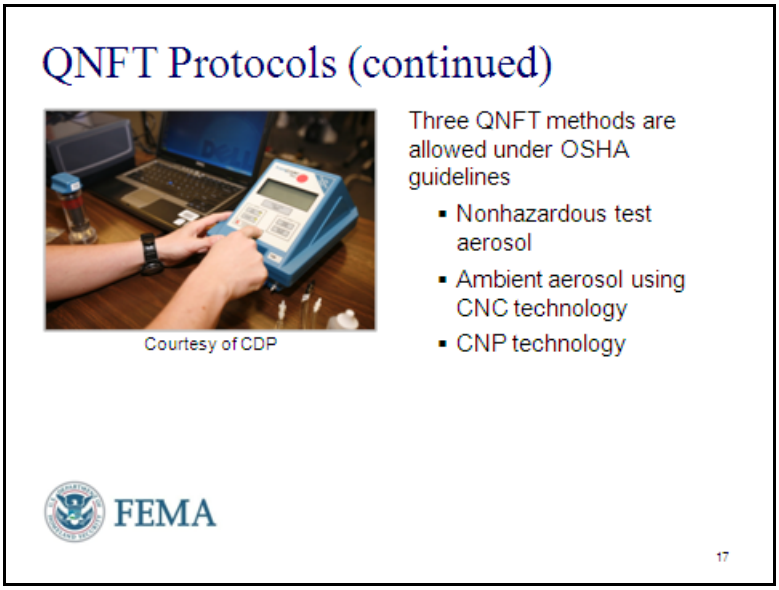


QNFT Protocols

Key Point:

A QNFT measures agent leakage into respirators without dependence on a test subject's voluntary or involuntary response to the agent (TSI Incorporated, 2003). QNFT must be used for respirators that require a fit factor of 100 or greater (Respiratory Protection, 29 C.F.R. § 1910.134, 2013).

Notes:



Quantitative fit testing is scientific and produces a test result measurement on completion. OSHA guidelines allow QNFTs by one of three methods:

- Use a nonhazardous test aerosol generated in a test chamber and employ instrumentation to quantify the respirator fit.
- Use ambient aerosol as the test agent and appropriate instrumentation (Condensation Nuclei Counter [CNC]) to quantify the respirator fit.
- Use Controlled Negative Pressure (CNP) and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

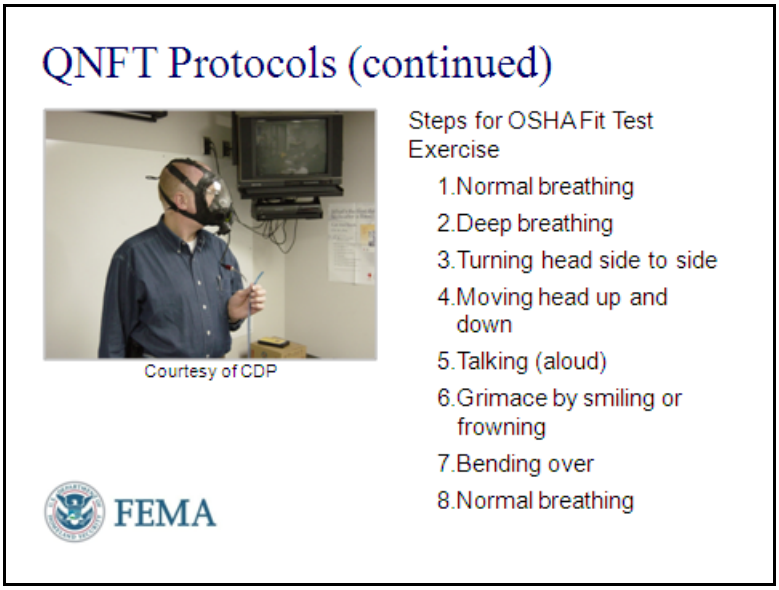
Notes:

The seven competency standards of the test conductor performing a QNFT, found in Appendix A, Part I.C.1, are as follows:

- Calibrate the equipment
- Perform tests properly
- Recognize invalid tests
- Calculate fit factors properly
- Test equipment to ensure it is working properly
- Keep equipment clean
- Maintain and calibrate equipment according to manufacturer's instructions (2013)

The two types of QNFT procedures are ambient aerosol CNC and CNP.

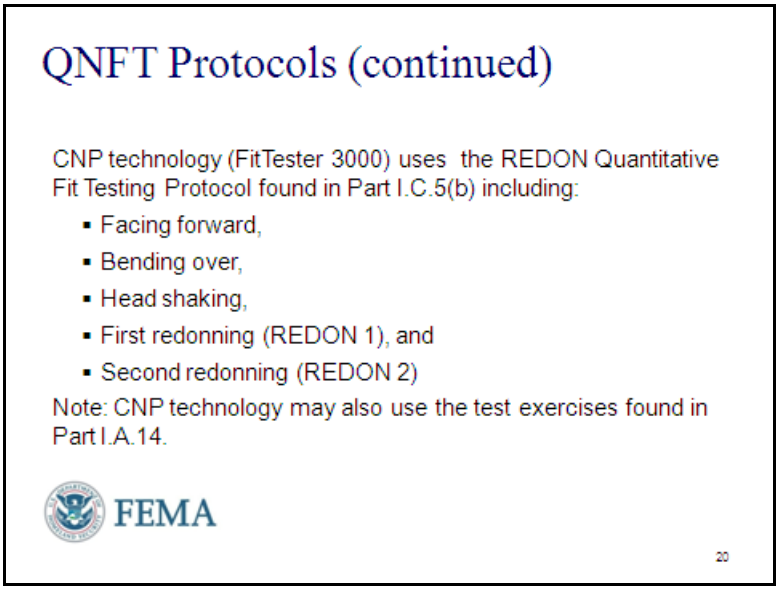
Notes:



The CNC method tests for particulates and requires a High-Efficiency Particulate Air (HEPA) filter worn on the mask. The PortaCount® uses the QNFT protocol found in the OSHA Fit Test Exercise in Part I.A.14 and listed below:

1. Normal breathing
2. Deep breathing
3. Turning head side to side
4. Moving head up and down
5. Talking (aloud)
6. Grimace by smiling or frowning
7. Bending over
8. Normal breathing

Notes:

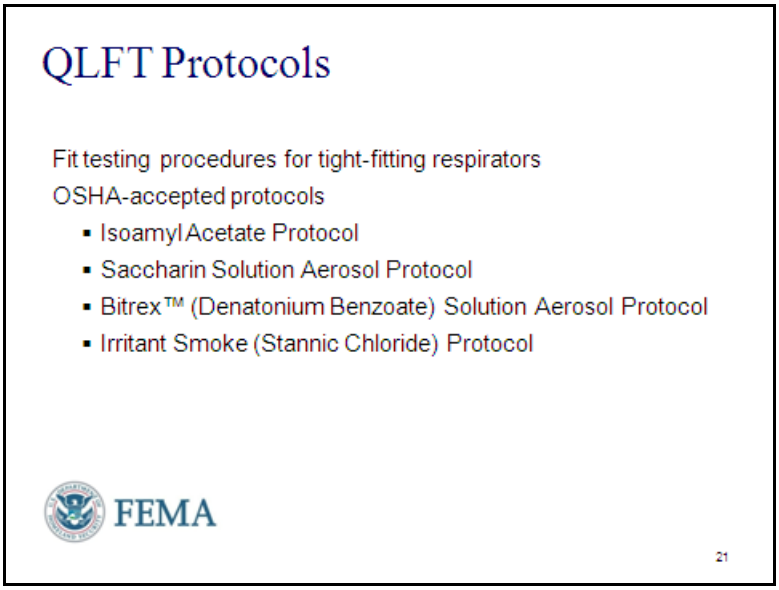


The CNP method tests for seal leakage, so the respirator does not use a filter when performing the quantitative test. The FitTester 3000 uses the protocol found in Part I.A.14 above as well as CNP REDON Fit Testing Protocol found in Part I.C.5(b) below:

- Facing forward
- Bending over
- Head shaking
- First redonning (REDON 1)
- Second redonning (REDON 2)

According to § 1910.134 (2013), Appendix A, at the completion of the test protocol, the test subject is to be questioned by the test conductor regarding the comfort of the respirator. If the respirator is unacceptable, the employer shall ensure that the test administrator repeats the protocol using another respirator model.

Notes:



QLFT Protocols

Qualitative fit testing checks for a thorough seal using a chemical that produces a smell, taste, or an irritant. This induces a response from the tested person if leakage occurs. The OSHA-accepted protocols include Isoamyl Acetate Protocol, Saccharin Solution Aerosol Protocol, Bitrex™ (Denatonium Benzoate) Solution Aerosol Protocol, and Irritant Smoke (Stannic Chloride) Protocol. An example of a qualitative fit test is the use of stannic chloride. This QLFT uses a person's response to the irritating stannic chloride smoke to detect leakage into the respirator. Each of the protocols requires the test subject to don the respirator without assistance and perform the required user seal check.

Notes:

QLFT Process

Play Video
Courtesy of CDP

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QLFT Process (continued)

Courtesy of CDP

Appendix A, Part I, Section B, paragraph 1(a) lists the test administrator competency standards for a QLFT

- Prepare test solutions
- Calibrate equipment
- Perform tests properly
- Recognize invalid tests
- Ensure that testing equipment is in proper working order

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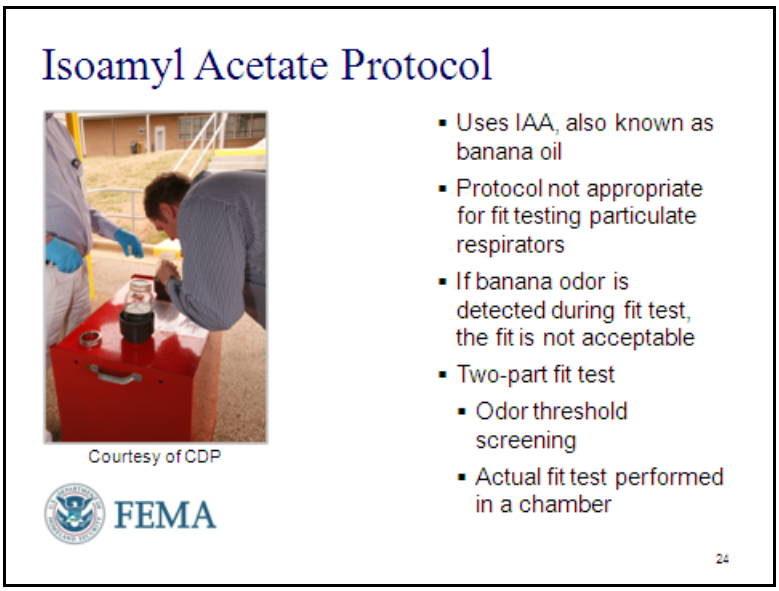
Notes:

QLFT Process

Key Point: Appendix A, Part I, Section B, paragraph 1(a) lists the following test administrator competency standards for a QLFT:

- Prepare test solutions
- Calibrate equipment
- Perform tests properly
- Recognize invalid tests
- Ensure that testing equipment is in proper working order



Isoamyl Acetate Protocol

The Isoamyl Acetate Protocol uses Isoamyl Acetate (IAA), more commonly known as banana oil, as a test agent. This QLFT protocol relies on a person's sense of smell; if a banana odor is detected during the fit test, the fit is not acceptable. This protocol is not appropriate to use for fit testing particulate respirators.

Notes:

Isoamyl Acetate Protocol (continued)

First Part

Odor threshold screening without wearing respirator

Two jars of distilled water are prepared:

- Low concentration of IAA
- Plain distilled water

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Isoamyl Acetate Protocol (continued)

Courtesy of CDP

First Part (continued)

- Jars are placed on the table with a typed card containing information about conducting the test
- Correctly identify the jar with banana odor

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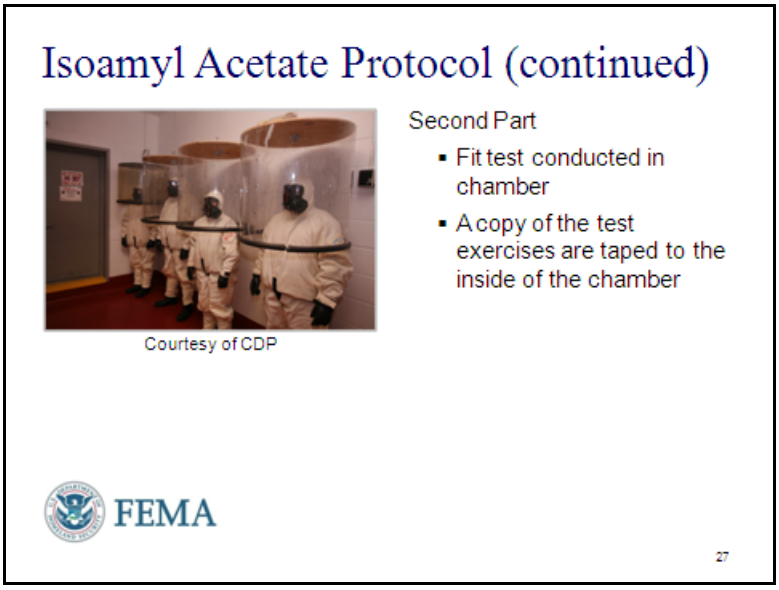
Notes:

This is a two-part test, including the threshold screening and the actual fit test. The first part of the test, as described in § 1910.134 (2013), Appendix A, Part I.B.2(a), involves the odor threshold screening that is performed without wearing a respirator. Two jars of odor-free water (i.e., distilled water) are prepared, one with a low concentration of IAA, the other with plain water. The screening test solution should be prepared at least weekly. To prevent olfactory fatigue, the screening test will be conducted in a separate room from the preparation room and the actual fit test. The odor test and the blank test jars are placed on a table with a typed card containing the information for conducting the test, found in I.B.2(a)(8), placed in front of them. Test subjects shall correctly identify the jar with the banana odor to qualify for the fit test. Those who cannot identify the correct jar must wait until their sense of smell recovers or be fit tested using another technique.



Notes:

Isoamyl Acetate Protocol (continued)

Courtesy of CDP

- A chamber can be constructed based on the directions in Appendix A, Part I, Section B, paragraph 2(b)
- Chamber room is separate from the odor threshold screening and respirator selection rooms

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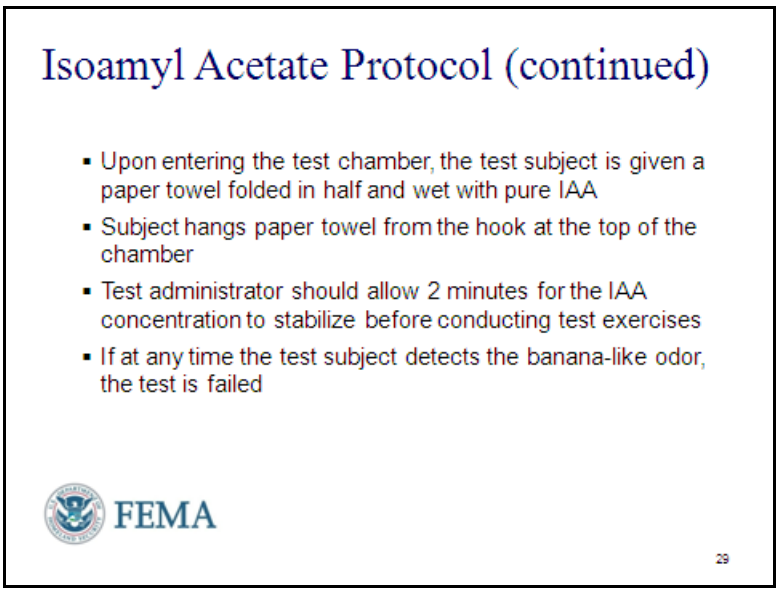
The second part of the Isoamyl Acetate Protocol is the actual fit test, as described in § 1910.134 (2013), Appendix A, Part I.B.2(b). To perform the fit test, a fit test chamber shall be constructed from a clear 55-gallon drum liner suspended inverted over a 2-foot-diameter frame so that the top of the chamber is about 6 inches above the subject's head and the inside top is fitted with a small hook. If a drum liner is not available, a similar chamber using plastic sheeting may be constructed. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. Once the respirator is selected, the test subject will wear it into the fit testing room. A copy of the test exercises is taped to the inside of the test chamber. The directions for constructing the chamber are found in Appendix A, Part I.B.2(b). The test chamber is located in a room separate from the threshold screening and the respirator selection rooms.

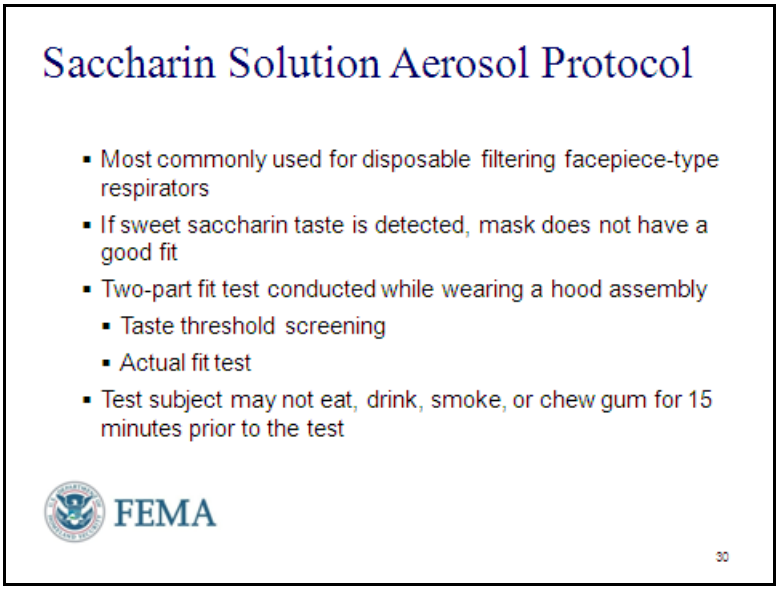
Notes:



Upon entering the test chamber, the test subject is given a paper towel (or other porous, absorbent, single-ply material) folded in half and wet with pure IAA, which is to hang from the hook at the top of the chamber. An IAA test swab or an ampoule may be substituted for the wet paper towel. The test conductor should allow 2 minutes for the IAA concentration to stabilize before starting the fit test exercises. If at any time during the test the subject detects the banana-like odor, the test is failed and the subject shall wait at least 5 minutes before retesting with a different respirator.

If the subject passes the isoamyl acetate fit test, the efficacy of the test procedure will be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber. When leaving the chamber, the subject shall remove the towel and return it to the test conductor so there is no significant concentration of IAA in the chamber during subsequent tests. The test conductor should keep all used towels in a self-sealing plastic bag to keep the test area from becoming contaminated.

Notes:



Saccharin Solution Aerosol Protocol

Saccharin Solution Aerosol Protocol is another type of QLFT. The technique is most commonly used for disposable filtering facepiece type respirators but can be used for other masks as well. The saccharin test relies on a person's sense of taste; if the sweet taste of the saccharin is detected, the mask does not have a good fit (TSI Incorporated, 2003).

This protocol is a two-part fit test, conducted while wearing a hood assembly. Prior to the actual fit test, the saccharin taste threshold screening is performed without a respirator, as described in § 1910.134 (2013), Appendix A, Part I.B.3(a). Screening is intended to determine whether the individual being tested can detect the taste of saccharin. For both the threshold screening and the fit test, the test subject will wear an enclosure about the head and the shoulders. The enclosure should have the following characteristics:

- Be approximately 12 inches in diameter and 14 inches tall
- Have a transparent front area
- Be a shape allowing free movement of the head when a respirator is worn

Notes:

- Have a ¾-inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle

It is important that the test procedures be explained prior to administering the threshold screening and fit test. The test subject is instructed to breathe through the slightly open mouth with the tongue extended. When a sweet taste is detected, the test subject is instructed to report it to the test conductor.

NOTE: Test subjects should not eat or drink anything sweet before the screening test, as they may be unable to taste the weak saccharin solution.

The threshold screening begins when the test conductor sprays the threshold check solution into the enclosure using a DeVilbiss® Model 40 Inhalation Medication Nebulizer, or the equivalent. The nozzle is directed away from the nose and the mouth of the subject. The test conductor must squeeze the nebulizer bulb firmly so that it completely collapses, then release and allow it to expand fully. Ten squeezes are repeated in rapid succession, and then the test subject is asked whether the saccharin can be tasted. If the test subject reports the sweet taste during the 10 squeezes, then the test is complete and the taste threshold is recorded as 10 regardless of the number of squeezes actually completed. The test subject is asked to note the taste for later reference in the fit test. However, if the test subject does not report a taste, the test is repeated a second time. If the subject reports no taste, the test is repeated a third time. If after the third series of 10 squeezes there is no taste reported, the subject is not to perform the saccharin fit test. At the completion of the test, the test conductor will thoroughly rinse in water, shake dry, and refill the nebulizer. The nebulizer should be refilled each morning and afternoon or at least every 4 hours.

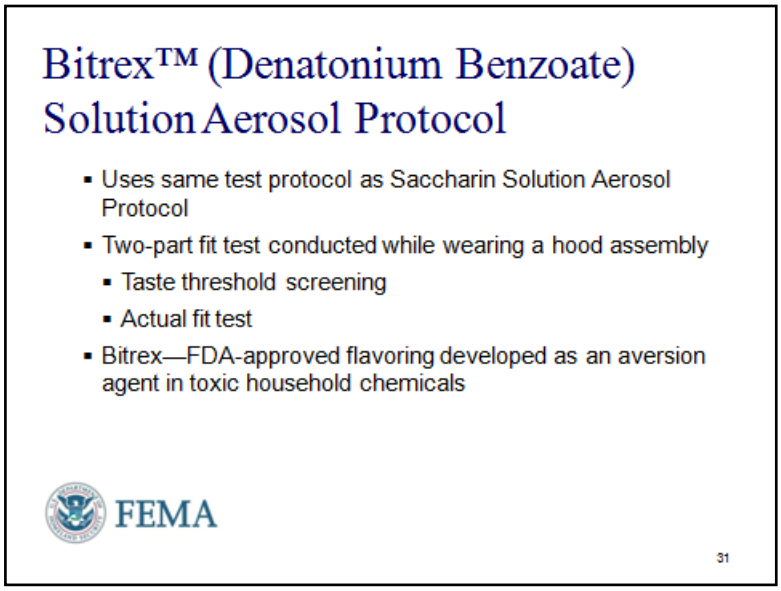
The second part of the protocol is the saccharin solution aerosol fit test procedure, as described in § 1910.134 (2013), Appendix A, Part I.B.3(b). It is performed after a successful threshold screening. The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes prior to the test. The fit test uses the same type of enclosure as the threshold screening. For the fit test, the subject will don the enclosure while wearing the appropriately selected, properly adjusted respirator. The respirator is equipped with a particulate filter for this test. A second nebulizer, clearly marked as the fit test solution, is used to spray the solution into the enclosure. Just as before, the test subject should be instructed to breathe through the slightly open mouth with the tongue extended. The nebulizer is inserted into the enclosure and the same number of squeezes is sprayed. For example, if the test subject required 20 squeezes to taste saccharin in the threshold screening, then 20 squeezes will be used for the test. A minimum of 10 squeezes is required. The test subject is then instructed to perform the exercises

Notes:

in Appendix A, section I.A.14; during that time, the test conductor uses half the original number of squeezes every 30 seconds to replenish the aerosol concentration. If at any time during the test the subject detects the taste of saccharin, the test is failed. A different respirator shall be tried and the entire test procedure, including taste threshold screening and fit test, shall be repeated.

NOTE: Because the nebulizer has a tendency to clog during use, the test operator shall periodically check to ensure that it is not clogged. The test is deemed invalid if clogging is found at the end of the test session.

National Institute for Occupational Safety and Health (NIOSH) had previously recommended not using the saccharin test because of its classification as a potential carcinogen; however, upon review NIOSH concluded that the risk to workers from using saccharin in a fit test was extremely small. As a result, NIOSH recommends saccharin for use in a qualitative fit test per § 1910.134 (NIOSH, 2004).



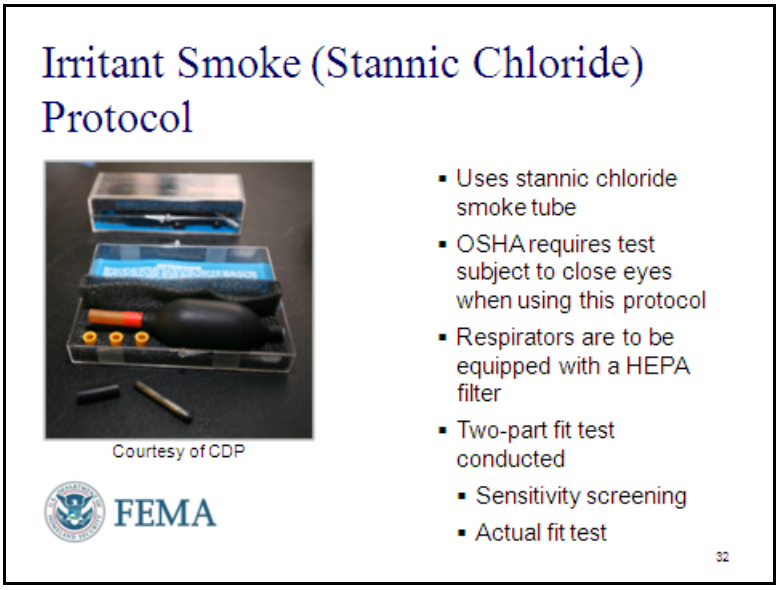
Bitrex™ (Denatonium Benzoate) Solution Aerosol Protocol

The Bitrex (Denatonium Benzoate) Solution Aerosol Protocol, as described in § 1910.134 (2013), Appendix A, Part I.B.4, uses the same widely accepted test protocol as the Saccharin

Notes:

Solution Aerosol Protocol. It is also a two-part fit test, conducted while wearing a hood assembly, and includes an odor threshold screening and a fit test.

For the amount of the substance used in the protocol, consult Paragraph (a) of I.B.4. Bitrex, a bitter-tasting substance, is a Food and Drug Administration (FDA)-approved flavoring originally developed to deter children from swallowing toxic household chemicals.



Irritant Smoke (Stannic Chloride) Protocol

The Irritant Smoke (Stannic Chloride) Protocol, described in § 1910.134 (2013), Appendix A, Part I.B.5(a), is the fourth agent that OSHA permits. This test uses a stannic chloride smoke tube. If enough of the irritant smoke leaks into the mask, it will result in a reaction, such as coughing or watery eyes.

When using the irritant smoke protocol, respirators are to be equipped with a HEPA filter. This protocol uses only stannic chloride smoke tubes, and does not require the test subject to use a test enclosure or hood. Because the smoke can be irritating to the eyes, lungs, and nasal passages, the test conductor must take precautions to minimize the test subject's exposure to irritant smoke. Additionally, the fit test protocol shall be performed in an area that has adequate ventilation to prevent the buildup of irritant smoke in the general atmosphere.

Notes:

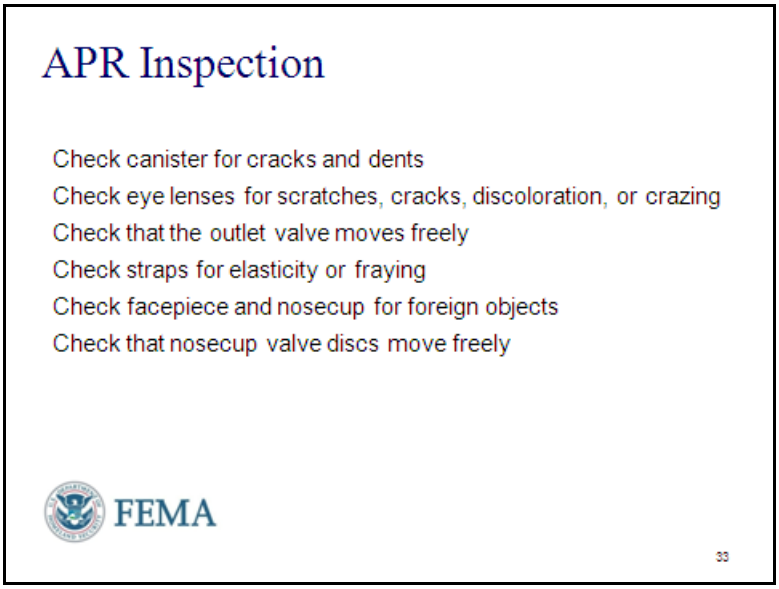
Like the previous protocols, the irritant smoke protocol has both a sensitivity screening check and a fit test procedure. The sensitivity screening check, as explained in § 1910.134 (2010), Appendix A, Part I.B.5(b), is conducted to detect the test subject's ability to detect a weak concentration of irritant smoke. The test conductor breaks both ends of the ventilation smoke tube containing stannic chloride and then attaches one end to either an aspirator squeeze bulb or a low-flow air pump set to deliver 200 ml per minute. The other end of the tube should be covered with a short piece of tubing to prevent potential injury from jagged edges. The test subject is told to keep his or her eyes closed while the test is performed to minimize eye, lung, and nasal passage irritation. The test conductor carefully directs a small amount of the irritant smoke toward the test subject to determine if he or she can detect it.

The irritant smoke fit test procedure, described in § 1910.134 (2013), Appendix A, Part I.B.5(c), requires the test subject to don the respirator without assistance and perform the required user seal check. The test subject is first instructed to keep his or her eyes closed. The test administrator directs the stream of irritant smoke from the smoke tube toward the test subject's face seal using either the low-flow pump or the squeeze bulb. The test administrator shall begin at least 12 inches from the facepiece and move the smoke stream around the perimeter of the mask. The administrator gradually makes two more passes around the perimeter of the mask (for a total of three passes), moving within 6 inches of the respirator. If the test subject does not respond involuntarily and/or detect the irritant smoke, proceed with the test exercises found in section I.A.14. of Appendix A. The test subject performs these exercises while the respirator seal is being continually challenged by the smoke at a distance of 6 inches. If the test subject detects the irritant at any time, the test is failed. The subject being retested shall repeat the entire sensitivity check and fit test procedure. Each test subject that passes the irritant smoke test without evidence of a response (e.g., involuntary cough, irritation) shall be given a second sensitivity screening check with the smoke from the same smoke tube used during the fit test. The second sensitivity screening check includes removing the respirator and determining whether the test subject still reacts to the smoke. If a response is produced during the second sensitivity check, then the fit test is passed. However, failure to evoke a response voids the fit test.

NOTE: According to *NIOSH Respirator Selection Logic*, the agency "strongly recommended against the use of this fit test method because of the health risk associated with exposure to irritant smoke" (NIOSH, 2004, p. 29). NIOSH has conducted tests and concluded when the irritant smoke test is administered there is a risk of overexposure to stannic chloride during the facepiece fit test.

Notes:

Enabling Learning Objective 6-3: Perform a proper inspection of an APR.



APR Inspection

Key Point:

The following are general inspection procedures employees should use each time an APR is donned:

- Check canister for cracks or dents.
- Check eye lenses for scratches, cracks, discoloration, or crazing.
- Check that the outlet valve moves freely.
- Check straps for elasticity or fraying.
- Check facepiece and nosecup for foreign objects.
- Check that nosecup valve discs move freely.

Notes:

For this course, the Mine Safety Appliances (MSA) Company Millennium® APR/CBRN Respirator will be used. Employers should always observe guidelines for how to inspect and clean APRs by using applicable regulatory standards and/or the guidebook for the particular equipment. Inspection of the following components should be completed before and after each use (at a minimum), and the following procedures should be the same for all respirator inspections; however, it is important to follow the manufacturer's guidelines (Mine Safety Appliances [MSA] Company, 2008):

- Inhalation valve assembly
- Exhalation valve
- Harness straps
- Lens
- Cartridge/canister
- Facepiece blank
- Accessories (if necessary)

Activity:

Participants will inspect an APR, following proper inspection procedures listed below.

The following are proper inspection procedures for an MSA Millennium APR/CBRN Respirator; however, employers should follow the manufacturer's guidelines when inspecting their own equipment (MSA Company, 2008):

1. Check for breaks or tears in the facepiece head-strap material.
2. Verify that all straps, fasteners, and adjusters are in place and not damaged.
3. Check the facepiece for dirt, cracks, tears, or holes.
4. Check the lens for cuts, scratches, or damage that would impair vision. Squeeze the lens; it should collapse easily between the fingers. Check that the lens is secured in the facepiece.
5. Check the shape of the facepiece for distortion due to improper storage.
6. Unthread the cartridge/canister (if installed), and check that the spider gasket, inhalation valve assembly, and deflector are installed and undamaged.

Notes:

7. Grasp the spider gasket by the raised tabs and pull it gently out of the facepiece. The gasket must be free of cracks, tears, dirt, and distortion. The gasket shall be soft and flexible.
8. Reach into the facepiece and remove the deflector and inhalation valve assembly. The deflector and inhalation valve assembly shall be free of cracks, tears, dirt, and distortion. The inhalation valve assembly shall be soft and flexible.
9. Set these parts aside in a clean location.
10. Insert the P/N 461828 wrench (spanner wrench) into the side voicemitter retaining ring. Turn the ring counterclockwise to unthread.
11. Remove the side voicemitter (smaller port on the side of the facepiece) from the port. The voicemitter may need to be pushed from inside the facepiece to remove.
12. Inspect the side voicemitter for signs of damage that would allow the contaminant to enter the facepiece.
13. Carefully remove the gasket from the port. The gasket shall be free of cracks, tears, dirt, and distortion. The gasket shall be soft and flexible.
14. Set the gasket aside in a clean location.
15. Inspect the speaking diaphragm (large port in the center of the facepiece below the lens) for signs of damage that would allow the contaminant to enter the facepiece.
16. Remove the exhalation valve cover from the exhalation valve. Lift the exhalation valve and inspect the seat and exhalation valve for cracks, tears, dirt, and distortion. The exhalation valve shall be soft and flexible.
17. Reinstall the exhalation valve cover. Be sure that the exhalation valve cover lip surrounds the exhalation valve completely and that the tab is inserted through the exhalation valve cover.
18. Remove the external drinking tube from the exhalation valve cover. Check the drinking tube for cuts, abrasions, or other signs of damage. Grasp the knurled surface and pull the tube out of the cover to check for signs of damage. Be sure the tube is reinstalled in its port completely.
19. Check the nosecup for dirt, tears, or holes.
20. Check the internal drinking tube for cuts, abrasions, or other signs of damage.

Notes:

21. Reinstall the gasket in the side port. Be sure that it is flat.
22. Place the voicemitter in the side port.

NOTE: The voicemitter's crimped side faces out (up).

23. Thread the retaining ring into the port and tighten using the spanner wrench.
24. Place the deflector (with the inhalation valve assembly in place on the post) into the facepiece.
25. Line up the deflector so that it is between the guide tabs molded into the facepiece.
26. While holding the deflector in place, press the spider gasket onto the post from outside the facepiece.
27. Insert the gasket groove into the port so that the groove captures the lip of the port completely. Run a finger around the gasket to be sure the gasket lays flat.
28. Thread the cartridge/canister into the port.
29. If any part is damaged or deteriorated, it shall be replaced. Store only undamaged respirators for further use. When not in use, store the respirator in cool, dry, clean ambient air. Keep new filters in their packing.

Notes:

Points for APR Fit

Play Video
Courtesy of OSHA

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Points for APR Fit (continued)

Courtesy of CDP

Remove hairpins, buns, braids

Adjust straps

Don respirator

- Position head-harness pad
- Tighten straps (ABC—Above, Below, Center)
- Clear and seal respirator

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Notes:

Points for APR Fit (continued)

Courtesy of CDP

Check APR fit

- Facepiece is not into hairline
- Straps do not cut into ears
- Head-harness straps are flat and in a straight line
- Eyes are centered in the lenses
- Skin in front of the ears is not wrinkled

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Points for APR Fit (continued)

Conduct a user seal check each time the APR is donned

- Place two fingers over the exhalation valve cover
- Exhale slightly one time
- Place the palm of the hand over the filter canister portal(s)
- Inhale and hold for 5–10 seconds. (Mask should collapse on the face and remain collapsed for the duration of this step)

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Notes:

Points for APR Fit

There are several different types of APR, including half-face or full-face designs. The normal APR used for PPE Level C emergency operations includes full facepieces or tight-fitting coverings and filtering systems that make up the APR. The full facepieces are made of flexible molded rubber, neoprene, silicone, or other materials. Present designs incorporate rubber or woven elastic head straps attached at two to six points. They buckle together at the back of the head or may form a continuous loop of material. Each APR wearer should use the filter specifically for that particular manufacturer's mask. The following are general steps for donning APR:

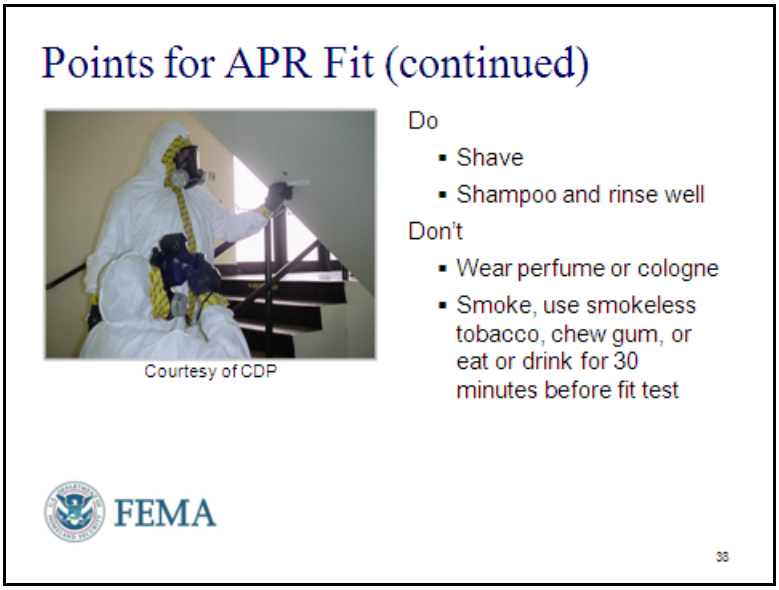
- Remove hairpins, buns, and/or braids.
- Adjust straps.
- Don respirator.
  - Position head-harness pad.
  - Tighten straps (Above, Below, Center [ABC]).
  - Clear and seal respirator.

The following list is used to check the fit of the APR once donned:

- Facepiece is not into hairline.
- Straps do not cut into ears.
- Head-harness straps are flat and in a straight line.
- Eyes are centered in the lenses.
- Skin in front of the ears is not wrinkled.
- An APR user seal check is performed as follows:
  1. Place two fingers over the exhalation valve cover.
  2. Exhale slightly one time (air should escape from the contact area between the sides of the face, forehead, and the mask).
  3. Place palm of hand over the filter canister portal(s).

Notes:

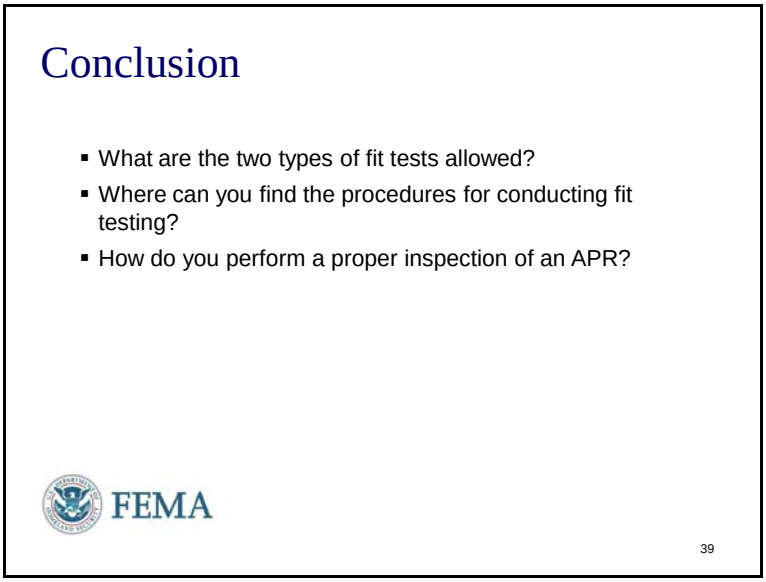
4. Inhale and hold for 5–10 seconds. (The mask should collapse on the face and remain collapsed for the duration of this step.)



Listed below are some helpful "Do's and Don'ts" for the test subject prior to being fit tested.

- Do
  - Shave to get a good APR seal.
  - Shampoo and rinse well.
- Don't
  - Wear perfume or cologne.
  - Smoke, use smokeless tobacco, chew gum, or eat or drink for 30 minutes before fit test.

Notes:



Conclusion

Employers should understand when fit testing is mandated and be able to determine what type and process of fit test is appropriate. Fit testing shall occur annually or any time there is a physical change of the wearer. A QLFT relies on the response of the wearer to a specific agent while a QNFT relies on instruments to measure face-seal leakage. There are advantages and disadvantages of each type of test.

A fit test shall follow accepted protocols for the type of fit test. These protocols and procedures are discussed in depth in Appendix A. Fit factors are determined for both the QLFT and QNFT. A QLFT may only be used to test negative-pressure respirators that shall achieve a fit factor of 100 or less. The QNFT is for both tight-fitting half facepieces and full facepieces. For a half facepiece, the fit factor is 100 or greater while it is 500 or greater for a full facepiece.

Inspection of the respirator should occur prior to each time the respirator is to be donned. It is important to check for cracks, dents, scratches, discoloration, fraying, or other mechanical issues. Donning the respirator should include positioning the head-harness pad, tightening the straps, and clearing and sealing the respirator. It is important to conduct a user seal check once the respirator is donned. An administrator should verify that the respirator is donned and fits properly before starting the fit test examination.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Fit Testing Procedures, Appendix A to 29 C.F.R. § 1910.134 (2013).

Mine Safety Appliances Company. (2008). *Millennium APR/CBRN respirator operations and instructions* (Rev. 17). Retrieved from http://media.msanet.com/NA/USA/DomesticPreparedness/GasMasksAPR/MillenniumCBA/MillenniumManualR4.pdf

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Occupational Safety and Health Administration. (Producer). (2009, December). Respirator safety. *Donning (putting on) and doffing (taking off) and user seal checks* [Video]. Available from http://63.234.227.130/SLTC/respiratoryprotection/index.html

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

TSI Incorporated. (2003, January 27). *Introduction to respirator fit testing TSI application note ITI-070*. Retrieved from http://tsi.com/uploadedFiles/Product_Information/Literature/Application_Notes/iti_070.pdf

CNP Fit Testing Technology Exercise

Duration: 2.00 Hours

Summary: Participants are introduced to the Controlled Negative Pressure (CNP) equipment (i.e., FitTester 3000) and conduct an inventory check. Participants demonstrate how to use the CNP equipment in the computer-assisted mode. Participants follow the manufacturer's instructions, included in the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], as they learn the fit testing technology. The computer captures the data from the testing and provides a record of training. Participants perform a Quantitative Fit Test (QNFT) using CNP technology. Instructors divide participants into two groups that are approximately equal in size. Module 6, "Qualitative and Quantitative Fit Testing," and Module 7 are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions. The second group attends the "CNP Fit Testing Technology Exercise." After each module concludes, the groups switch places.

Terminal Learning Objective: At the conclusion of this module, participants will be able to complete QNFT in accordance with Fit Testing Procedures (Mandatory), Appendix A, Part I to 29 *Code of Federal Regulations* (C.F.R.) § 1910.134, using the CNP fit testing technology.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

7-1 Conduct an inventory of the CNP equipment to ensure that all necessary parts are present.

7-2 Demonstrate use of the CNP technology in computer-assisted mode.

7-3 Complete a QNFT using CNP fit testing technology.

Practical Exercise: Participants participate in small-group activities and discussions as well as instructor-facilitated collaborative knowledge checks throughout the module. Participants begin the module by conducting an inventory of the CNP equipment to ensure that all necessary parts are present. If participants identify any missing parts, they are to notify the instructors. Approximate time for this activity is 10 minutes. Participants then demonstrate use of the CNP technology in computer-assisted mode. Specifically, they perform the setup for the CNP (i.e., FitTester 3000) technologies and operate the computer software. Approximate time for this activity is 20 minutes. Working in small groups, with one participant performing as the test administrator and one as the test subject, each participant performs a QNFT, uses the information from the fit test, and determines the results based on the fit test process. The participant, under the direction of an instructor, completes a QNFT using CNP fit testing technology in accordance with § 1910.134, Appendix A, Part I (2013). Approximate time for this exercise is 30 minutes.

Risk Assessment: Low

Methods of Instruction: Participants participate in facilitated and demonstrated hands-on exercise supported by presentation visuals in a classroom environment. Under the direction and coaching of the instructor, participants perform a fit test, use the information from the fit test, and determine the results based on the fit test process. Reflective questioning challenge

participants' critical thinking skills and reinforce module content. Participants participate in instructor-guided and collaborative knowledge checks.

Instructor-to-Participant Ratio: 1:5

Required Reading: *Reference Manual*

Evaluation Strategies: In this hands-on exercise, participants self-assess and participate in peer-to-peer evaluations using the performance checklist, located in the CNP (FitTester 3000) Participant Performance Checklist handout, prior to assessment by the instructor. The performance checklist assesses participants' knowledge and skills of identified skills. In addition, participants participate in collaborative and instructor-guided knowledge checks. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: Participants are divided into two groups that are approximately equal in size. Module 6, "Qualitative and Quantitative Fit Testing," and Module 7 are taught simultaneously. The first group attends the facilitated lecture that includes small-group discussions. The second group attends the "CNP Fit Testing Technology Exercise." After each module concludes, the groups switch places. **NOTE:** If performing a mask certification, calibrated fit testing equipment is required.

Objectives

- Conduct an inventory of the Controlled Negative Pressure (CNP) equipment to ensure that all necessary parts are present
- Demonstrate use of the CNP technology in computer-assisted mode
- Complete a QNFT using CNP fit testing technology

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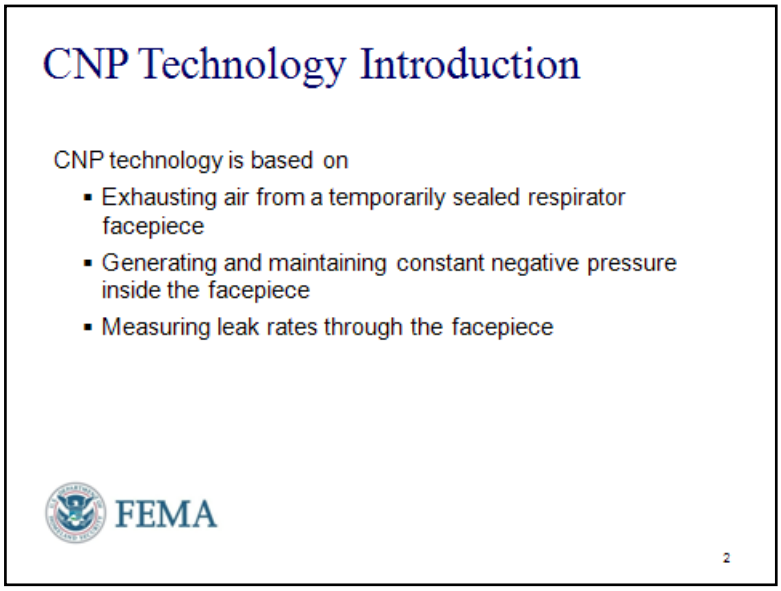
Notes:

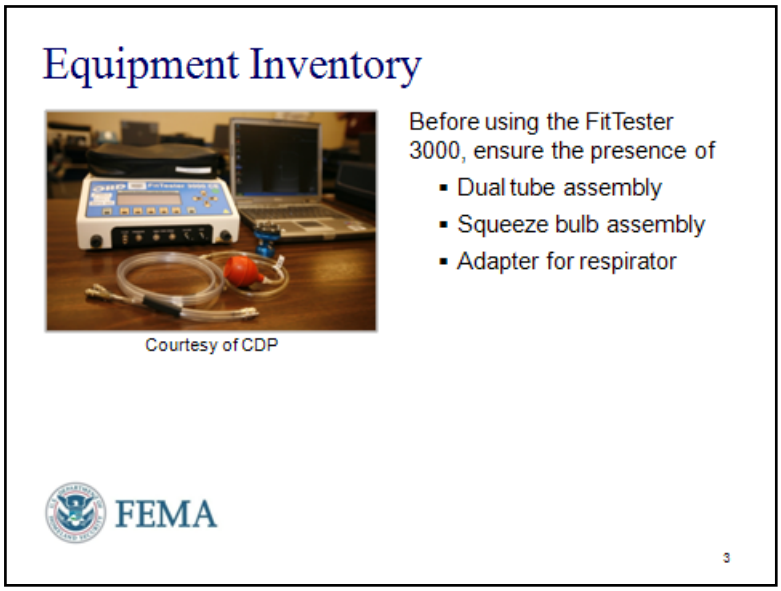
Enabling Learning Objective 7-1: Conduct an inventory of the CNP equipment to ensure that all necessary parts are present.



CNP Technology Introduction

CNP technology is an alternative to aerosol fit test methods. CNP technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. CNP technology measures leak rates through the facepiece as a method for determining the facepiece fit of negative-pressure respirators. An example of CNP technology is the FitTester 3000.

Notes:



Equipment Inventory

Before using the FitTester 3000, it is important to inspect the FitTester 3000 and its accompanying accessories. The following accessories should be present:

- Dual tube assembly,
- Squeeze bulb assembly, and
- Blue adaptor for the respirator.

The black pouch part of the FitTester 3000 equipment contains these accessories The dual tube assembly has one male quick-disconnect adapter and one female quick-disconnect adapter. The blue adapter is the correct adapter for the respirator being fit tested.

The following instructions for operation of the FitTester 3000 are based on the *FitTester 3000 CD Personal Respirator Leak Rate Analyzer Manual* (Occupational Health Dynamics, 2004). These instructions are also located in Tab 9 of the *Reference Manual*.

Notes:

Enabling Learning Objective 7-2: Demonstrate use of the CNP technology in computer-assisted mode.

FitTester 3000 in Computer-Assisted Mode

Courtesy of CDP

1. Press the <On/Off> button at the back to turn on the FitTester 3000
2. Perform Zero Pressure Calibration
   - Press the <Right> arrow twice for the system menu. Press the <Up> arrow once (or press the <Down> arrow three times). Press <Enter>

FEMA

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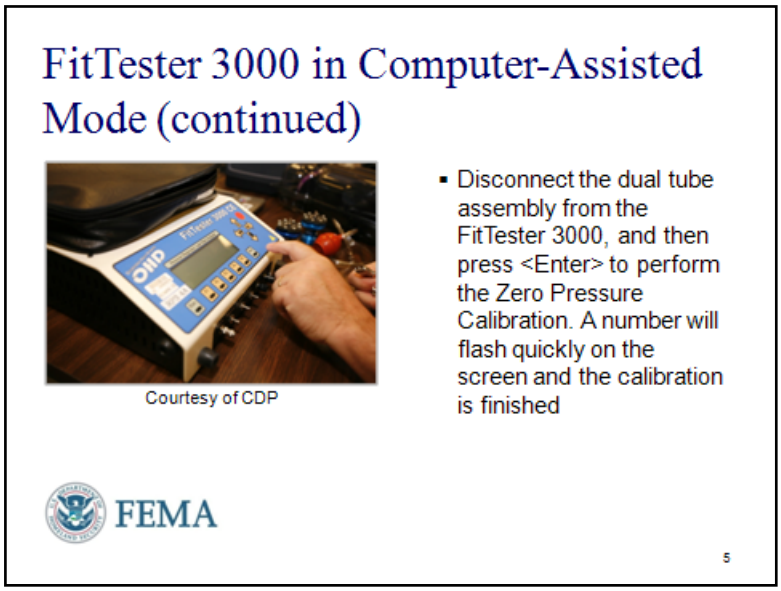
Notes:



FitTester 3000 in Computer-Assisted Mode

NOTE: When the symbols < > appear in this module, this signifies that the participant will perform an action.

1. Press the <On/Off> button at the back of the machine to turn the FitTester 3000 to the "On" position.
2. Perform Zero Pressure Calibration.
   - Press the <Right> arrow twice for the system menu. Then press the <Up> arrow once or the <Down> arrow three times. Then press <Enter>.
   - Follow the instructions to disconnect the dual tube assembly from the FitTester 3000; then press <Enter> to perform the Zero Pressure Calibration. A number will flash quickly on the screen and the Zero Pressure Calibration is finished.

Notes:

FitTester 3000 in Computer-Assisted Mode (continued)

Courtesy of CDP

3. Perform Dual Tube Calibration
   - Press the <Up> arrow once for Dual Tube Cal; then press <Enter>
   - Connect the male quick-disconnect adapter of the dual tube assembly to the adapter labeled "Flow"

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FitTester 3000 in Computer-Assisted Mode (continued)

Courtesy of CDP

- Connect the female quick-disconnect adapter to the adapter labeled "Pressure"
- Connect the two female-quick disconnect adapters to either of the adapters on the front labeled "Dual Tube Check"

FEMA

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Notes:

FitTester 3000 in Computer-Assisted Mode (continued)

Courtesy of CDP

- Press <Enter> to begin the test
- The FitTester 3000 performs a self-test that lasts 1 minute
- When the test is complete press <Save>
- Press <Escape> to return to the Service Menu

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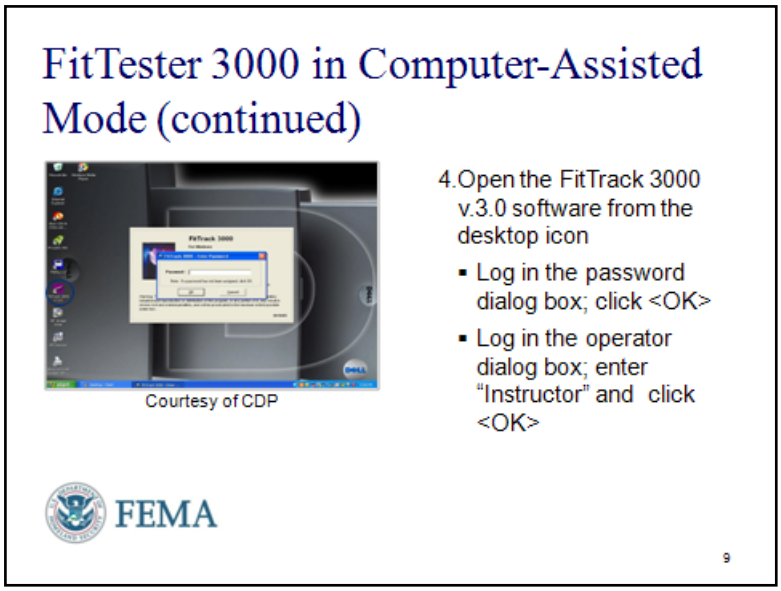
3. Perform Dual Tube Calibration.
   - After the Zero Pressure Calibration, press the <Up> arrow once to highlight Dual Tube Cal. Press <Enter>.
   - Instructions are given to connect all four ends of the dual tube to the FitTester. Due to the connector fittings, the tubes cannot be placed incorrectly. Connect the male quick-disconnect adapter of the dual tube assembly to the female quick-disconnect adapter labeled “Flow” on the front of the machine.
   - Connect the female quick-disconnect adapter of the dual tube assembly to the male quick-disconnect adapter labeled “Pressure” on the front of the machine.
   - Calibrate the dual tube assembly by connecting the two female quick-disconnect adapters on the dual tube assembly to either of the male quick-disconnect adapters on the front panel labeled “Dual Tube Check.”
   - Press <Enter> to begin the test. The FitTester 3000 performs a self-test that lasts 1 minute.

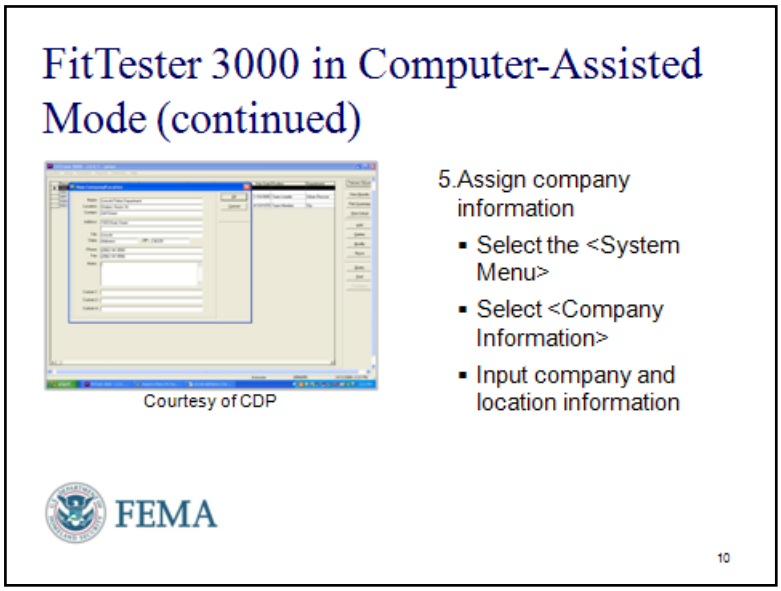
Notes:

- When the test is complete, press <Save>. If using a printer connected directly to the FitTester 3000, <Print> can be selected to receive a printout of that day's calibration.
- Finally, press <Escape> to return to the Service Menu. Use the <right> or <left> arrows to return to the Test Menu.



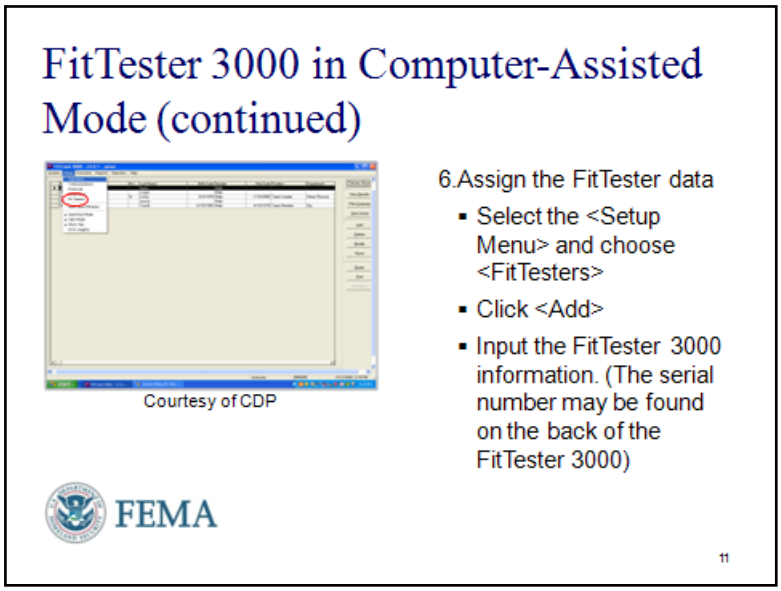
4. Open the FitTrack 3000 v.3.0 software from the desktop icon.
   - Log in the password dialog box; click <OK>.
   - Log in the operator dialog box; enter "Instructor" and click <OK>.

Notes:



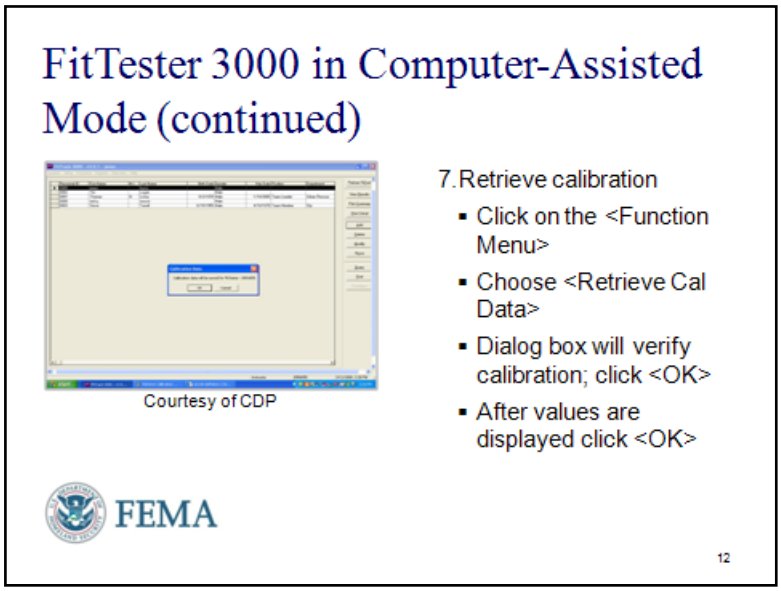
5. Assign company information.
   - Select <System Menu>.
   - Select <Company Information>.
   - Input company and location information.

Notes:



6. Assign the FitTester data.
   - Select <Setup Menu> and choose <FitTesters>.
   - Click <Add>.
   - Input the FitTester 3000 information. (The serial number may be found on the back of the FitTester 3000.)

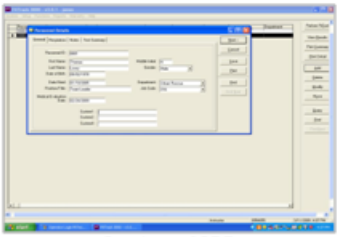
Notes:



7. Retrieve calibration.
   - Click on <Function Menu>.
   - Choose <Retrieve Cal Data>.
   - A dialog box will verify that calibration is received for the correct FitTester 3000. Click <OK> to verify.
   - After the values are displayed on the screen, click <OK>.

Notes:

FitTester 3000 in Computer-Assisted Mode (continued)



Courtesy of CDP

8. Input the test subject's data
   - Test subject's first and last name
   - Test subject's personal identification number (use "0000"); click <Add>

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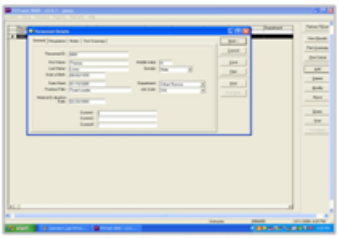
FitTester 3000 in Computer-Assisted Mode (continued)



Courtesy of CDP

- Fill in the appropriate demographic information
- Click <Next> in the upper right hand corner

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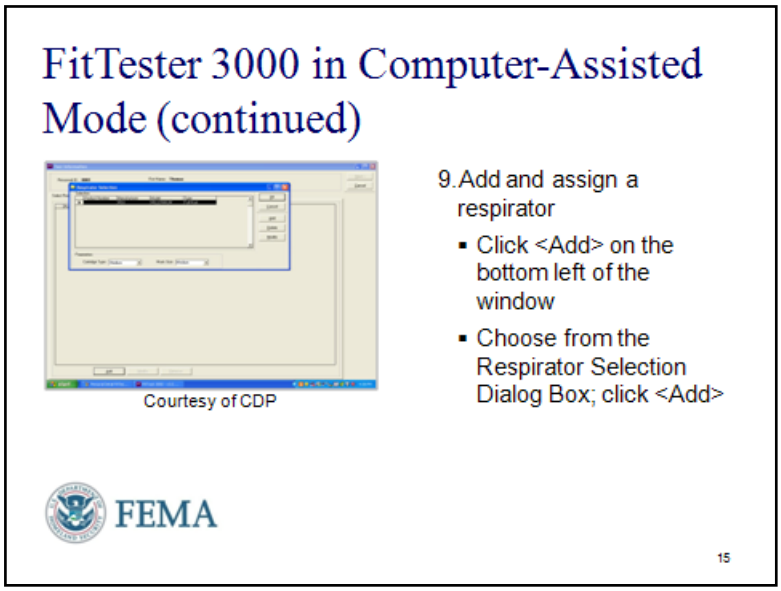
Notes:

8. Input the test subject's data.
   - Test subject's first and last name.
   - Test subject's personal identification number (use "0000"); click <Add>.
   - Fill in the appropriate demographic information. The custom fields can be assigned in the "Company Information" window, which can be found under the "System Menu" under "Company/Location Properties" or "Account Properties."
   - Click <Next> in the upper right-hand corner.



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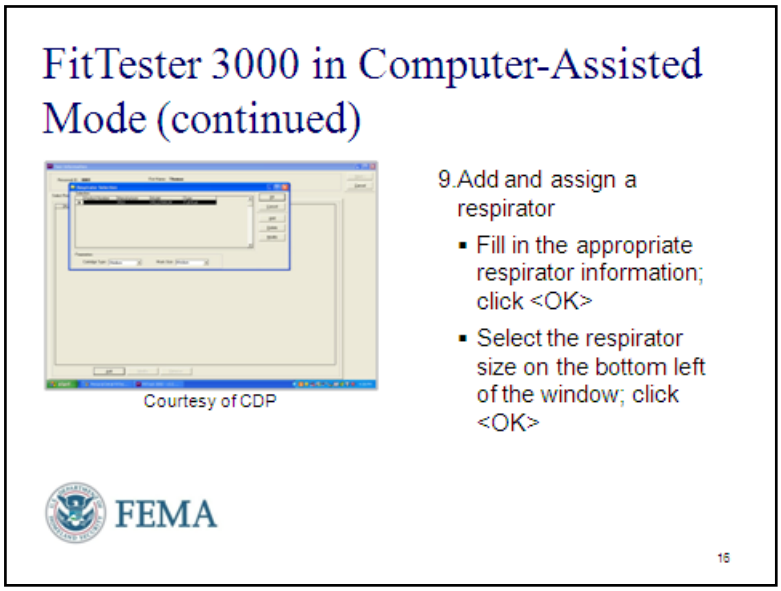
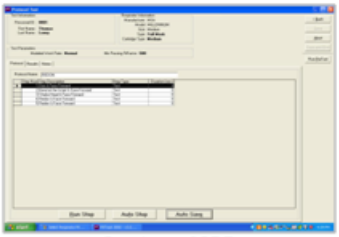


9. Add and assign a respirator.
   - Click <Add> on the bottom left of the window.
   - To add a respirator, choose from the Respirator Selection Dialog box; click <Add> on the right center of this window.
   - Fill in the appropriate respirator information and click <OK>.
   - Be sure to select the respirator size on the bottom left of the open window, and then click <OK>.

Notes:

FitTester 3000 in Computer-Assisted Mode (continued)



Courtesy of CDP

10. Select the proper protocol
    - Click on the <Select Protocol> tab at the top of the current window

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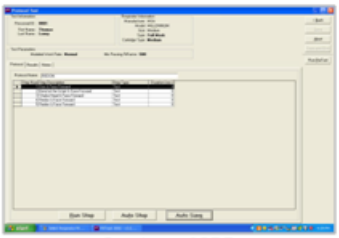
FitTester 3000 in Computer-Assisted Mode (continued)



Courtesy of CDP

- Choose the protocol (use REDON 5-Step Protocol)
- Click <Next> in the top right of the window

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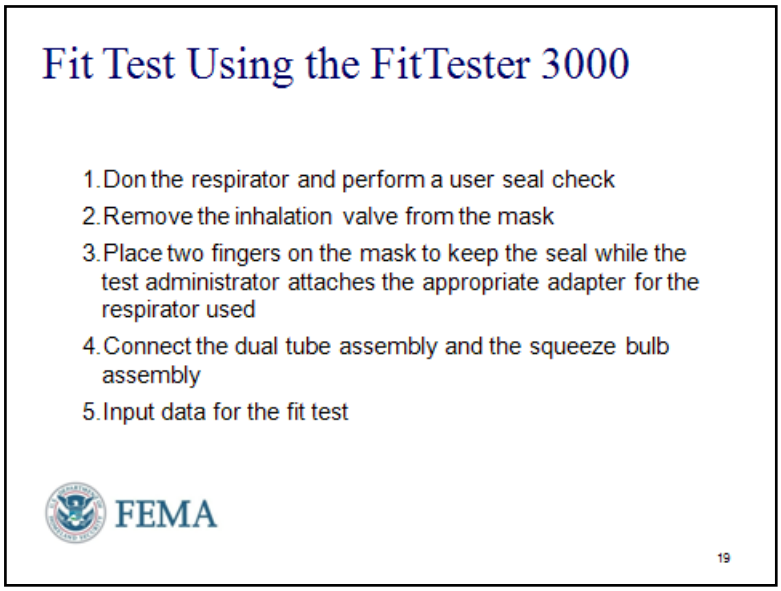
Notes:

10. Select the proper protocol.
    - Click on the <Select Protocol> tab at the top of the current window.
    - Choose the protocol from the drop-down list (use REDON 5-Step Protocol).

NOTE: The protocol chosen in this step will remain as the default protocol for all future fit tests until this tab is changed.

- Click <Next> in the top right of the window.

Enabling Learning Objective 7-3: Complete a QNFT using CNP fit testing technology.



Fit Test Using the FitTester 3000

Activity:

For this activity, participants work in small groups. One participant fills the role of the test subject and the other performs the role of the test administrator. Upon completion, participants switch roles and perform the steps again. The step-by-step instructions are included on the visuals for

Notes:

the participants to reference during the activity. Participants may use the CNP (FitTester 3000) Participant Performance Checklist handout to perform informal peer-to-peer evaluations.

Explain the following steps in the fit test process to the test subject:

1. Don the respirator and perform a user seal check.
2. Remove the inhalation valve from the mask.

NOTE: This is usually, but not always, a small circular diaphragm blocking the part of the respirator that connects to air filters or cartridges. These must be removed to correctly perform a fit test.

3. Place two fingers on the mask to keep the seal while the test administrator attaches the appropriate adapter for the respirator used.

NOTE: These adapters will fit into the place where a filter or cartridge would be attached. When using a self-contained breathing apparatus (SCBA) mask, it must first be converted into an air-purifying respirator by obtaining the appropriate adapter from the respirator manufacturer.

4. Connect the dual tube assembly and the squeeze bulb assembly.

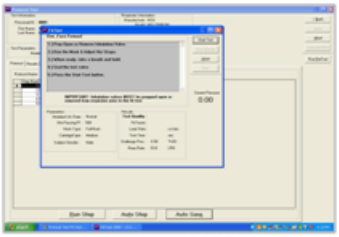
NOTE: The squeeze bulb will obviously connect to the single connector while the dual tube assembly will connect to the pair of connectors.

5. Input data for the fit test.

NOTE: This data may already be in the computer database. Select correct data from the pull-down menus when prompted.

Notes:

Fit Test Using the FitTester 3000 (continued)



Courtesy of CDP

6. Perform the fit test
7. Select <Run Step> at the bottom of the screen
8. Read the instructions at each step of the test

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6. Perform the fit test.
7. Select <Run Step> at the bottom of the screen.
8. Read the instructions at each step of the test. The instructions appear on the upper left of the screen.

Notes:

Fit Test Using the FitTester 3000 (continued)

Courtesy of CDP

9. Perform the test exercises—Hold the breath, squeeze the bulb, and then click <Start>
   - Facing Forward—Stand and breathe normally for 30 seconds; face forward and hold the breath for 10 seconds
   - Bending Over—Bend at the waist for 30 seconds; face parallel to the floor and hold the breath for 10 seconds

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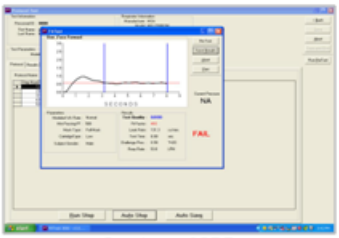
Fit Test Using the FitTester 3000 (continued)



Courtesy of CDP

- Head Shaking—For approximately 3 seconds, shake the head back and forth vigorously several times while shouting; face forward and hold the breath for 10 seconds

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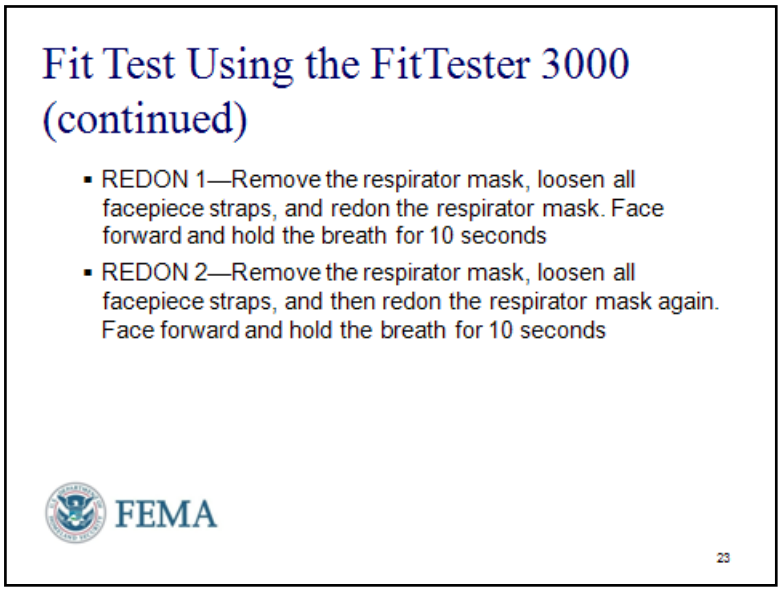
Notes:



9. Perform the test exercises. Hold the breath, squeeze the bulb, and then the test administrator will click <Start>. Continue until each protocol step has been completed.

NOTE: For this course, the CNP REDON protocol will be used.

- Facing forward—Stand and breathe normally, without talking, for 30 seconds; face forward and hold the breath for 10 seconds.
- Bending over—Bend at the waist for 30 seconds; face parallel to the floor and hold the breath for 10 seconds.
- Head shaking—For approximately 3 seconds, shake the head back and forth vigorously several times while shouting; face forward and hold the breath for 10 seconds.
- REDON 1—Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask. Face forward and hold the breath for 10 seconds.
- REDON 2—Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask again. Face forward and hold the breath for 10 seconds.

Notes:

Fit Test Using the FitTester 3000 (continued)

Courtesy of CDP

10. Click <Save and Print>
11. Print the test after all protocol steps are completed
12. Test subject will be questioned regarding the comfort of the respirator
13. Record data for documentation

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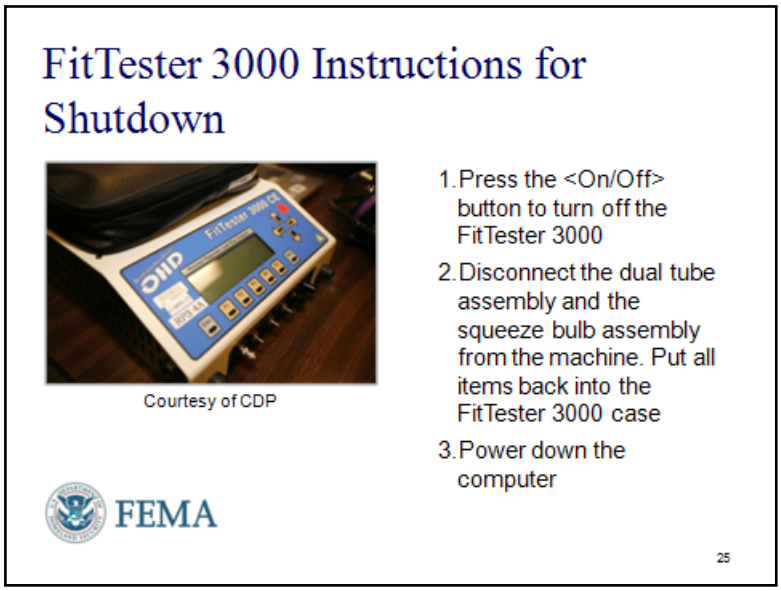
10. Click <Save and Print>.
11. Print the test after all protocol steps are completed.
12. Upon completion of the test exercises, the test subject will be questioned by the test administrator regarding the comfort of the respirator.
13. Record the individual's name and fit test score data on a separate paper. The information is also saved on the computer, but a paper back up copy is always a good idea in case of computer malfunction.

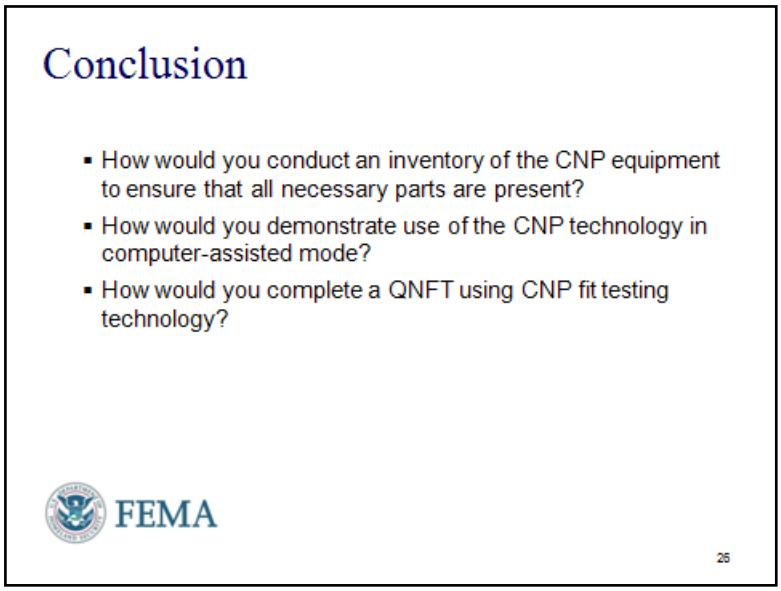
Notes:



FitTester 3000 Instructions for Shutdown

1. Press the <On/Off> button to turn off the FitTester 3000.
2. Disconnect the dual tube assembly and the squeeze bulb assembly from the machine. Put all items back into the FitTester 3000 case.
3. Power down the computer.

Notes:



Conclusion

In this module, the application of a CNP technology in a QNFT, an equipment inventory, and a demonstration of the CNP technology in a computer-assisted mode are reviewed. Additionally, this module reviewed starting up/shutting down procedures of CNP equipment and using the CNP technology for a QNFT.

Appendix A of § 1910.134 was utilized during this module. Because respirator fit testing is ultimately a matter of life safety, it is important not only to be aware of the requirements but also to practice the procedure.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Fit Testing Procedures (Mandatory), Appendix A to 29 C.F.R. § 1910.134 (2013).

Occupational Health Dynamics. (2004, June 8). *FitTester 3000 personal respirator leak rate analyzer: Operating Manual*. Birmingham, AL: Author.

Respirator Use

Duration: 0.75 Hour

Summary: Participants take part in a study of the required and proper use of respirators in different environments. The requirements for employers to establish procedures for using respirators are discussed in accordance with Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(g) (2013) and User Seal Check Procedures (Mandatory), Appendix B-1 to § 1910.134. Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate document provided to participants, as § 1910.134(g) and Appendix B-1 are reviewed.

Terminal Learning Objective: At the conclusion of this module, participants will be able to explain when respirators are required according to § 1910.134(g).

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

8-1 Describe the proper use of respirators according to § 1910.134(g) and Appendix B-1.

8-2 Discuss the establishment and implementation of procedures for the proper use of respirators according to § 1910.134(g).

8-3 Explain the procedures for proper use of respirators in routine and reasonably foreseeable emergencies, including interior structural firefighting according to § 1910.134(g).

Practical Exercise: Participants take part in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. In small groups, participants participate in a True or False activity as a review of the module content. Participants identify statements as either true or false. For each statement, participants must justify their answer and locate where it is within the standard. In the small-group discussion, participants discuss how the standard applies to his or her agency. The time for the activity is approximately 15 minutes.

Risk Assessment: Low

Methods of Instruction: Instructors use a facilitated lecture format supported by presentation visuals and case studies. Reflective questioning challenge participants' critical thinking skills and reinforce module content. Participants take part in instructor-guided and collaborative knowledge checks throughout the module, where they describe the proper use of respirators and explain the procedures for proper use of respirators in routine and reasonably foreseeable emergencies. In small groups, participants complete a True or False activity as a review of key concepts from the module. Participants share their answers with their group and instructors correct and review material as necessary.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group discussions

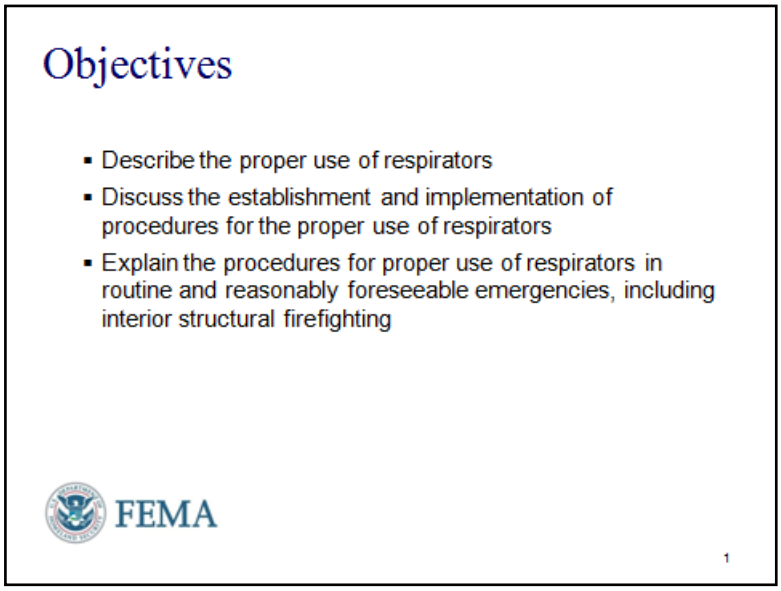
Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary

material to ensure participant comprehension of key points. Additionally, instructors assess participants based upon their presentation of responses/answers to the True or False activity. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134(g) and Appendix B-1 are reviewed using the *Reference Manual*.

Enabling Learning Objective 8-1: Describe the proper use of respirators according to § 1910.134(g) and Appendix B-1.

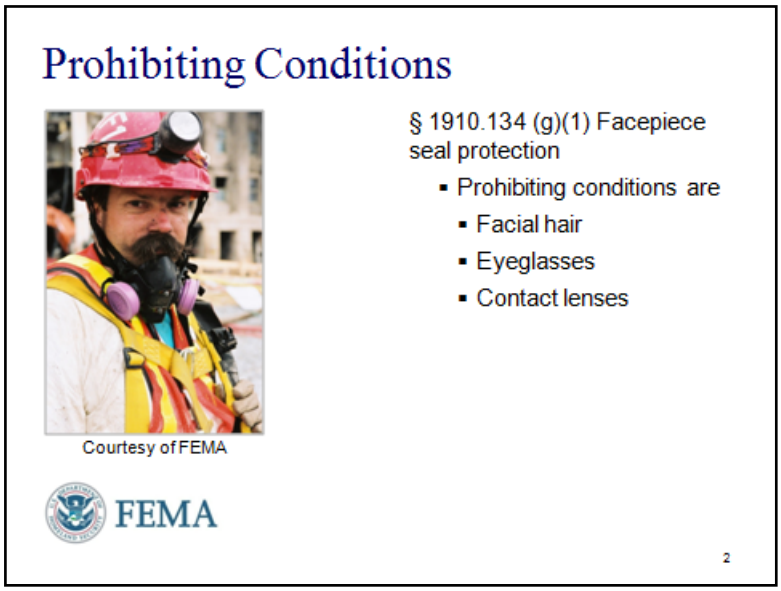


§ 1910.134(g)

Key Point:

Section 1910.134(g) addresses the use of respirators; it prohibits conditions that may result in facepiece seal leakage, prevents employees from removing respirators in hazardous environments, promotes actions that ensure continuously effective respirator operation through the work shift, and establishes procedures for respirator use in Immediately Dangerous to Life or Health (IDLH) atmospheres or in interior structural firefighting situations. Even though paragraph (g) does not specifically address physiological response to respirator use, it is an important issue to consider.

Notes:



Prohibiting Conditions

The first part of this section prohibits the use of negative-pressure respirators when there is any condition to interfere with face seal or valve function. Some of these conditions include facial hair, other facial characteristics, and corrective eyewear.

According to §1910.134(g)(1)(i),

> The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have: §1910.134(g)(1)(i)(A), Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or §1910.134(g)(1)(i)(B), Any condition that interferes with the face-to-facepiece seal or valve function (2013).

These conditions shall be avoided when using tight-fitting respirators, because a respirator that permits air to leak inside the facepiece during inhalation is a hazard and, in the case of positive-pressure devices, will either reduce service time or waste breathing air.

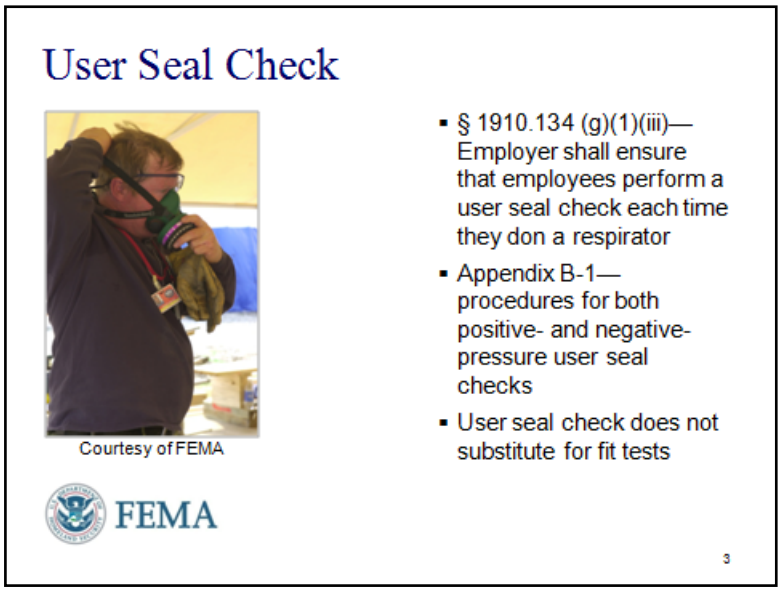
Section 1910.134(g)(1)(ii) states,

Notes:

> If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user. (2010)

Eyeglasses, particularly those with temple bars or straps, cannot be used with full facepiece respirators. For individuals who require corrective lenses, special corrective lenses, available from the manufacturer, can be mounted inside full-facepiece respirators. An individual designated and qualified by the manufacturer to install accessory items must install these corrective lense inserts. Eyeglasses and goggles may also interfere with the seal on half facepieces, so it may be necessary to wear a full facepiece with special corrective lenses.

The standard allows contact lenses to be worn as an alternative to eyeglasses. However, the type of respirator, especially atmosphere-supplying respirators, worn may restrict or even prohibit the use of contact lenses. When wearing full facepieces, the incoming air is directed toward the eye. This condition can cause dirt, lint, or other debris to be deposited onto the contact lenses.



Notes:

User Seal Check

Section 1910.134(g)(1)(iii) states,

> For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section. (2013)

Key Point:

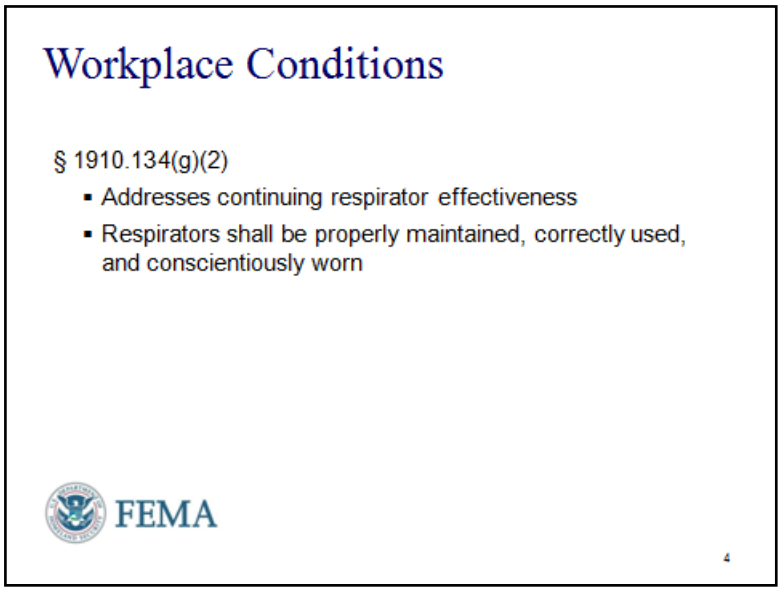
Section 1910.134 (2013), Appendix B-1 also mandates a user seal check must be performed every time an employee dons a tight-fitting respirator.

Acceptable seal check methods include either the positive- or the negative-pressure check listed in Appendix B-1, or the respirator manufacturer's recommendation. The user seal checks are not substitutes for qualitative or quantitative fit tests.

Section 1910.134 (2013), Appendix B-1, Part I.A (2010) describes the positive-pressure check. It should be performed by closing off the exhalation valve and exhaling gently into the facepiece. This may require removing the exhalation valve cover before closing off the exhalation valve. If a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal, then the respirator has a satisfactory face fit.

Section 1910.134 (2013), Appendix B-1, Part I.B (2010) describes the negative-pressure check. It should be performed by closing off the inlet opening of the canister or cartridges by covering with the palm of the hand, inhaling gently so that the facepiece collapses slightly, and holding the breath for approximately 10 seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, then the respirator tightness is satisfactory. If some cartridge inlet openings cannot be covered effectively with the palms of the hand, it might be necessary to use a thin vinyl or nitrile glove for this purpose.

Notes:



Workplace Conditions

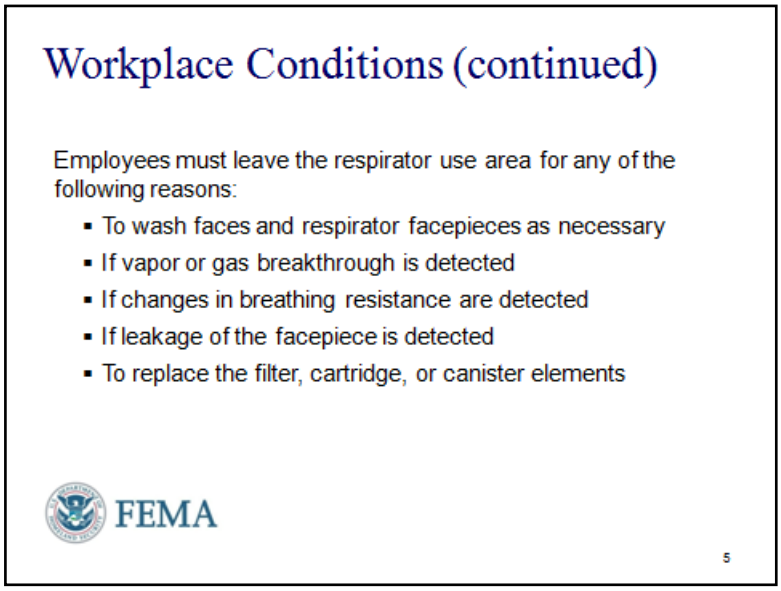
Section 1910.134(g)(2) addresses continuing respirator effectiveness. In particular, it states that respirators must be properly maintained, correctly used, and conscientiously worn. The usage limitations of air-purifying elements, particularly gas and vapor cartridges, must not be exceeded. The respirator must be approved by the National Institute for Occupational Safety and Health (NIOSH). Employees must leave a contaminated area immediately on suspicion of respirator failure.

Section 1910.134(g)(2)(ii) specifies under what conditions and when the employees must leave the respirator use area. This paragraph ensures that employees leave for any of the following conditions:

- To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with the respirator use
- If they detect vapor or gas breakthrough
- If they detect changes in breathing resistance
- If they detect leakage of the facepiece

Notes:

- To replace the respirator or filter, cartridge, or canister elements (Respiratory Protection, 29 C.F.R. § 1910.134, 2013)



Additionally, if the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

Physiological Response to Respirator Use

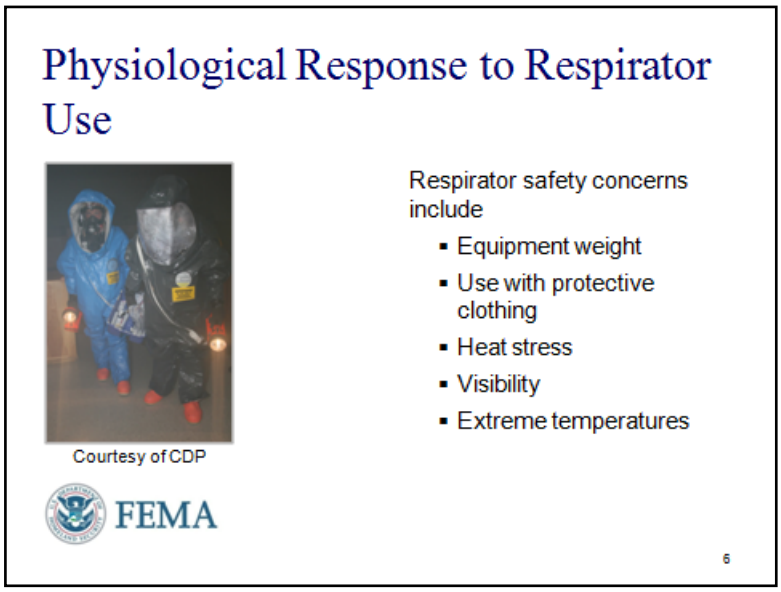
Respirator use may impose physiological stress on the wearer. The use may be alone or with other types of personal protective equipment (PPE). Extra weight, heat stress, and extreme temperatures are factors that affect the wearer.

The physical stress of wearing PPE and using a respirator can add extra weight to the wearer, which may limit mobility. Because of the additional weight, the wearer has to expend more energy and increase the demand for oxygen.

Heat stress is the most immediate hazard faced by the wearer. The use of PPE prevents the body from cooling itself properly because the clothing does not allow the heated air to leave the skin surface. It is important to monitor the wearer for heat stress (Oldfield, 2005). Users must be

Notes:

aware of the signs and symptoms of heat stress, including heat cramps, heat exhaustion, and heat stroke. Heat stroke is a true medical emergency and should not be ignored.



To reduce the incidence of heat stress, considerations should include the following:

- Providing plenty of fluids
- Rotating personnel frequently
- Using cooling devices
- Monitoring the wearer medically
- Conducting nonemergency activities when the ambient temperature is cooler (Noll, Hildebrand, & Yvorra, 2005)

To prevent low temperatures from fogging respirator lenses, the inner surface of the lens should be coated with an antifogging compound. Extremely low temperatures may cause exhalation valves to freeze. The approval label lists the minimum temperature at which a self-contained breathing apparatus (SCBA) has been tested and approved for use.

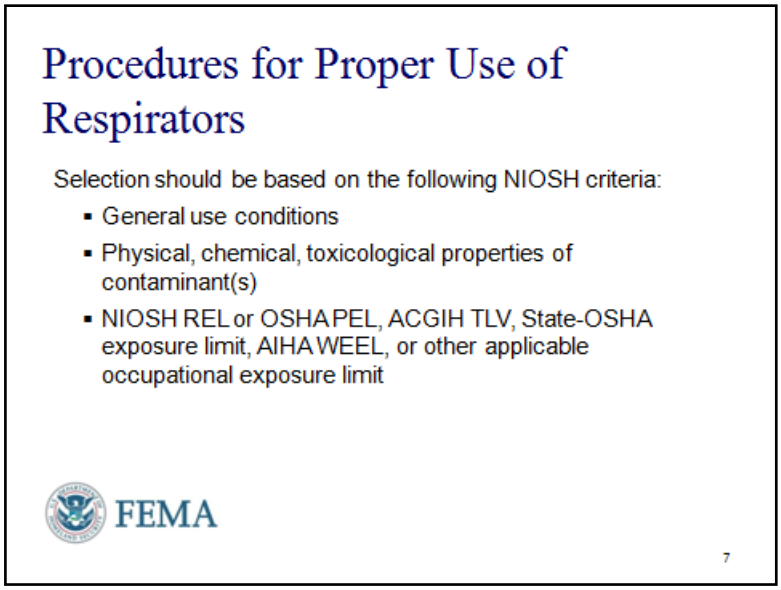
When working in high-temperature air, a lightweight respirator with low breathing resistance should be used to minimize stress on the wearer.

Notes:

✔ **Knowledge Check:**

- Describe the proper use of respirators as outlined in § 1910.134(g) and Appendix B-1, including prohibiting and workplace conditions.
- Describe some physiological responses that might impact the proper use of respirators.

Enabling Learning Objective 8-2: Discuss the establishment and implementation of procedures for the proper use of respirators according to § 1910.134(g).

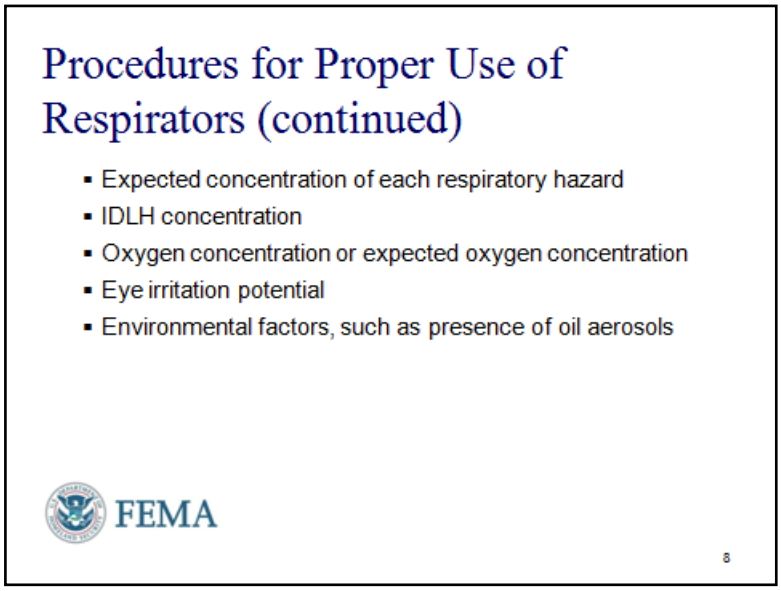


Procedures for Proper Use of Respirators

Respirators protect the user in two basic ways: the first is by filtering contaminants from the breathing air, and the second is by supplying clean respirable air from another source. Respirators that filter contaminants include particulate filters, which filter out airborne particles, and gas masks, which filter out certain chemicals and gases. Respirators that supply air from another source include supplied-air respirators (SAR), which use compressed air from a remote

Notes:

source, and SCBA, which include their own air supply NIOSH, National Personal Protective Technology Laboratory [NPPTL], n.d.).



Respirators should only be used as a last line of defense when administrative and engineering control systems are not feasible. Engineering control systems, such as adequate ventilation or scrubbing of contaminants, should be used to negate the need for respirators (NIOSH, NPPTL, n.d.).

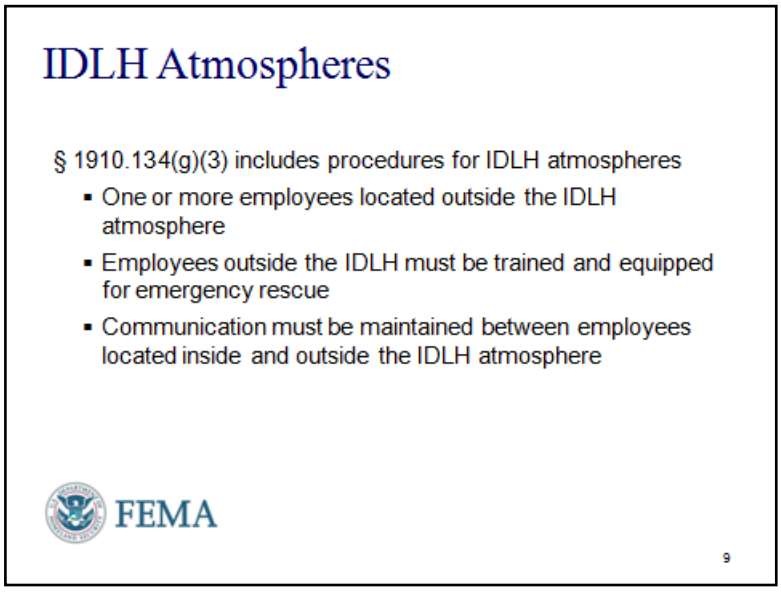
NIOSH issues recommendations for respirator use. Industrial-type approvals are in accordance with the NIOSH Federal respiratory regulations Public Health, 42 C.F.R. Part 84. Development of respirator standards is in concert with various partners from government and industry (NIOSH, NPPTL, n.d.).

In order to use the selection logic, the toxicology, safety, and other relevant information for each contaminant that the user will encounter must be identified. Some of the NIOSH criteria for selecting respirators are as follows:

- General use conditions, including determination of contaminant(s)
- Physical, chemical, and toxicological properties of the contaminant(s)
- Applicable exposure limit, such as

Notes:

  - NIOSH Recommended Exposure Limit (REL)
  - OSHA Permissible Exposure Limits (PEL)
  - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)
  - State-OSHA exposure limit
  - American Industrial Hygiene Association (AIHA) Workplace Environmental Exposure Limit (WEEL)
- Expected concentration of each respiratory hazard
- IDLH concentration
- Oxygen concentration or expected oxygen concentration
- Eye irritation potential
- Environmental factors, such as presence of oil aerosols (NIOSH, 2004)



Notes:

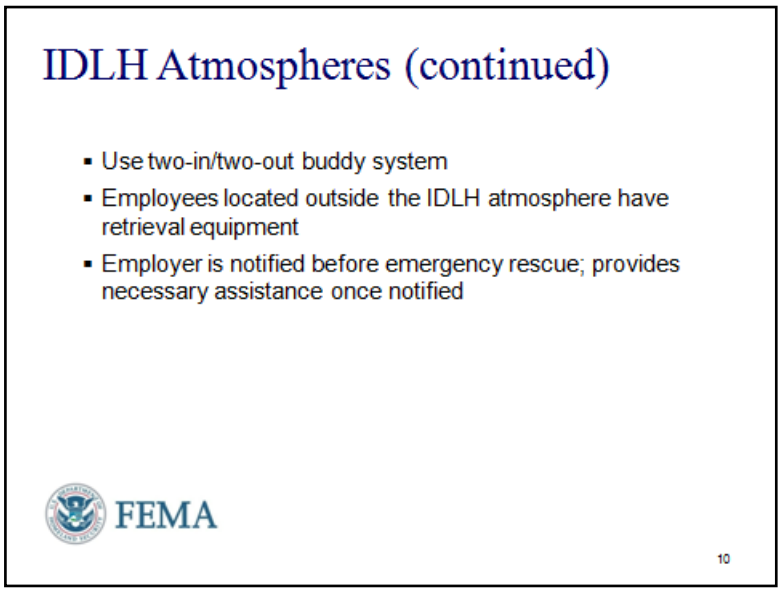
IDLH Atmospheres

Key Point:

Section 1910.134(g)(3) establishes the employee and equipment procedures for IDLH atmospheres.

In order for work to be performed in IDLH environments, one or more employees must be located outside the IDLH atmosphere. The employees located outside the IDLH atmosphere must be equipped with proper rescue equipment (including an SCBA), staged in the nearest safe area, and trained and equipped to provide effective emergency rescue for those wearing respirators in an IDLH atmosphere.

In addition, § 1910.134(g)(3)(ii) states that "visual, voice, or signal line communication is maintained between the employees in the IDLH atmosphere and the employees located outside the IDLH atmosphere" (2013). Talking while wearing a respirator equipped with a facepiece may break the seal of the facepiece, so necessary communication within a contaminated area should be done with the help of special communication equipment obtained from the respirator manufacturer or designed for use with the respirator.



Notes:

In working in the IDLH environment, the two-in/two-out buddy system is recommended. The employees located outside the IDLH environment are equipped with the retrieval equipment. Before entering the IDLH environment to provide emergency rescue, the employer is to be notified. Once notified, the employer provides the necessary assistance to the situation.

Employees located outside the IDLH environment are to be equipped per § 1910.134(g)(3)(vi)(A) through (g)(3)(vi)(C) with the following:

- Either pressure-demand or other positive-pressure SCBA, or pressure-demand or other positive-pressure SAR with auxiliary SCBA; or
- Appropriate retrieval equipment for removing the employees who enter these hazardous atmospheres, where such equipment would contribute to the rescue and would not increase the overall risk resulting from entry or equivalent means for rescues.

Confined spaces are enclosures that are physically restrictive, such as storage tanks, tank cars, boilers, sewers, tunnels, pipelines, pits, and tubs. Some enclosed buildings may be considered confined spaces when IDLH atmospheres occur due to intentional or accidental introduction of hazardous substances.

Enabling Learning Objective 8-3: Explain the procedures for proper use of respirators in routine and reasonably foreseeable emergencies, including interior structural firefighting according to § 1910.134(g).

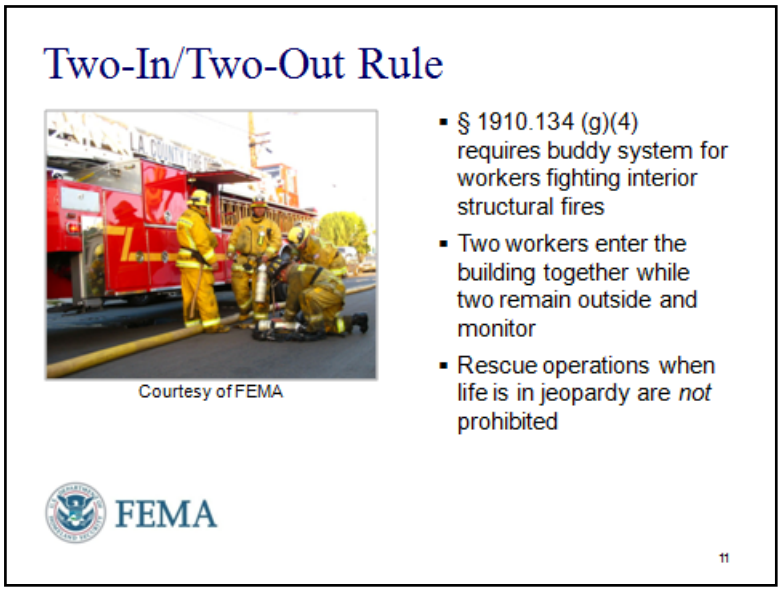
Interior Structural Firefighting

Key Point:

Section 1910.134(g)(4) addresses the procedures for interior structural firefighting.

In addition to the requirements of paragraph (g)(4), interior structural firefighting must also adhere to paragraph (g)(3). The two-in/two-out rule, which requires that workers engaged in fighting interior structural fires work in a buddy system, is part of paragraph (g)(4); at least two workers must enter the building together so that they can monitor each other's whereabouts as well as the work environment.

Notes:



Two-In/Two-Out Rule

As with other employee entries into IDLH environments, there must be at least two standby personnel outside the fire area prepared to rescue the firefighters inside, should the need arise. However, Note 1 to § 1910.134(g) states that the firefighters outside must actively monitor the status of the firefighters inside, but the second firefighter stationed outside may be assigned an additional role. This additional role must not interfere with his or her ability to perform assistance or rescue activities. Such interference will jeopardize the safety and health of any firefighter working at the scene.

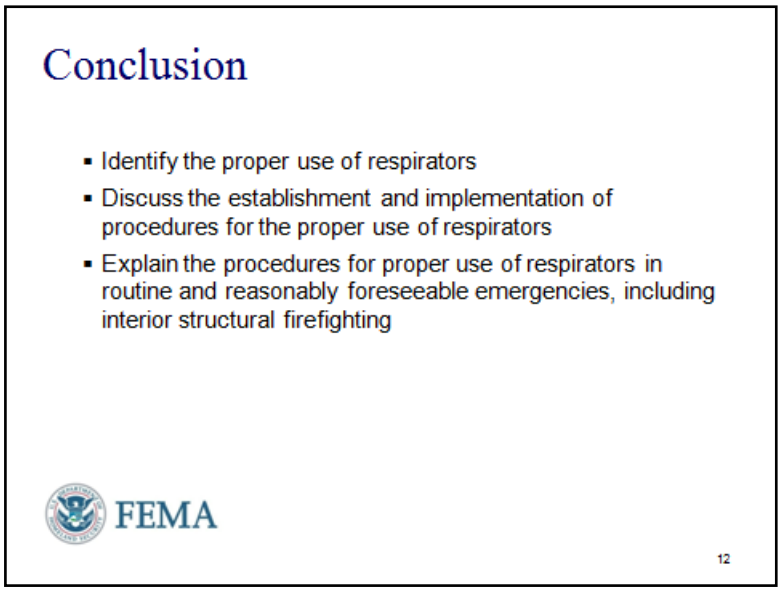
The only exception to the standard concerning the two-in/two-out rule is when life is in jeopardy. Then the firefighters have the discretion to perform the rescue. It also does not prohibit firefighters from entering a burning structure to perform rescue operations when there is a reasonable belief that casualties may be inside.

Activity:

Mark each statement true or false. Justify the answer by providing the location in the standard where the information is found. If the statement is false, cross out the false information and write in the correct information.

Notes:

1. If an employee wears corrective glasses or goggles or other personal protective equipment, the employee must ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.
2. For all tight-fitting respirators, the employer must ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section.
3. If the employer detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer can choose to replace or repair the respirator before allowing the employee to return to the work area.
4. Visual-only communications is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
5. The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.



Notes:

Conclusion

Paragraph (g) of § 1910.134 requires employers to establish and implement procedures for the proper use of respirators. Respirators protect a user in two basic ways: by filtering contaminants from the air, such as chemicals and gases, and by supplying air from another source.

To wear a respirator, there cannot be a break in the seal. Facial hair, facial deformities, eyeglasses, contact lenses, and communications can affect the use of a respirator. The body itself may have physiological responses to respirator use. This may include the weight of the equipment and the nature of the environment. Participants should understand the proper use of respirators and the importance of performing a user seal check each time they don a respirator.

Respirators should be properly maintained, correctly used, and conscientiously worn. Paragraph (g)(4) also addresses working in IDLH environments. When working in this environment, at least one trained employee who is equally equipped must be located outside the IDLH environment. This employee is to notify the employer before entering the IDLH environment to provide emergency rescue.

When performing interior structural firefighting, the two-in/two-out rule must be followed. This concept is addressed as part of paragraph (g)(4) and requires that two firefighters enter the building together with at least two standby personnel on the outside of the fire area in case a need arises for a rescue.

This C.F.R. section is intended to mandate safe and effective respirator use in the workplace. Awareness and understanding of Part 1910, Subpart I, Section 134(g) and Appendix B-1 may allow both employers and employees to successfully affect that outcome.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

National Institute for Occupational Health and Safety. (2004, October*). NIOSH respirator selection logic* (NIOSH Publication No. 2005-100). Retrieved from http://www.cdc.gov/niosh/docs/2005-100/pdfs/05-100.pdf

National Institute for Occupational Health and Safety, National Personal Protective Technology Laboratory. (n.d.). *Respirators*. Retrieved from http://www.cdc.gov/niosh/npptl/topics/respirators/

Noll, G., Hildebrand, M. S., & Yvorra, J. G. (2005). *Hazardous materials: Managing the incident* (3rd ed.). Stillwater, OK: Fire Protection Publications.

Oldfield, K. W. (Ed.). (2005). *Emergency responder training manual for the hazardous materials technician* (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Public Health, 42 C.F.R. Part 84 (2009).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

User Seal Check Procedures (Mandatory), Appendix B-1 to 29 C.F.R. § 1910.134 (2013).

Maintenance and Care of Respirators

Duration: 0.50 Hour

Summary: Participants take part in a study of the employer's responsibility to provide respirators that are in good condition. One aspect of that responsibility includes the maintenance and care of respirators. The requirements for the maintenance and care of respirators are listed in this module in accordance with Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(h) (2013) and Respirator Cleaning Procedures (Mandatory), Appendix B-2 to § 1910.134. Participants identify cleaning and disinfecting procedures and how to manage respirator repairs. Additionally, participants explain and discuss respirator storage and inspection procedures. Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate document provided to participants, as § 1910.134(h) and Appendix B-2 are reviewed.

Terminal Learning Objective: At the conclusion of this module, participants will be able to describe the requirements for the employer to provide respirator maintenance in accordance with § 1910.134(h).

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

9-1 Identify the cleaning and disinfecting procedures for respirators according to § 1910.134(h)(1).

9-2 Explain the storage procedures for respirators according to § 1910.134(h)(2).

9-3 Discuss the procedures for inspecting respirators according to § 1910.134(h)(3).

9-4 Identify how repairs on respirators should be managed according to § 1910.134(h)(4).

Practical Exercise: Participants take part in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. Additionally, participants identify the cleaning and disinfecting procedures for respirators and explain the respirator storage procedures. Participants also discuss the procedures for inspecting respirators and identify how repairs on respirators should be managed. The approximate time for the activity is 5 minutes.

Risk Assessment: Low

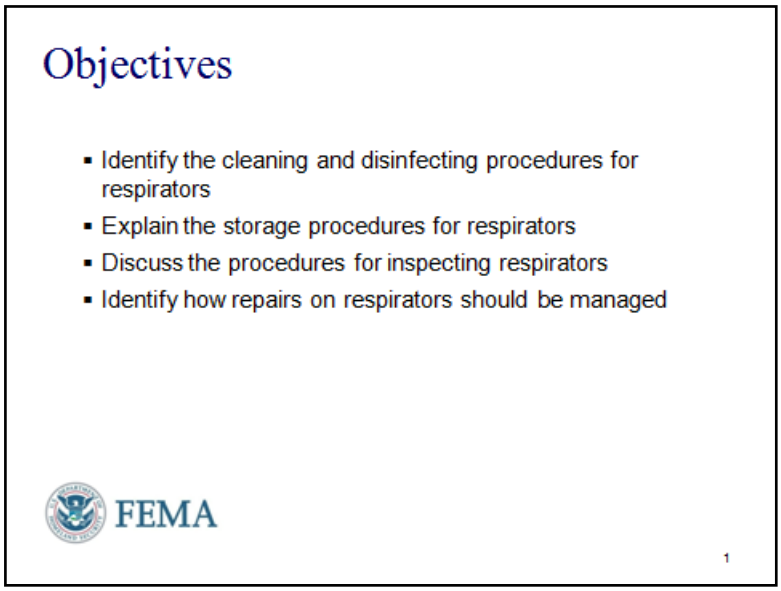
Methods of Instruction: Instructors use facilitated lecture format supported by presentation visuals. Reflective questioning challenge participants' critical thinking skills and reinforce module content. Participants take part in instructor-guided and collaborative knowledge checks throughout the module, where they identify the cleaning and disinfecting procedures for respirators, explain the storage procedures, and discuss respirator inspection procedures. In the small-group discussion, participants identify how their departments or jurisdictions apply the § 1910.134(h) and Appendix B-2.

Instructor-to-Participant Ratio: 1:30

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participants' comprehension through their participation in large-group discussions. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134(h) and Appendix B-2 are reviewed using the *Reference Manual*.



Enabling Learning Objective 9-1: Identify the cleaning and disinfecting procedures for respirators according to § 1910.134(h)(1).

Respirator Maintenance and Care

Section 1910.134(h) addresses the maintenance and care of respirators. “This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees” (Respiratory Protection, 29 C.F.R. § 1910.134[h], 2013).

Notes:

Respirator Maintenance and Care

Courtesy of CDP

§ 1910.134(h)—Maintenance and care of respirators

- Cleaning and disinfecting
- Storage
- Inspection
- Repairs

FEMA

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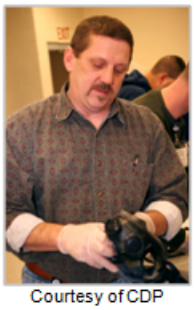
Respirator Maintenance and Care (continued)



Courtesy of CDP

§ 1910.134(h)(1)—Employer shall provide clean, sanitary, and effective respirators

Appendix B-2—Respirator must be cleaned and disinfected in a manner that

- Prevents respirator damage
- Does not cause harm to the user

FEMA

3

Notes:

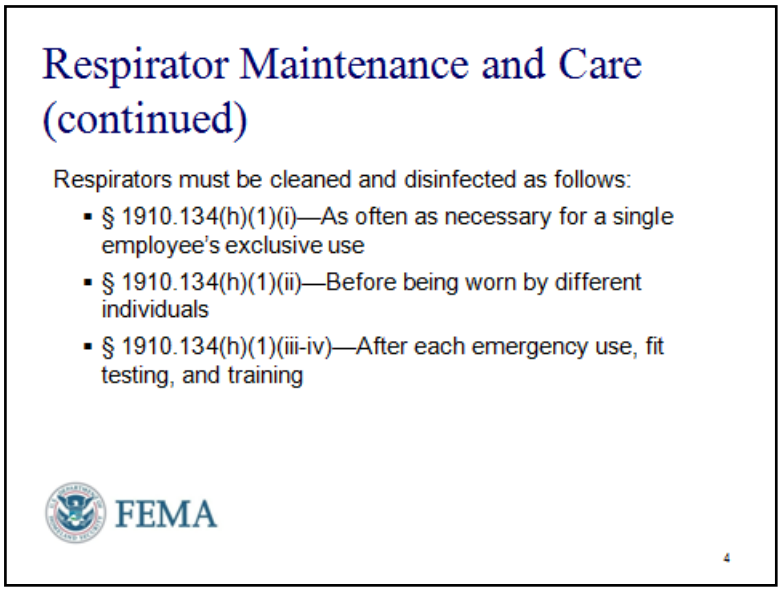
Key Point:

Section 1910.134(h)(1) pertains to the cleaning and disinfecting of respirators. This paragraph stresses that the employer must provide each employee that uses a respirator with a respirator that is clean, sanitary, and effective. It is important that respirators are cleaned and sanitized to prevent the potential spread of disease or other harmful substances.

The paragraph states further that the employer is obligated to ensure that respirators are cleaned and disinfected using either the general procedures in § 1910.134, Appendix B-2 or manufacturer-recommended procedures, “provided that such procedures are of equivalent effectiveness” (Respiratory Protection, 29 C.F.R. § 1910.134[h][1], 2013). Specifically, equivalent effectiveness means that the procedures must accomplish the following objectives set forth in Appendix B-2:

- Proper cleaning and disinfection of the respirator, to include disassembling, washing, rinsing, disinfecting, drying, and then reassembling it
- No damage to the respirator
- No harm to the user

Notes:



NOTE: This course assumes a 20-minute contact time between the respirator and the disinfecting solution.

The frequency of respirator cleaning is dictated by § 1910.134(h)(1)(i) and is based on the number of users and the manner in which the respirator will be used. Respirators issued for a single employee's exclusive use must be cleaned and disinfected as often as necessary. According to paragraph (h)(1)(ii), respirators that are issued to multiple employees must be cleaned and disinfected before being worn by different individuals. Section 1910.134(h)(1)(iii-iv) addresses respirators maintained for emergency use, for fit testing, and for training. These respirators must be cleaned and disinfected after each use.

✔ **Knowledge Check:**

- Why is it important to clean and disinfect a respirator?
- When should a respirator be cleaned and disinfected?

Notes:

Enabling Learning Objective 9-2: Explain the storage procedures for respirators according to § 1910.134(h)(2).

Respirator Storage

Courtesy of CDP

Per § 1910.134(h)(2), all respirators shall be stored to protect from

- Deformity
- Damage
- Contamination
- Dust
- Sunlight
- Extreme temperatures
- Excessive moisture
- Damaging chemicals

FEMA

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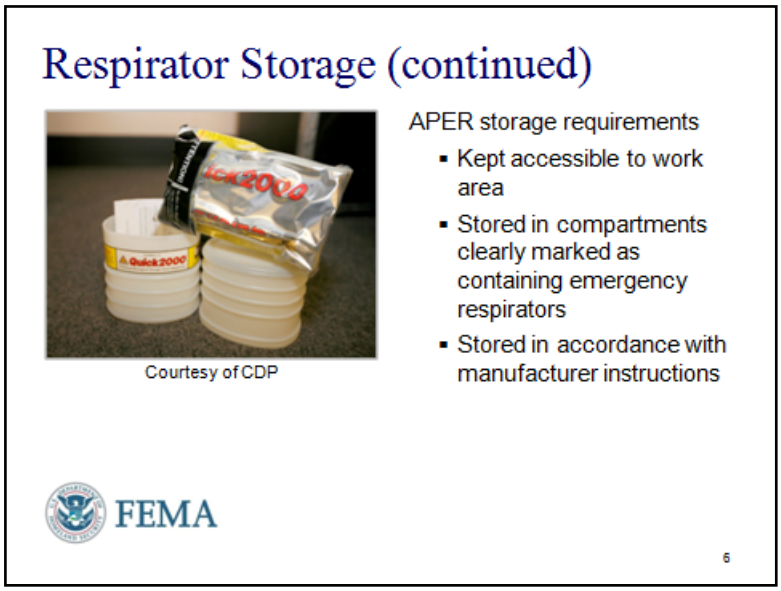
Notes:



Respirator Storage

Section 1910.134(h)(2) addresses respirator storage. Respirators should never be stored with the straps of the mask pulled to the outside. This practice deforms the base-point material that affixes the strap to the mask. This deformity may result in seal leakage, so it is important to avoid this by properly arranging the APR straps during storage. The respirators must be packed or stored in a manner that prevents deformation of the facepiece and exhalation valve. Additionally, all respirators must be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.

Emergency respirators (i.e., air-purifying escape respirators [APER]) require several other unique storage conditions, as explained in § 1910.134(h)(2)(ii).

Key Point:

Emergency respirator storage conditions include the following:

- Being kept accessible to the work area

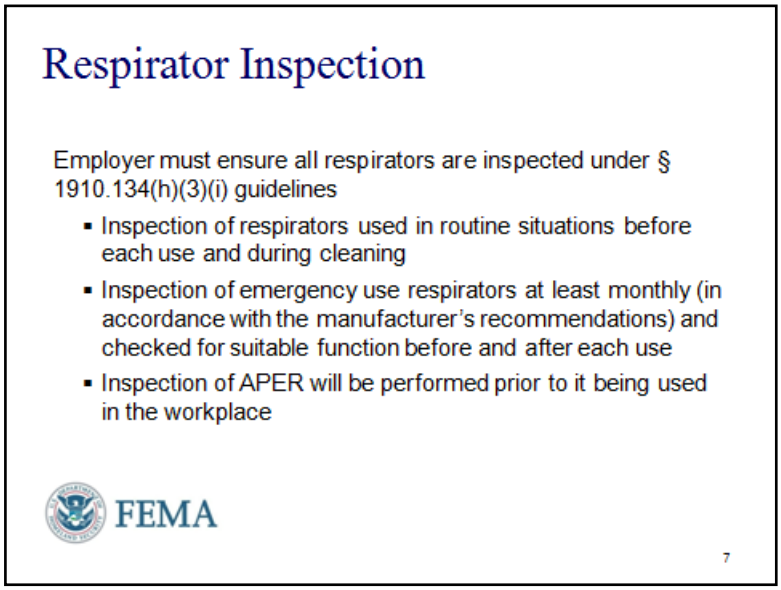
Notes:

- Being stored in compartments that are clearly marked as containing emergency respirators
- Being stored in accordance with any applicable manufacturer instructions (Respiratory Protection, 29 C.F.R. § 1910.134, 2013)

✔ **Knowledge Check:**

Explain the difference and/or similarities in storing a respirator for everyday use versus emergency respirators.

Enabling Learning Objective 9-3: Discuss the procedures for inspecting respirators according to § 1910.134(h)(3).



Respirator Inspection

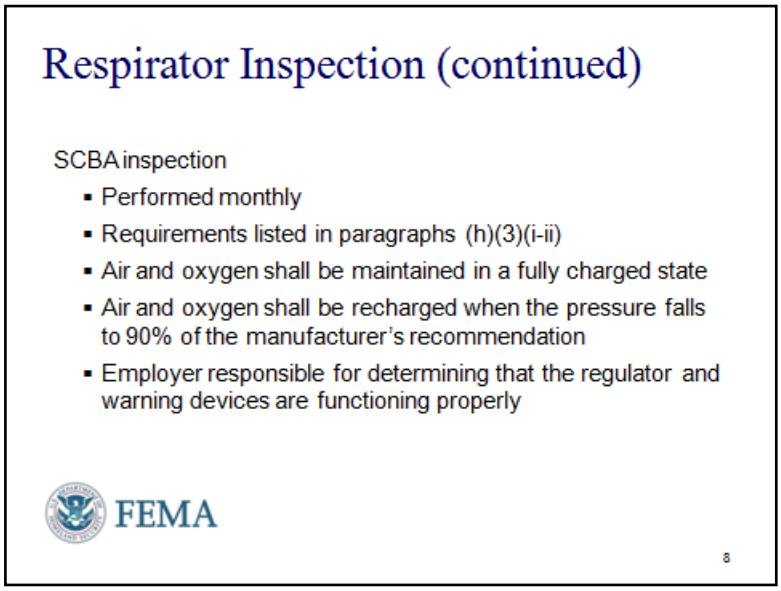
Section 1910.134(h)(3) pertains to the inspection of the respirator. It is the employer's responsibility to ensure that all respirators are inspected under the guidelines of §

Notes:

1910.134(h)(3)(i). This paragraph regulates when inspections are performed, what constitutes an inspection, and what documentation is required to demonstrate inspection.

Respirators used in routine situations must be inspected before each use and each time they are cleaned; however, respirators maintained for use in emergency situations (i.e., APERs) must be inspected at least monthly and in accordance with the manufacturer's recommendations. Section 1910.134(h)(3)(i)(B) states that APERs must also be checked for suitable function before and after each use. Additionally, § 1910.134(h)(3)(i)(C) states that APERs must be inspected before using it in the workplace.

Section 1910.134(h)(3)(ii)(A–B) explains the necessary components of an inspection.



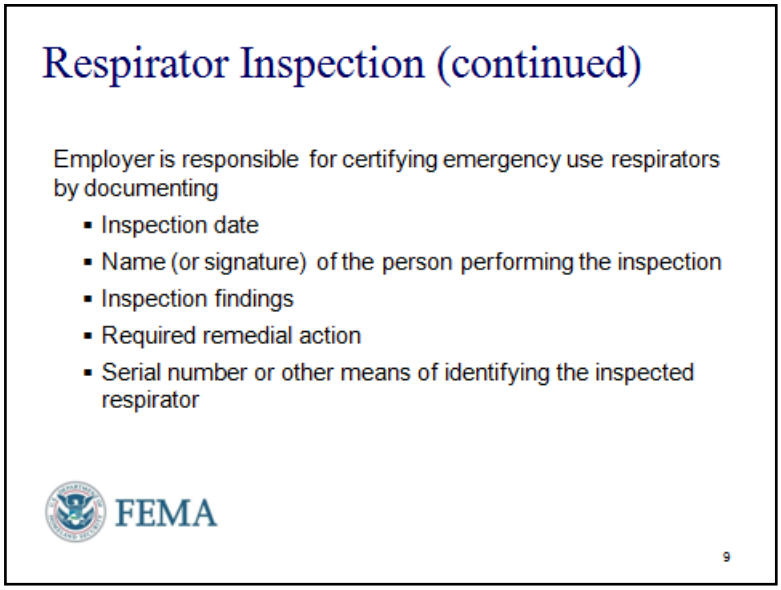
Key Point:

The employer must ensure that respirator inspections check the following:

- Respirator function
- Tightness of connections

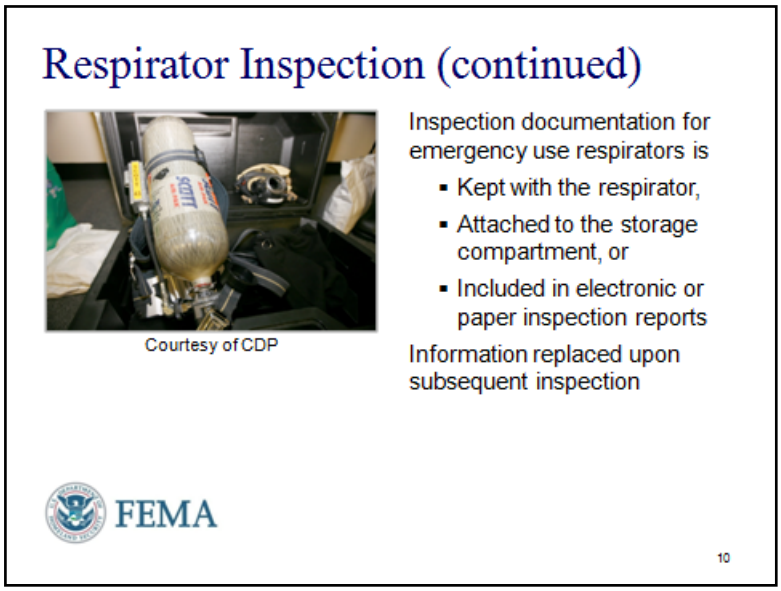
Notes:

- Condition of the following parts:
  - Facepiece
  - Head straps
  - Valves
  - Connecting tube
  - Cartridges, canisters, or filters
  - The elastomeric parts of the respirator (the base-point material that affixes the straps to the mask)



Self-contained breathing apparatus (SCBA) inspection requirements are contained in § 1910.134 paragraphs (h)(3)(i-ii); however, paragraph (h)(3)(iii) adds several unique SCBA requirements. SCBA must be inspected monthly, and employers are responsible for determining that the regulator and warning devices are functioning properly. Additionally, “air and oxygen shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer’s recommended pressure level” (Respiratory Protection, 29 C.F.R. § 1910.134[h][3][iii], 2013).

Notes:



Because respirators for emergency use may be used by any individual, emergency respirators must have documentation of inspection. According to § 1910.134(h)(3)(iv)(A), it is the employer's responsibility to certify the respirator by documenting the following:

- The date the inspection was performed
- The name (or signature) of the person who performed the inspection
- The findings
- Required remedial action
- A serial number or other means of identifying the inspected respirator (2013)

In addition to documenting the inspection information for emergency-use respirators, employers must attach that documentation to respirators maintained for emergency use. The information must be provided "on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files" (Respiratory Protection, 29 C.F.R. § 1910.134[h][3][iv][B], 2013). This information must be maintained until replaced following a succeeding inspection certification.

Notes:

✔ **Knowledge Check:**

- When should respirators be inspected?
- What parts of the respirator should be inspected?

Enabling Learning Objective 9-4: Identify how repairs on respirators should be managed according to § 1910.134(h)(4).

Respirator Repair Procedures

Section 1910.134(h)(4) discusses respirator repairs. It is the responsibility of the employer to ensure that the respirators that fail an inspection or are defective be removed from service. It is also the responsibility of the employer to discard, repair, or adjust in accordance with procedures outlined by the standard. These include the following:

Notes:

Respirator Repair Procedures (continued)

Procedures for respirator discard, repair, or adjustment

- Repairs or adjustments are to be made only by a person appropriately trained to perform such operations and will contain only the respirator manufacturer's NIOSH-approved parts designed for the respirator

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Respirator Repair Procedures (continued)

Other procedures for respirator discard, repair, or adjustment

- Repairs shall be made according to manufacturer's recommendations and specifications
- Reducing and admission valves, regulators, and alarms shall be adjusted and repaired only by the manufacturer or a technician trained by the manufacturer

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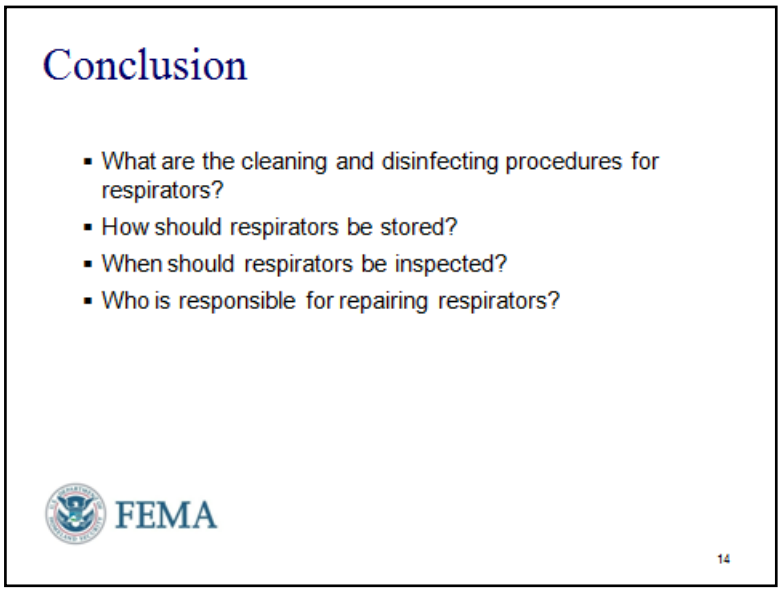
Notes:

- Repairs or adjustments to respirators are to be made only by a person appropriately trained to perform such operations and must use only the respirator manufacturer's National Institute for Occupational Health and Safety (NIOSH)-approved parts designed for the respirator
- Repairs must be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed
- Reducing and admission valves, regulators, and alarms must be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer (Respiratory Protection, 29 C.F.R. § 1910.134 [h][4][i-iii], 2013)



Conclusion

The maintenance and care of respirators is addressed in § 1910.134(h). The paragraph specifically addresses cleaning and disinfecting, storing, inspecting, and repairing of respirators. The objectives for cleaning the respirator are set forth in Appendix B-2. In some cases, the regulatory standard is more thorough than the manufacturer's recommendations for the cleaning, disinfection, and storage of respirators.

Notes:

Respirators should never be stored with the straps of the mask on the outside. Storing a mask in this manner will deform the base-point material that affixes the strap to the mask, which could result in leakage of the mask when worn.

Inspection of the respirator should occur before each use and during cleaning. It is the employer's responsibility to ensure that all respirators are inspected. For respirators used in emergency situations and with SCBA, an inspection should occur at least monthly. Documentation of the inspection must accompany the respirator.

The employer is to remove from service any respirators that fail inspection or are otherwise found defective. Only NIOSH-approved parts may be used on the respirator. The technician trained by the manufacturer is the only person who can make repairs.

Fundamentally, § 1910.134(h) is concerned with keeping respirators clean, sanitary, and in good functioning order—all vital to a successful respiratory protection program.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Respiratory Cleaning Procedures (Mandatory), Appendix B-2 to 29 C.F.R. § 1910.134 (2013).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

APR Cleaning Procedures

Duration: 1.75 Hours

Summary: Participants perform a hands-on activity by disassembling, cleaning, and disinfecting an air-purifying respirator (APR) in accordance with Respiratory Cleaning Procedures (Mandatory), Appendix B-2(A–E) to 29 *Code of Federal Regulations* (C.F.R.) § 1910.134 (2013) and the manufacturer's guidelines as well as identify the parts of an APR. This exercise is completed at the end of Day 2. The APRs are air-dried overnight as recommended according to Appendix B-2(F). On Day 3, the APRs are reassembled during Module 14, "APR Assembly and Inspection." Participants complete the study of Appendix B-2(G–H) during Module 14, "APR Assembly and Inspection." The reassembling of the APRs provides participants an opportunity to review before the posttest. Participants have the opportunity to complete a self-assessment and evaluation by peers prior to the performance evaluation.

Terminal Learning Objective: At the conclusion of this module, participants will be able to demonstrate cleaning procedures for respirator maintenance in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

10-1 Perform the disassembly of a given respirator in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines.

10-2 Perform proper cleaning and disinfecting procedures for respirator maintenance in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines.

10-3 Identify the components of an APR per manufacturer's guidelines.

Practical Exercise: Under the direction of an instructor, participants divide into two groups. Group 1 disassembles, cleans, and disinfects an APR in a breakout room in accordance with § 1910.134, Appendix B-2.I.A-F (2013) and manufacturer's guidance. In the main classroom, Group 2 identifies the different components of an APR by matching up different parts with the correct term. Each group uses performance checklists to self-assess and perform peer-to-peer evaluations before instructor assessment. The approximate time for this practical exercise is 20 minutes. At the completion of each hands-on exercise, instructors direct each group to the other room to complete the remaining exercise. This exercise allows participants to become familiar with the manufacturer's guidelines presented to properly clean, disinfect, and disassemble the *Mine Safety Appliances Company (MSA) Millennium® APR/CBRN Respirator*. The approximate time for this practical exercise is 45 minutes.

Risk Assessment: Low

Methods of Instruction: Participants take part in facilitated and demonstrated hands-on exercises supported by presentation visuals in a classroom environment. Under the direction and coaching of the instructor, participants disassemble, clean, and disinfect an APR in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines as well as identify the parts of an APR. Reflective questioning challenges participants' critical thinking skills and reinforces course content. During the hands-on practical exercise, participants take part in instructor-guided and collaborative knowledge checks. Instructors use knowledge checks to

assess participant comprehension of the components of the APR and the manufacturer's guidelines for disassembling, cleaning, and disinfecting the APR.

Instructor-to-Participant Ratio: 1:5

Required Reading: *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*]

Evaluation Strategies: In this hands-on exercise, participants self-assess and participate in peer-to-peer evaluations using the performance checklist prior to assessment by the instructor. The performance checklist assesses participants' knowledge and skills in the identified APR cleaning procedures. Participants submit the APR parts identification worksheet to the instructor for grading. The instructor checks the worksheet for completeness and accuracy, and identifies any problem areas to address to the class. In addition, participants take part in instructor-guided and collaborative knowledge checks. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134, Appendix B-2 is applied. Participants separate into two groups. One group remains in the main classroom to perform the APR parts identification activity while the other group is in the breakout room performing cleaning and disinfecting procedures. After each activity concludes, the groups switch places. Participants submit the APR parts identification worksheet to the instructor to check completeness and accuracy. If problem areas are identified, the instructor should address them to the class.

Objectives

- Perform the disassembly of a given respirator
- Perform proper cleaning and disinfecting procedures for respirator maintenance
- Identify the components of an air-purifying respirator (APR)

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Introduction

- Appendix B-2 provides mandatory procedures for respirator cleaning and disinfecting
- Employers can use manufacturer's guidelines for cleaning and disinfecting respirators as long as it meets or exceeds the procedures listed in Appendix B-2

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Notes:

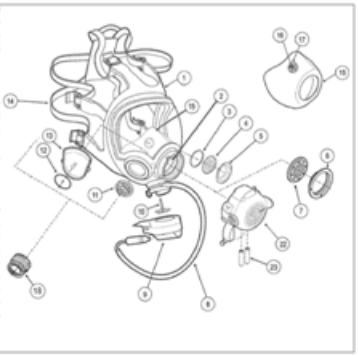
Introduction

Section 1910.134 (2013), Appendix B-2 provides mandatory procedures for respirator cleaning and disinfecting. Appendix B-2 states that employers can use the manufacturer's guidelines for cleaning and disinfecting respirators as long as they meet or exceed the procedures listed in Appendix B-2.

Enabling Learning Objective 10-1: Perform the disassembly of a given respirator in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines.

Disassemble the APR

Millennium® Facepiece		
Item No.	Part No.	Description
1	10006591	Small, Faceblank Lens Assembly
	10006590	Medium, Faceblank Lens Assembly
	10006592	Large, Faceblank Lens Assembly
2	10008189	Internal Drinking Tube
3	10007979	Gasket
4	805343	Voicemitter
5	10007991	Retaining Ring
6	805111	Metal Retaining Ring
7	805103	Speaking Diaphragm
8	10008191	External Drinking Tube
9	10007997	Exhalation Valve Cover
10	10007996	Exhalation Valve
11	10007994	Spider Gasket
12	10007421	Inhalation Valve Assembly
13	10007388	Deflector
14	10008587	Head Harness
15	10006824	Small, Nosecup Assembly
	10006823	Medium, Nosecup Assembly
	10006825	Large, Nosecup Assembly
16	305349	Nosecup Valve Disc
17	305350	Nosecup Valve Seat
18	96547	Adapter Assembly (required for Riot Control P100/CS/CN Canister p/n 817589)



Millennium® APR/CBRN Respirator Operation and Instructions

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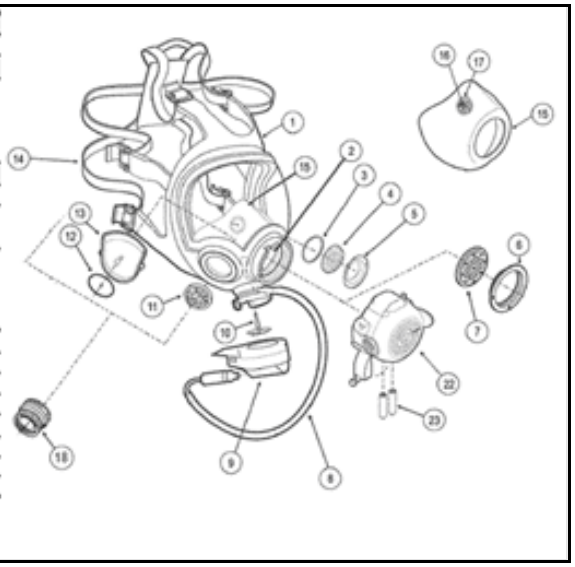
Notes:

Activity 1:

Disassemble the APR

Millennium® Facepiece		
Item No.	Part No.	Description
1	10006591	Small, Faceblank Lens Assembly
	10006590	Medium, Faceblank Lens Assembly
	10006592	Large, Faceblank Lens Assembly
2	10008189	Internal Drinking Tube
3	10007979	Gasket
4	805343	Voicemitter
5	10007991	Retaining Ring
6	805111	Metal Retaining Ring
7	805103	Speaking Diaphragm
8	10008191	External Drinking Tube
9	10007997	Exhalation Valve Cover
10	10007996	Exhalation Valve
11	10007994	Spider Gasket
12	10007421	Inhalation Valve Assembly
13	10007388	Deflector
14	10008587	Head Harness
15	10006824	Small, Nosecup Assembly
	10006823	Medium, Nosecup Assembly
	10006825	Large, Nosecup Assembly
16	305349	Nosecup Valve Disc
17	305350	Nosecup Valve Seat
18	96547	Adapter Assembly (required for Riot Control P100/CS/CN Canister p/n 817589)



(MSA Company, 2008)

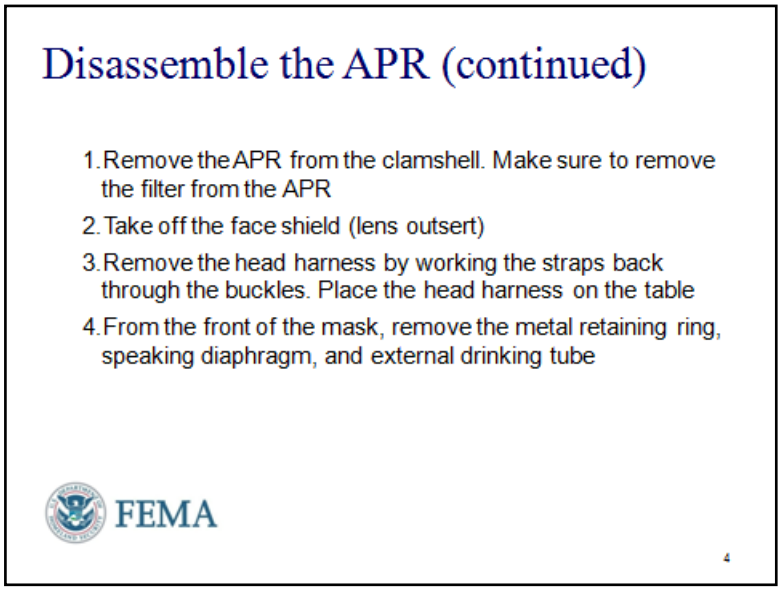
It is important to follow the manufacturer's instructions for disassembling and cleaning. Completely disassemble the facepiece in order to clean the facepiece of all bodily fluids. For this course, the *Mine Safety Appliances Company (MSA) Millennium® APR/CBRN Respirator* is used. The *MSA Millennium APR/CBRN Respirato*r requires the use of the spanner wrench (P/N 461828) for assembly and disassembly.

NOTE: Put on protective gloves before handling the APR for disassembling and cleaning.

1. Remove the APR from the clamshell. Make sure to first remove the filter from the APR.
2. Take off the face shield (lens outsert).
3. Remove the head harness by working the straps back through the buckles. Place the head harness on the table.

Notes:

4. From the front of the mask, remove the metal retaining ring, speaking diaphragm, and external drinking tube.



Notes:

Disassemble the APR (continued)

Courtesy of CDP

5. Carefully unhook and remove the exhalation valve cover and the exhalation valve
6. Remove the nosecup from inside the mask
7. Remove the nosecup valve disc and the nosecup valve seat from the nosecup
8. Separate the nosecup valve disc from the nosecup valve seat

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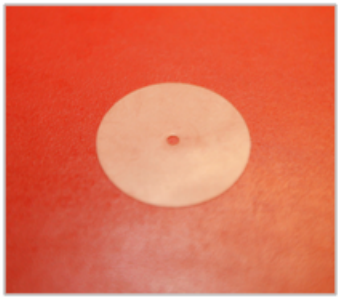
Disassemble the APR (continued)



Courtesy of CDP

9. Remove the deflector. Take the inhalation valve assembly off the deflector
10. Remove the spider gasket
11. Inside the facepiece, remove the internal drinking tube from the mouthpiece
12. Using the spanner wrench, remove the retaining ring, voicemitter, and gasket from the side of the facepiece

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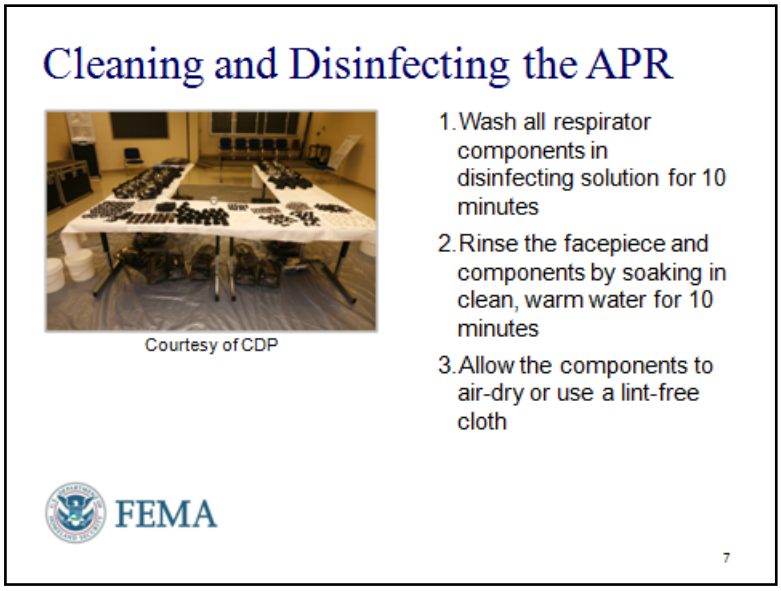
Notes:

5. Carefully unhook and remove the exhalation valve cover and the exhalation valve.
6. Remove the nosecup from inside the facepiece.
7. Remove the nosecup valve disc and the nosecup valve seat from the nosecup.
8. Separate the nosecup valve disc from the nosecup valve seat.
9. Remove the deflector. Take the inhalation valve assembly off of the deflector.
10. Remove the spider gasket.
11. Inside the facepiece, remove the internal drinking tube from the mouthpiece.
12. Using the spanner wrench, remove the retaining ring, voicemitter, and gasket from the side of the facepiece.

Notes:

Enabling Learning Objective 10-2: Perform proper cleaning and disinfecting procedures for respirator maintenance in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines.



Cleaning and Disinfecting the APR

The following information is quoted from *MSA Millennium APR/CBRN Respirator Operation and Instructions*.

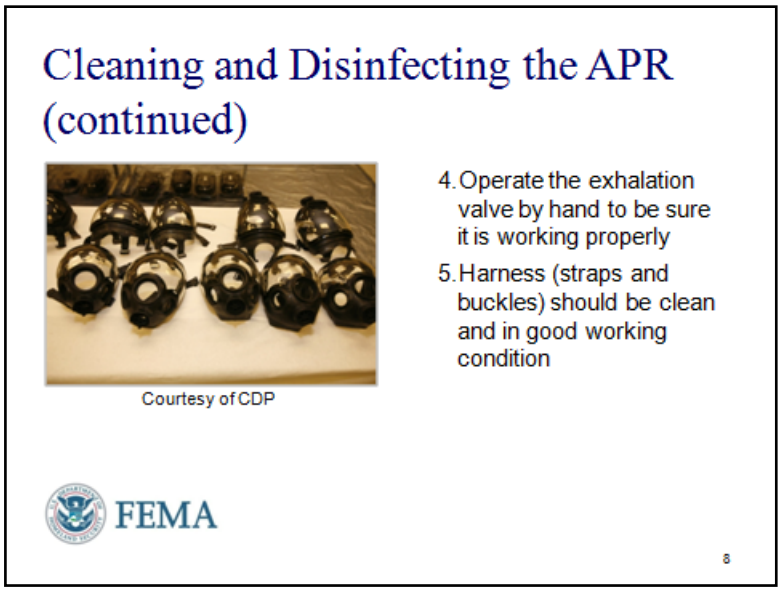
Caution: Do not use alcohol as a germicide because it may deteriorate rubber parts.

1. Wash all respirator components thoroughly in the disinfecting solution for 10 minutes.
2. Rinse the facepiece and components by soaking in clean, warm (110°F) water for 10 minutes.

NOTE: If the respirator is not rinsed thoroughly, cleaning agent residue may irritate the wearer's skin.

Notes:

3. Allow the components to air dry. Do not dry the parts by placing them near a heater or in direct sunlight (the rubber will deteriorate). Respirator components may be dried using a lint-free cloth.

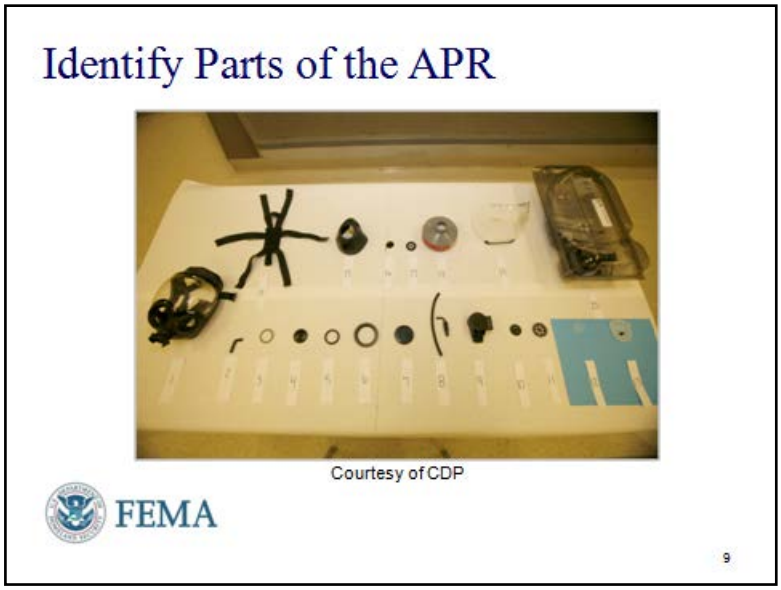


4. Operate the exhalation valve by hand to be sure it works properly.
5. Harness (straps and buckles) should be clean and in good working condition. (Mine Safety Appliances Company, 2008)

Notes:

Enabling Learning Objective 10-3: Identify the components of an APR per manufacturer's guidelines.

Activity 2:



Notes:

Identify parts of the APR

Parts of the APR
Courtesy of CDP

APR System Parts Identification Checklist

Name _____ Date _____

1._____ 11. _____

2._____ 12. _____

3._____ 13. _____

4._____ 14. _____

5._____ 15. _____

6._____ 16. _____

7._____ 17. _____

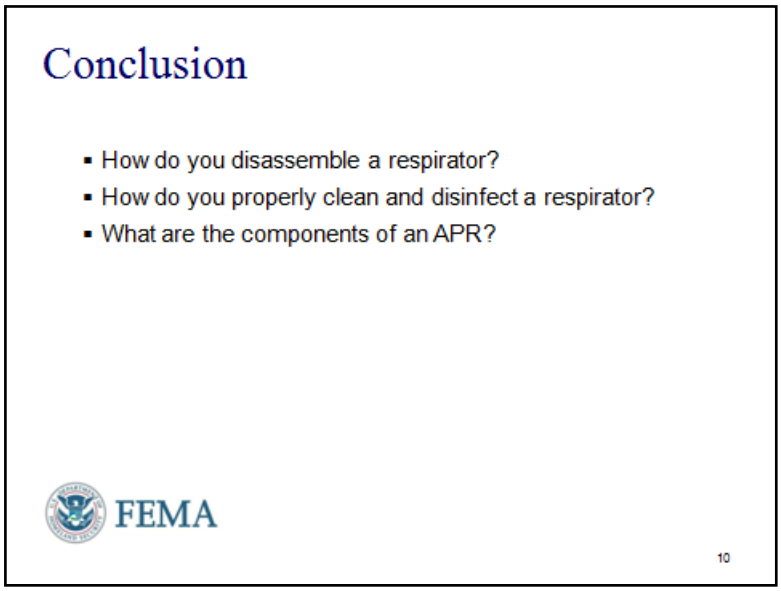
8._____ 18. _____

9._____ 19. _____

10._____ 20. _____

Word Bank

Speaking Diaphragm	Gasket	Spider Gasket	Valve Seat	Voicemitter
External Drinking Tube	Deflector	Valve Disc	Metal Retaining Ring	Facepiece
Head Harness	Nosecup	Storage Case (Clamshell)	Retaining Ring	Inhalation Valve Assembly
Lens Outsert	Exhalation Valve	Canister	Exhalation Valve Cover	Internal Drinking Tube



Conclusion

Employers should understand the important role proper APR cleaning plays in a respiratory protection program. All employees responsible for APR maintenance should be trained to properly disassemble, clean, disinfect, and reassemble APR in accordance with § 1910.134, Appendix B-2 and the manufacturer's guidelines.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Mine Safety Appliances Company. (2008). *Millennium APR/CBRN respirator operations and instructions* (Rev. 17). Retrieved from http://media.msanet.com/NA/USA/DomesticPreparedness/GasMasksAPR/MillenniumCBA/MillenniumManualR4.pdf

Respiratory Cleaning Procedures, Appendix B-2 to 29 C.F.R. § 1910.134 (2013).

Air Quality

Duration: 0.75 Hour

Summary: Participants take part in a study of the responsibility of the employer to provide the employee who is wearing atmosphere-supplying respirators (supplied-air and self-contained breathing apparatus [SCBA]) with air that is of high purity. The specifics of those responsibilities are identified per Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(i) (2013). Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate document provided to participants, as § 1910.134(i) is reviewed.

Terminal Learning Objective: At the conclusion of this module, participants will be able to explain the employer's responsibility to provide employees who are using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity in accordance with § 1910.134(i).

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

11-1 Identify the employer's responsibility for supplied air according to § 1910.134(i).

11-2 Identify the employer's responsibility for maintenance of air quality equipment according to § 1910.134(i).

Practical Exercise: Participants take part in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module to identify the employer's responsibility for supplied air and maintenance of air quality. Participants examine a brief case study related to the employer's responsibility for maintenance of air quality equipment. Instructors facilitate a brief large-group discussion on the case study using the discussion questions included in the instructor notes as examples. Approximate time for the activity is 10 minutes.

Risk Assessment: Low

Methods of Instruction: Instructors use facilitated lecture format supported by presentation visuals and a case study. Reflective questioning challenges participants' critical thinking skills and reinforces module content. Participants participate in instructor-guided and collaborative knowledge checks in which they identify the employer's responsibility for supplied air and for maintenance of air quality equipment. Instructors introduce a brief case study and instruct participants to review it. Within the larger group, instructors ask participants questions regarding the case study that supports the material on the employer's responsibility for maintenance of air quality equipment.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group discussions

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess

participants' comprehension based upon their responses during the discussion of the case study. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134(i) is reviewed using the *Reference Manual*.

Objectives

- Identify the employer's responsibility for supplied air
- Identify the employer's responsibility for maintenance of air quality equipment

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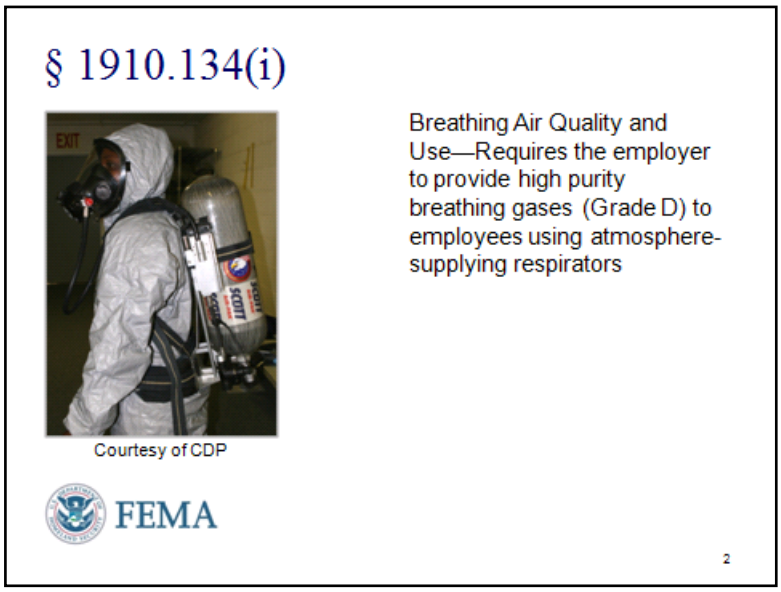
Notes:

Enabling Learning Objective 11-1: Identify the employer's responsibility for supplied air according to § 1910.134(i).

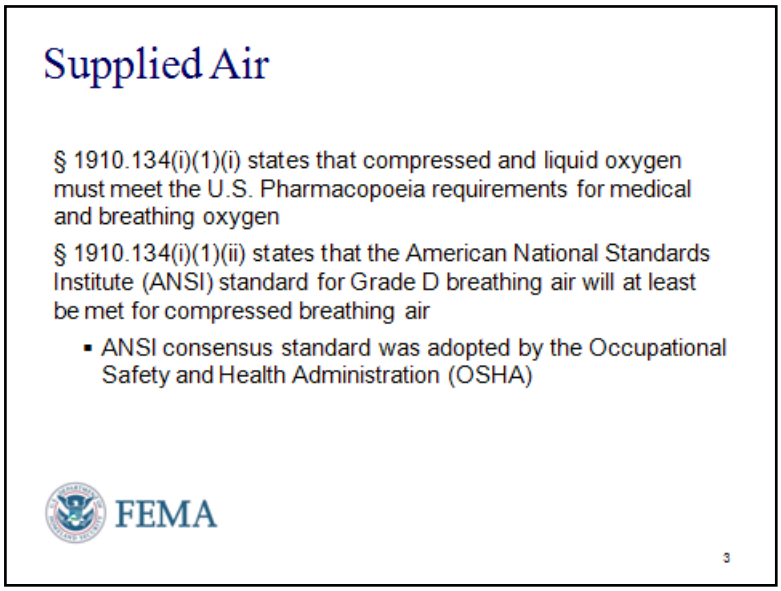


§ 1910.134(i)

Section 1910.134(i) addresses breathing air quality and use. This paragraph requires the employer to provide high-purity breathing gases to employees using atmosphere-supplying respirators (Respiratory Protection, 29 C.F.R. § 1910.134[i], 2013).

The employer is also responsible for ensuring that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air. Furthermore, the employer is responsible for ensuring that oxygen concentration greater than 23.5% is used only in equipment designed for oxygen service or distribution.

Notes:



Supplied Air

Section 1910.134(i)(1)(i) states, in part, that "compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen" (2010). Section 1910.134(i)(1)(ii) states that "compressed breathing air shall meet at least the requirements for Grade D breathing air described in American National Standards Institute (ANSI) *Compressed Gas Association Commodity Specification for Air*, G-7.1-1989" (2010).

Originally a consensus standard, the ANSI standard was adopted by the Occupational Safety and Health Administration (OSHA) and consequently made into a regulatory standard. The standard lists the requirements for Grade D breathing air as follows:

- Oxygen content (v/v) 19.5–23.5%
- Hydrocarbon (condensed) content ≤ 5 milligrams per cubic meter of air
- Carbon monoxide (CO) content ≤ 10 parts per million (ppm)
- Carbon dioxide (CO_2) content ≤ 1000 ppm
- Lack of noticeable odor (Respiratory Protection, 29 C.F.R. § 1910.134, 2013)

Notes:

"Closed-circuit SCBAs, also known as rebreathers, recycle exhaled gases and contain a small cylinder of oxygen to supplement the exhaled air of the wearer. Escape SCBAs provide air for a limited amount of time and should only be used for emergency escapes from a dangerous situation" (Agency for Toxic Substances & Disease Registry [ATSDR], 2001, p. 33).

✔ **Knowledge Check:**

- What are the two primary employer responsibilities for supplied air according to § 1910.134(i)?
- What role does the ANSI standard (*Compressed Gas Association Commodity Specification for Air)* play in the types of supplied air provided by employers?

Notes:

Enabling Learning Objective 11-2: Identify the employer's responsibility for maintenance of air quality equipment according to § 1910.134(i).

Maintenance of Air Quality Equipment

- Cylinders tested and maintained as prescribed in 49 C.F.R. § § 173 and 178.
- Cylinders containing breathing air must have a certificate of analysis from the supplier stating that the breathing air meets Grade D requirements
- Moisture content in the cylinder does not exceed a dew point of -50° F (-45.6° C) at 1 atmosphere pressure

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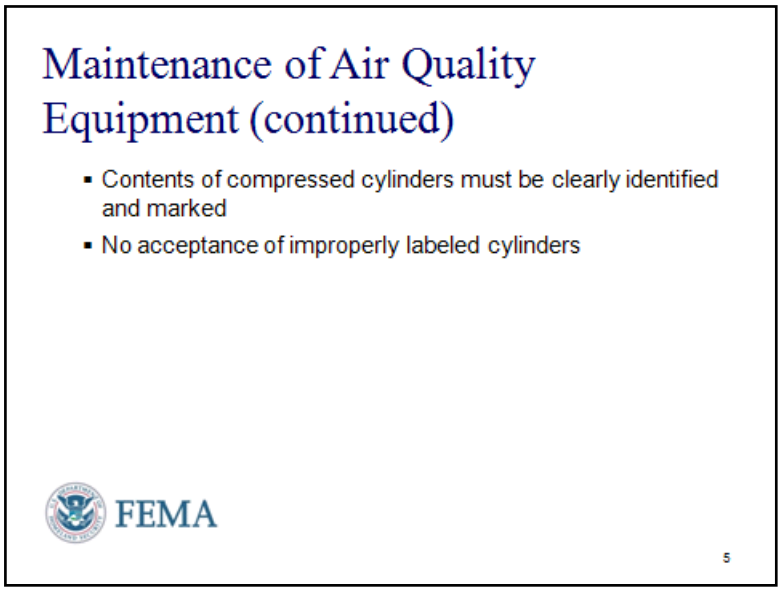
Notes:



Maintenance of Air Quality Equipment

Employers must ensure that cylinders used to supply breathing air to respirators meet three requirements, according to § 1910.134(i)(4). The three requirements are as follows:

- Cylinders are to be tested and maintained as approved in the Shipping Container Specification Regulations of the U.S. Department of Transportation (49 C.F.R. §§ 173 and 178), according to paragraph § 1910.134(i)(4)(i).
- Section 1910.134(i)(4)(ii) states that cylinders containing breathing air must have a certificate of analysis from the supplier stating that the breathing air meets the requirements for Grade D breathing air.
- Section 1910.134(i)(4)(iii) states that “moisture content in the cylinder must not exceed a dew point of -50° F (-45.6° C) at 1 atmosphere pressure.” (2013)

Section 1910.134(i)(5)(i-iv) emphasizes that “the employer shall ensure compressors used to supply breathing air to respirators are constructed and situated appropriately” (2013). As part of § 1910.134(i)(5), a tag containing the most recent change date and the signature of the authorized person to complete the change is required to be maintained at the compressor.

Notes:

The contents of any compressed-gas cylinder must be clearly identified and marked. Do not solely rely on color-coding because colors can differ between suppliers. If a container is not clearly marked, the employer should mark as unidentified and return to the supplier (Oklahoma State University, n.d.).

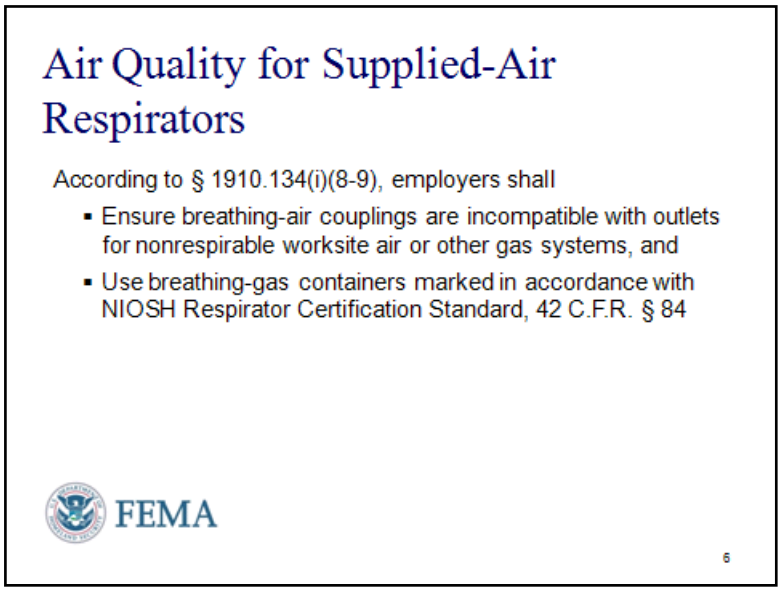
Activity:

For discussion with the larger group, review the case study and the questions that follow.

Case Study: May 1983, Fort McClellan, AL, Noble Army Hospital, three patients died from being connected to a tank containing argon instead of oxygen. The argon tank resembled an oxygen tank, was incorrectly labeled (faint, handwritten “argon” on one side), and was connected to one of the main oxygen lines supplied to the hospital. The mislabeling of containers caused unnecessary deaths.

- How should the tanks have been labeled?
- What should the hospital have done to prevent this type of error?

Notes:



Air Quality for Supplied-Air Respirators

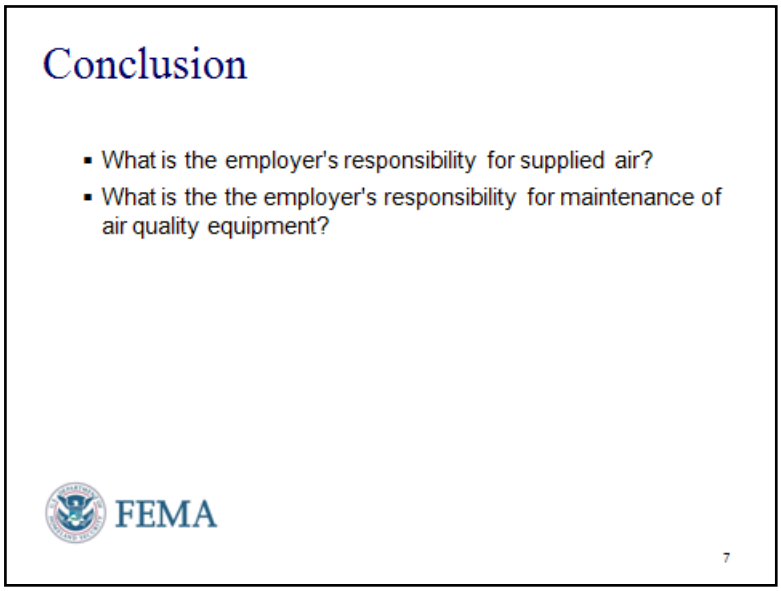
Section 1910.134(i)(8) states, “the employer shall ensure that breathing-air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems” (2013). The point of this paragraph is to ensure that no asphyxiating substance shall be introduced into breathing airlines.

Section 1910.134(i)(9) states the employer will use breathing-gas containers that are marked in accordance with the National Institute for Occupational Safety and Health (NIOSH) Respirator Certification Standard, Public Health, 42 C.F.R. Part 84 (2012). This standard establishes the performance and design requirements to certify an SCBA used by emergency responders for a chemical, biological, radiological, nuclear, and explosive (CBRNE) incident.

✔ **Knowledge Check:**

What are the three primary cylinder maintenance requirements that employers must meet?

Notes:



Conclusion

Employers are required to provide employees who use atmosphere-supplying respirators with breathing gases of high purity. Employers and employees should understand the requirements for Grade D breathing air. Regulations require cylinders containing breathing air to have a certificate of analysis from the supplier stating that the air meets the requirements for Grade D. Breathing-gas containers shall be used in accordance with Public Health, 42 C.F.R. Part 84 (2012), the NIOSH Respirator Certification Standard.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Agency for Toxic Substances & Disease Registry. (2001). Emergency medical services response to hazardous materials incidents. *Hospital emergency departments* (p. 33). Retrieved from http://www.atsdr.cdc.gov/MHMI/mhmi-v2-2.pdf

Oklahoma State University. (n.d.). *Compressed gas cylinder safety.* Retrieved from http://ehs.okstate.edu/MODULES/cylinder/CGC_safety.doc

Public Health, 42 C.F.R. Part 84 (2012).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

*United States Pharmacopeial Convention. (2010). *About USP*. Retrieved from http://www.usp.org/aboutUSP/

* Used only in the Instructor Guide.

Types of Atmosphere-Supplying Respirators

Duration: 1.75 Hours

Summary: Participants take part in a study of self-contained breathing apparatus (SCBA). Participants identify the different types of atmosphere-supplying respirators, along with when and how to maintain atmosphere-supplying respirators. In addition, participants take part in hands-on identification of the components of an SCBA. Participants use the manufacturer's instructions, included in the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], as they describe the basic operation of an SCBA. Participants have an opportunity to practice donning and doffing SCBAs to become familiar with the physical demands of using an SCBA.

Terminal Learning Objective: At the conclusion of this module, participants will be able to describe the basic operation of an SCBA per manufacturer's guidelines.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

12-1 Identify the types of atmosphere-supplying respirators according to Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(b).

12-2 Identify the components of an SCBA according to manufacturer's guidelines.

12-3 Demonstrate SCBA operational inspection procedures according to manufacturer's guidelines.

12-4 Demonstrate SCBA donning and doffing procedures according to manufacturer's guidelines.

12-5 Demonstrate SCBA cylinder replacement procedures according to manufacturer's guidelines.

12-6 Discuss maintenance issues for atmosphere-supplying respirators according to Fire Brigades, § 1910.156.

Practical Exercise: Participants take part in large- and small-group discussions and instructor-facilitated collaborative knowledge checks and demonstrations. Participants identify the components of an SCBA and demonstrate SCBA inspection procedures prior to demonstrating SCBA donning and doffing procedures. After doffing SCBAs, participants demonstrate SCBA cylinder replacement procedures. The approximate time for this activity is 45 minutes. Participants also discuss maintenance issues for atmosphere-supplying respirators.

Risk Assessment: Low

Methods of Instruction: Instructors use facilitated lecture format supported by presentation visuals. Participants take part in instructor-guided and collaborative knowledge checks and a hands-on exercise of donning and doffing SCBAs. Participants perform an operational inspection on an SCBA before demonstrating donning and doffing procedures. Reflective questioning challenges participants' critical thinking skills and reinforces module content.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group exercise

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. In the demonstration exercises, participants are assessed using performance checklists completed by the instructors. Throughout the presentation of the module, the instructor uses reflective questioning and observations to informally assess participants' comprehension of key information. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content as well as address any additional participant questions.

Special Instructions: Present the visuals in the main classroom and move to the breakout rooms to perform the donning and doffing procedures for the SCBA.

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Objectives

- Identify the types of atmosphere-supplying respirators
- Identify the components of an self-contained breathing apparatus (SCBA)
- Demonstrate SCBA operational inspection procedures
- Demonstrate SCBA donning and doffing procedures

FEMA

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Objectives (continued)

- Demonstrate SCBA cylinder replacement procedures
- Discuss maintenance issues for atmosphere-supplying respirators

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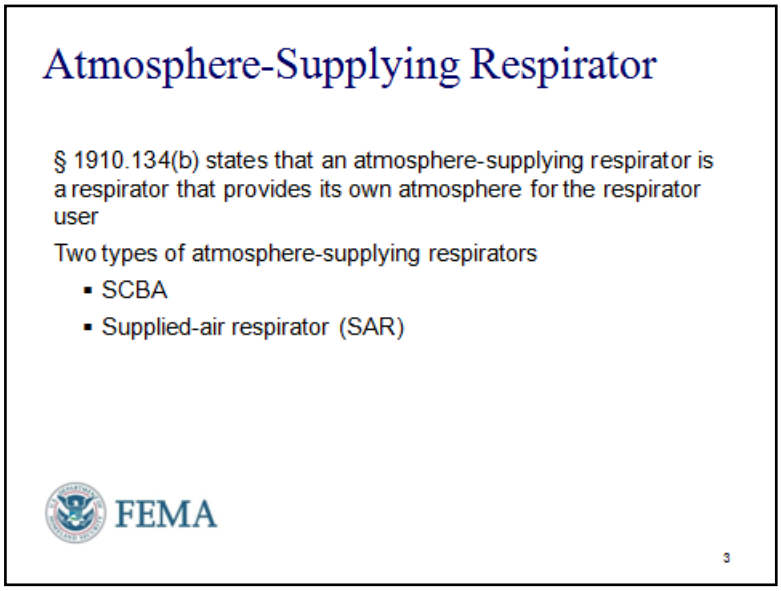
Notes:

Enabling Learning Objective 12-1: Identify the types of atmosphere-supplying respirators according to Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(b).



Atmosphere-Supplying Respirator

According to § 1910.134(b) (2013), an atmosphere-supplying respirator is “a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.” An atmosphere-supplying respirator is a respirator that creates its own atmosphere for the respirator user. This course discusses both SCBAs and SARs.

Notes:

SCBA

- May be open- or closed-circuit
- Must be National Institute for Occupational Safety and Health (NIOSH)-approved
- Limited supply of air; it must be resupplied
- Current PPE ensembles do not offer an easy method for exchanging cylinders

FEMA

4

SCBA (continued)

MSA SCBA
Courtesy of CDP

Scott SCBA
Courtesy of CDP

FEMA

5

Notes:

Self-Contained Breathing Apparatus

National Fire Protection Association® (*NFPA*®) *472,* 7.4.2 Using Protective Clothing and Respiratory Protection states that the responder will "Demonstrate the ability to don, work in, and doff self-contained breathing apparatus in addition to any other respiratory protection provided by the AHJ" (National Fire Protection Association [NFPA], 2007a, p. 472-33; 2008 edition).

An SCBA may be open-circuit or closed-circuit. Open-circuit means that as air is exhaled, it is expelled into the environment in which the user is working. This means that when wearing a personal protective equipment (PPE) Level A ensemble, some air is contained within the suit, which allows a small emergency air supply in the event of running out of air or SCBA failure.

Open-circuit SCBA can be purchased with air cylinders having 30-minute, 45-minute, or 60-minute duration times. For all practical purposes, hazardous materials (HAZMAT) responders use the 60-minute duration cylinders while wearing PPE Level A ensembles to facilitate entry, exit, and decontamination operations (Noll, Hildebrand, & Yvorra, 2005).

Open-circuit SCBA manufacturers must follow the requirements of *NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services* (NFPA, 2007b). One of the major provisions of this standard requires all SCBAs manufactured to receive the National Institute for Occupational Safety and Health (NIOSH) chemical, biological, radiological, and nuclear (CBRN) approval in order to comply with the standard (Noll et al., 2005).

Closed-circuit SCBA is commonly referred to as "re-breather" units. When the user exhales, the air is recirculated within the system and not expelled into the atmosphere. The backpack harness contains an alkaline scrubber that removes the carbon dioxide and an oxygen cylinder that mixes fresh oxygen into the exhaled air to maintain the appropriate level of breathable air. This allows the user to work for an extended time period, usually 4 hours or longer.

Closed-circuit SCBA is not typically used with chemical vapor-protective ensembles. Heat is generated by the action of the system that will be retained inside the suit (Noll et al., 2005). This can greatly increase the amount of stress on those wearing the ensemble. Closed-circuit SCBA used at a HAZMAT incident must also have received NIOSH CBRN approval.

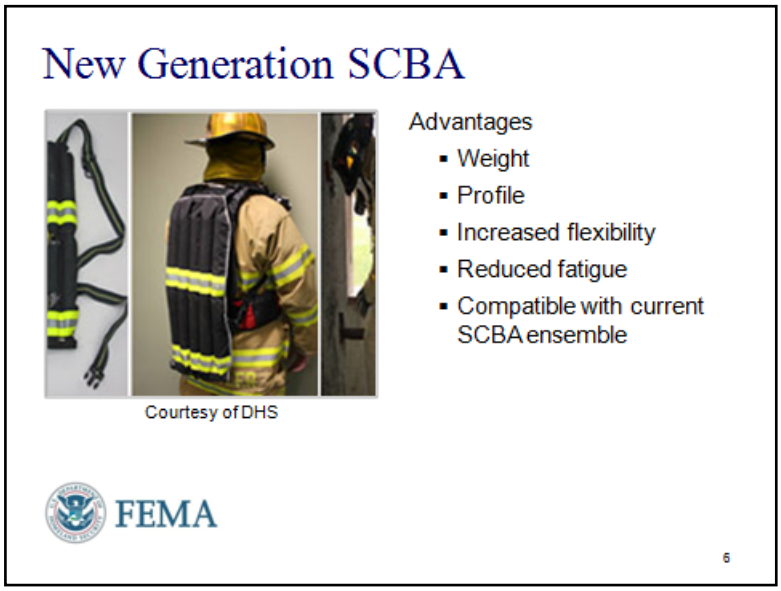
The air cylinders worn as part of the SCBA contain a limited supply of breathable air and must be resupplied. These PPE ensembles offer no easy method for exchanging air cylinders, and responders wearing the equipment must be decontaminated before the protective suits are opened to facilitate air-cylinder exchange. Any malfunction of the SCBA can lead to a critical air

Notes:

shortage due to the small amount of residual air in the suit. The arrangement is also heavier than other configurations, causing earlier exhaustion of the users (Noll et al., 2005).

Several SCBA manufacturers offer a kit that will allow the SCBA facepiece to be converted into an air-purifying respirator (APR). This configuration was developed to allow firefighters to remove the extra weight of the SCBA cylinder and the harness while performing operations in an environment where respiratory protection is still required for particulates and some vapors but does not constitute an Immediately Dangerous to Life and Health (IDLH) atmosphere. Currently, none of these converted facepiece configurations have received NIOSH CBRN approval. This means that any time an incident commander determines that respiratory protection can be downgraded to the APR level during an incident involving chemical, biological, radiological, nuclear, and explosive (CBRNE) materials, only NIOSH CBRN-approved APRs may be worn (Noll et al., 2005).

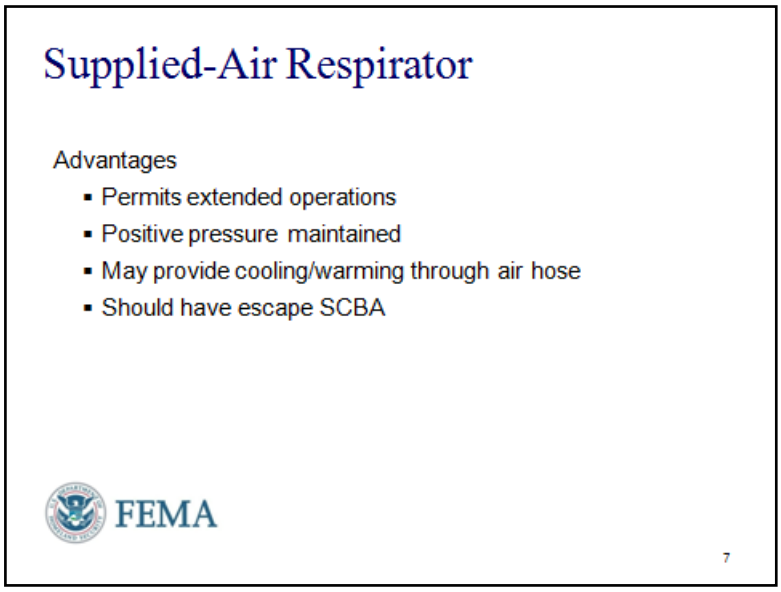
NOTE: Keep in mind that there are several manufacturers of SCBA, and each has its own donning and doffing procedures. Follow the appropriate manufacturer's donning and doffing procedures whenever using SCBA. Also, follow the manufacturer's maintenance, service, and care requirements to maintain the units in good condition and working order.



Notes:

New Generation SCBA

SCBAs are not known for their light and easy functionality. The U.S. Department of Homeland Security's (DHS) Science and Technology Directorate (2010) issued contracts to create a new and lighter SCBA. The International Association of Fire Fighters and other agencies developed the Cylinder. The Cylinder Array is a lighter, more compact system that "will allow first responders more mobility and less fatigue while responding to emergencies, as well as increasing accessibility to confined spaces" (DHS, TechSolutions, n.d.). An additional advantage is that it is compatible with current SCBA ensembles.



Supplied-Air Respirator

Instead of having an enclosed, vapor-proof protective suit with the SCBA equipment enclosed within the suit, the SAR method uses an attached hose that supplies clean, uncontaminated air to the user. This ensemble may be recognized from the lack of the "humpback" that identifies the presence of SCBA. Instead, the arrangement can be distinguished by the presence of an air-supply hose attached to the suit.

Notes:

Supplied-Air Respirator (continued)

Disadvantages

- Maximum air hose length (300 feet) limits the area of operation
- Hose may become tangled or create tripping hazard
- Hose must be compatible to chemicals encountered

FEMA

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Supplied-Air Respirator (continued)

Disadvantages (continued)

- Hose must be strong yet flexible
- Use in a deadly atmosphere requires secondary air supply
- Requires personnel to monitor the air-supply source

FEMA

9

Notes:

Noll, Hildebrand, and Yvorra (2005) provide components of the SAR:

- Source of uncontaminated air
- Air-line hose
- Positive-pressure respirator
- Emergency air supply

There are advantages to using the SAR:

- PPE Level A with an SAR may be used when extended working times are required, such as for decontamination operations or cleanup. In the SAR system, air is supplied through an air-line from a remote source, typically an SCBA cylinder cascade and manifold system. This extends the amount of time personnel can operate. The cascade system typically has two to four SCBA air cylinders connected to the manifold. In a laboratory setting, air is usually supplied from a prepiped air-line system connected to an air reservoir or compressor system.
- The protective suits maintain a positive pressure at all times.
- The user may be cooled by pumping cooled air through the hose to prevent overheating. This process allows for longer periods of work in warm conditions. The user may also choose to wear another type of cooling device inside the suit as well. Warmed air may be pumped through the hose to warm the responder in cold conditions.
- Personnel wearing an SAR should use an escape SCBA to provide for continued air supply in emergencies.

There are also disadvantages to using the SAR:

- Maximum air hose length (300 feet) limits the area of operation of the responder wearing PPE relying on hose-delivered air.
- The hose presents a trip hazard or may become tangled, thereby reducing the user's area of maneuverability.
- The air-supply hose must be designed to operate in a chemically contaminated environment, just as the chemical-resistant clothing is.
- It must be strong enough to resist mechanical damage yet be flexible enough to allow the responder to move about.

Notes:

- Use of air lines in a deadly atmosphere requires the use of a secondary air supply such as an escape pack used in the event of failure or contamination of the air line.
- Use of an air line also requires personnel to monitor the air-supply source.

The SAR Level A configuration ensemble is rarely used during emergency response operations because of these limitations. It is more often used in a laboratory or industrial setting, where personnel are working in an area containing hazardous materials or CBRNE, and extended working times are required (Noll et al., 2005).

✔ **Knowledge Check:**

- What are the two types of atmosphere-supplying respirators according to § 1910.134(b)?
- What are some advantages and disadvantages of each type?

Enabling Learning Objective 12-2: Identify the components of an SCBA according to manufacturer's guidelines.

SCBA Components

There are several components vital to an SCBA. The following are component names and descriptions, and some are derived from the *Scott® Air Pak® Operating and Maintenance Instructions*:

- Facepiece—Incorporates the nosecup, two inhalation valves, and dual voicemitter assemblies
- Regulator—Removable pressure-demand breathing regulator mounts directly to the facepiece
- Air saver switch—Located on the regulator that prevents the rapid loss of air supply when the cylinder valve is opened
- Purge knob—In an emergency, it allows air to flow into the facepiece without breathing on the respirator

Notes:

SCBA Components

Courtesy of CDP

- Facepiece
- Regulator
- Air Saver Switch
- Purge Knob
- Remote Pressure Gauge
- Pressure Reducer
- Frame Back
- Regulator Holder
- Cylinder and Valve Assembly
- Tri-Slide Buckle
- Cylinder Latch

FEMA

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- Remote pressure gauge—Will provide the amount of air in the cylinder, remotely from the cylinder gauge
- Pressure reducer—Takes pressure from the cylinder from 4,500 psi to 4 psi
- Frame back—Aluminum frame to support cylinder and harness assembly
- Regulator holder—Device mounted on waist strap to secure regulator when not in use
- Cylinder and valve assembly—Breathing air cylinder, 4,500 psi with pressure gauge
- Tri-slide buckle—Adjustable strap to secure cylinder
- Cylinder latch—Two-step latch device to secure cylinder to harness bracket (Scott Health & Safety, 2005).

✔ Knowledge Check:

- The instructor will show a few components of the SCBA. Participants should name these components.

Notes:

Enabling Learning Objective 12-3: Demonstrate SCBA operational inspection procedures according to manufacturer's guidelines.

NOTE: The procedures listed are for the Scott Air-Pak system used in this hands-on training module. Procedures for other systems could vary. Check manufacturer's instructions for system checks and operation for the type of system used in each jurisdiction.

SCBA Inspection Procedures

1. Inspect for worn rubber parts that could show cracking, splitting, or brittleness.
2. Inspect for worn harness webbing.
3. Inspect the gasket on the breathing regulator for damage that could possibly break the seal.
4. The facepiece must be complete and in good functioning condition with no worn, loose, or damaged parts. The following should be completed to ensure that the facepiece is suitable for use:
   a. Inspect the facepiece seal and other rubber components for cracks and deformation.
   b. Inspect the lens for cracks and scratches that could visually impair the user.
   c. Inspect the lens frame for cracks.
   d. Check that all lens frame retainers are accounted for and installed correctly.
   e. Check that all harness anchors present pivot freely.
   f. Inspect the head harness for correct installation and that all of the straps are oriented correctly.
   g. Inspect the head harness for damaged parts.
   h. Inspect the nosecup.
5. If any damage is reported, remove the respirator from service and ensure that it is repaired by authorized personnel (Scott Health & Safety, 2005).

Notes:

Operational Checks on SCBA

Due to the critical functions of the SCBA, perform a complete and thorough operational check before each use.

These checks should be made in the following order:

- After the case is opened, check gauges on the air cylinder and harness assembly.
- The gauges should read the same pressure level and be close to the full mark; if they are not, do not use the cylinder or harness assembly, but request another.
- Check the red bypass knob on the regulator. Turning the knob clockwise closes the valve. Find the tent-shaped, rubber-covered protrusion (i.e., switch) by looking at the opening of the regulator with the red knob to the left. Press the switch down. This switch, when pressed down, resets the regulator to the closed mode. When this switch is open, the regulator is in the positive-pressure mode, and air will flow through the regulator.
- The latch on the regulator directly across from the red knob is the locking latch that locks the regulator to the facepiece. This slides away from the face to unlock; if the latch does not automatically spring back into the locked position, do not use the harness assembly, and request another.
- Open the air cylinder by turning the knob on the air cylinder in a counterclockwise direction.
- As air flows, the Vibralert (i.e., low air-pressure alarm) should sound, then stop.
- If the Vibralert alarm does not sound or the gauges do not agree, do not use the SCBA.

Enabling Learning Objective 12-4: Demonstrate SCBA donning and doffing procedures according to manufacturer's guidelines.

Donning the SCBA

Lift the SCBA from the case, using the over-the-head or over-the-shoulder method. Bend forward at the waist and place the SCBA so that its weight evenly balances on the shoulders. Evenly distribute the weight of the SCBA between the shoulders and the hips. Reach forward and grasp the underarm straps. Pull the underarm or shoulder straps to the back and down while straightening to the upright position. Fasten the waist strap and tighten.

Notes:

Doffing the SCBA

The following steps provide the basic steps for doffing the SCBA.

1. Move the latch on the right of the regulator forward (i.e., away from the face) and turn the regulator to the right so that the red knob is on top.
2. When removing the regulator, depress the positive-pressure switch and pull the regulator from the facepiece.
3. Remove the facepiece and place it in the case.
4. Remove the SCBA and place it in the case.

It is important to follow the manufacturer's doffing procedures because they may differ from manufacturer to manufacturer.

Enabling Learning Objective 12-5: Demonstrate SCBA cylinder replacement procedures according to manufacturer's guidelines.

Cylinder Replacement Procedure

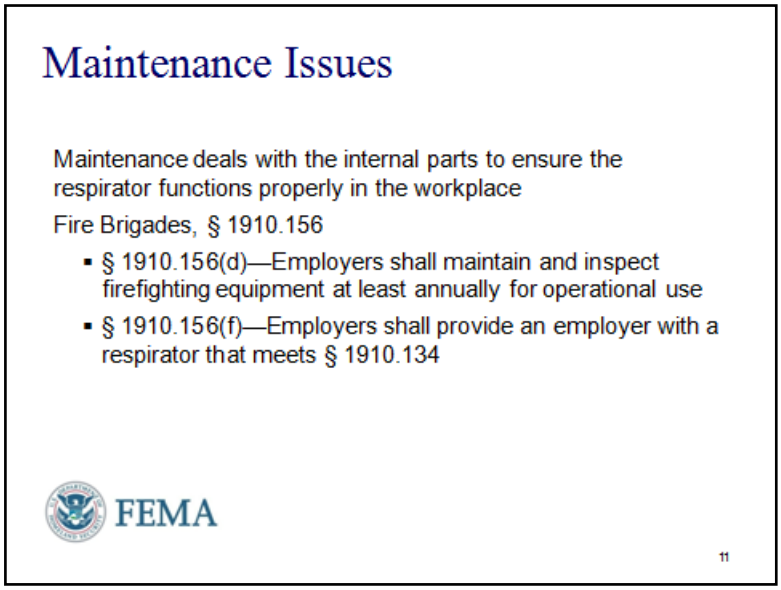
Cylinders that are depleted and partially depleted must be replaced with full cylinders. It is important to use only the cylinders that have the correct rated pressure for the respirator. The following steps can be used to replace a cylinder:

1. Leave the area that requires respiratory protection.
2. Doff the facepiece.
3. Completely close the cylinder valve.
4. Slightly open the purge valve to release residual air pressure. When the air flow from the facepiece has stopped, close the purge valve.
5. Unthread the pressure reduce hose by rotating it counterclockwise.
6. Disengage the cylinder latch.
7. Grasp the cylinder below the retention strap, push the locking tab below the cylinder, and lift the cylinder from the bottom hook to remove.

Notes:

8. Replace with a fully charged cylinder-and-valve assembly that is compatible with the respirator (same rating pressure).
9. Connect the cylinder hanger in the hook at the bottom of the backframe.
10. Secure the cylinder in place by locking the cylinder latch. Fully engage the cylinder latch assembly.
11. Inspect the high-pressure coupling and ensure that the gasket seal is present and undamaged.
12. The respirator is ready for use.
13. The removed cylinder will be checked and filled by authorized personnel.

Enabling Learning Objective 12-6: Discuss maintenance issues for atmosphere-supplying respirators according to Fire Brigades, § 1910.156.



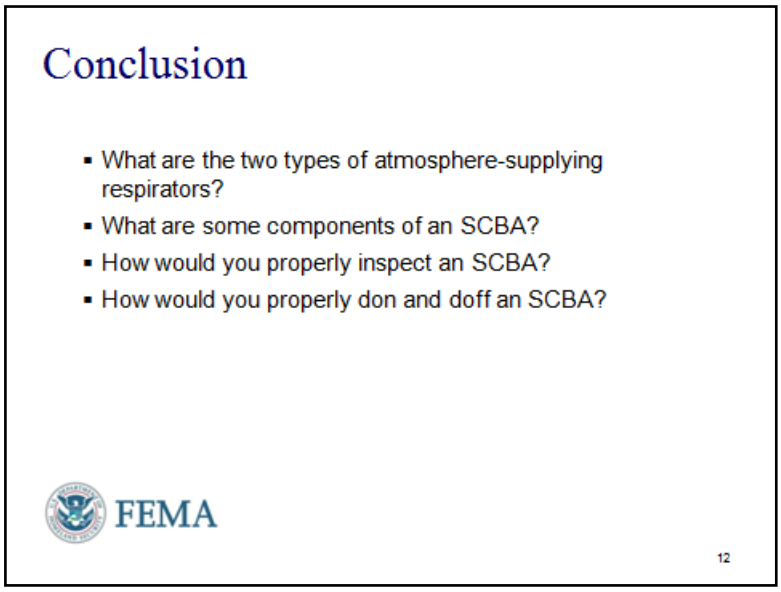
Notes:

Maintenance Issues

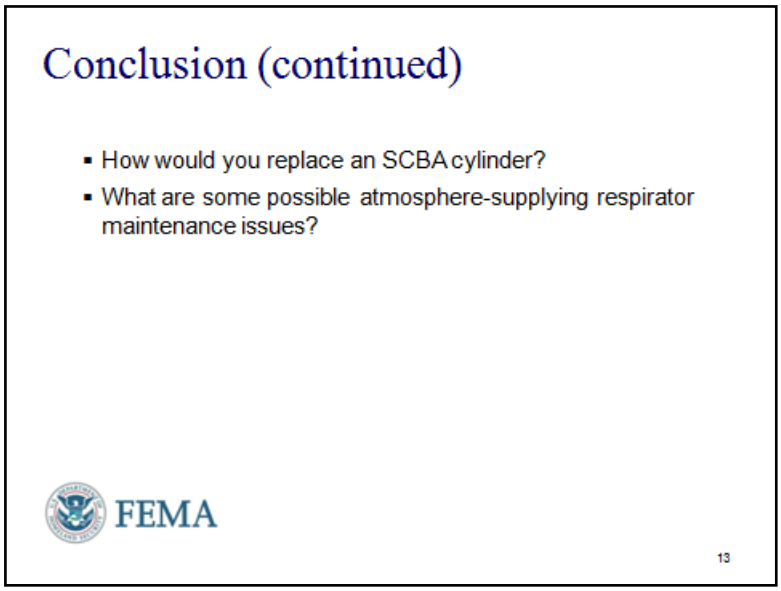
Equipment maintenance is different than equipment inspection because it deals with the internal working of parts. Maintenance ensures that the equipment will properly function in the workplace. Section 1910.156(d) (2013) deals with fire brigades and their equipment, and states

> The employer shall maintain and inspect, at least annually, firefighting equipment to assure the safe operational condition of the equipment. Portable fire extinguishers and respirators shall be inspected at least monthly. Firefighting equipment that is in damaged or unserviceable condition shall be removed from service and replaced.

Section 1910.156(f) (2013) specifically talks about respiratory protection devices for fire brigades. The employer shall provide each employee who is required to use a respirator with a respirator that meets § 1910.134 (2013) standard.



Notes:



Conclusion

SCBAs and SARs are two types of respiratory protection that an employer can provide to its employees, if necessary. SCBAs can be open- or closed-circuit, heavy, and contain only a certain amount of air. SARs are lighter; however, they have limited functionality due to the length of the hose.

There are specific steps for inspecting, donning and doffing, and replacing cylinders for an SCBA. This course utilized the *Scott Air-Pak Operating and Maintenance Instructions*; however, each manufacturer may have different procedures. It is important to follow the manufacturer's instructions. Another important aspect is to understand and identify potential maintenance issues for atmosphere-supplying respirators. The most important factor is, if there is an issue, remove the respirator and have it fixed by authorized personnel.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Fire Brigades, 29 C.F.R. § 1910.156 (2013).

National Fire Protection Association. (2007a). *NFPA 472, Standard for competence of responders to hazardous materials/weapons of mass destruction incidents* (2008 ed.). Quincy, MA: Author.

National Fire Protection Association. (2007b*). NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus* (*SCBA*) *for Emergency Services* (2007 ed.). Quincy, MA: Author.

Noll, G. G., Hildebrand, M. S., & Yvorra, J.G. (2005)*. Hazardous materials: Managing the incident* (3rd ed.). Chester, MD: Red Hat Publishing Co.

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

Scott Health & Safety. (2005). *Scott Air-Pak Models 2.2/3.0/4.5/Fifty, pressure demand, self-contained breathing apparatus (SCBA), NFPA-1981 (2002 ed.) compliant. Operating & Maintenance Instructions*. Monroe, TN: Author.

U.S. Department of Homeland Security, Science and Technology Directorate. (2010, February). *Cylinder array for self-contained breathing apparatus (SCBA)*.

U.S. Department of Homeland Security, TechSolutions. (n.d.). *Next generation breathing apparatus*. Retrieved from https://www.techsolutions.dhs.gov/Pages/QuadChart.aspx?MPID=1

Administrative Aspects of a Respiratory Protection Program

Duration: 1.50 Hours

Summary: Participants take part in a study of the administrative policy requirements that an employer must follow when developing a respiratory protection program. The administrative policy requirements should be clear and concise for employees' comprehension and for use during a chemical, biological, radiological, nuclear, and explosive (CBRNE) incident. During this module, the requirement of a respiratory protection plan is reviewed from Module 5, "Respiratory Protection." Participants identify certified equipment and record-keeping requirements, along with defining training requirements and naming respiratory protection program evaluation requirements. Participants use the *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*], which is a separate document provided to participants, as Respiratory Protection, 29 *Code of Federal Regulations* (C.F.R.) § 1910.134(j–o) (2013) is reviewed.

Terminal Learning Objective: At the conclusion of this module, participants will be able to identify administrative components required for employers to establish a respiratory protection program in accordance with § 1910.134(c).

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

13-1 Identify National Institute for Occupational Safety and Health (NIOSH)-approved canisters used by emergency responders under § 1910.134(j).

13-2 Define training requirements under § 1910.134(k) pertaining to the use of respirators.

13-3 Name respiratory protection program evaluation requirements under § 1910.134(l).

13-4 Identify respiratory protection program record-keeping requirements under § 1910.134(m) and Access to Employee Exposure and Medical Records, § 1910.1020(d).

13-5 Identify the effective date and the compliance of appendices with § 1910.134(n–o).

Practical Exercise: Participants take part in small-group discussions and instructor-facilitated collaborative knowledge checks throughout the module. Individually, participants answer multiple-choice questions pertaining to § 1910.134 for review. Approximate time for the multiple-choice activity is 15 minutes, which includes time for the instructor to review the answers with participants. In an additional activity, a variety of canisters is placed on a table, and participants identify the canisters as being NIOSH-approved, chemical, biological, radiological, and nuclear (CBRN)-approved, and/or having an expiration date. Approximate time for the canister identification activity is 15 minutes, which includes time for the instructor to review the answers with participants.

Risk Assessment: Low

Methods of Instruction: Instructors use a facilitated lecture format supported by presentation visuals. Reflective questioning challenges participants' critical thinking skills and reinforces module content. Participants take part in instructor-guided and collaborative knowledge checks throughout the module in which participants define training requirements and

name respiratory protection program evaluation requirements. In the small-group discussion, participants identify how their departments or jurisdictions apply § 1910.134(j–o). Individually, participants take part in a multiple-choice activity that pertains to § 1910.134. Participants also participate in a canister identification activity.

Instructor-to-Participant Ratio: 1:30 for lecture; 1:5 for small-group discussions

Required Reading: *Reference Manual*

Evaluation Strategies: Instructors informally assess participants' comprehension of key material using instructor-guided and collaborative knowledge checks throughout the module. Based upon the outcomes of these knowledge checks, instructors review any necessary material to ensure participant comprehension of key points. Additionally, instructors assess participants through participation in small-group discussions as well as the presentation of key points from their groups' discussions. Participants complete a multiple-choice activity to evaluate their knowledge of § 1910.134 as well as a hands-on activity that demonstrates their ability to interpret the NIOSH canister labeling system by identifying a variety of NIOSH-approved canisters. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content and any additional participant questions.

Special Instructions: During this module, § 1910.134(j–o) is reviewed using the *Reference Manual*.

Objectives

- Identify National Institute for Occupational Safety and Health (NIOSH)-approved canisters used by emergency responders
- Define training requirements under Respiratory Protection, 29 C.F.R. § 1910.134(k) pertaining to the use of respirators
- Name respiratory protection program evaluation requirements

FEMA

1

Objectives (continued)

- Identify respiratory protection program record-keeping requirements
- Identify the effective date and the compliance of appendices

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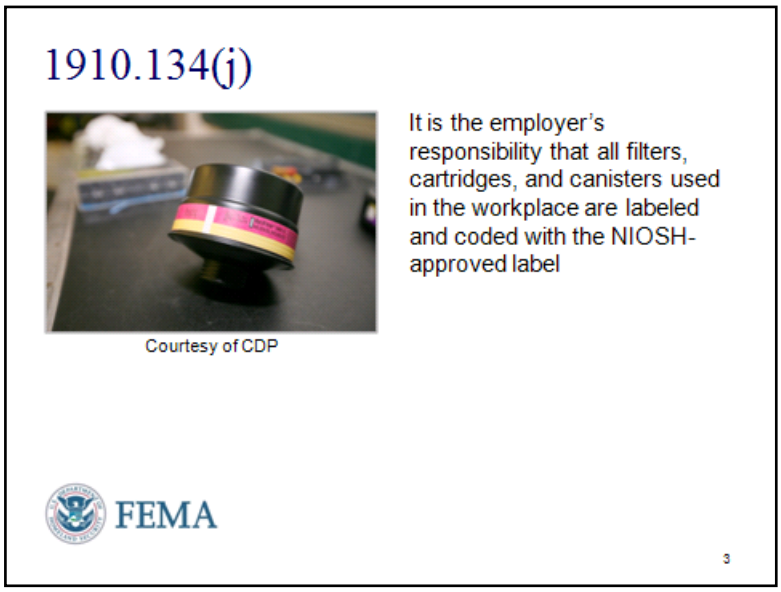
2

Notes:

Enabling Learning Objective 13-1: Identify NIOSH-approved canisters used by emergency responders under § 1910.134(j)



1910.134(j)

Section 1910.134(j) addresses the identification of filters, cartridges, and canisters. It is the employer's responsibility that all filters, cartridges, and canisters used in the workplace are labeled and coded with the NIOSH-approved label. The label is not to be removed and must remain legible.

Key Point:

All cartridges/canisters are assigned a color designating the type of contaminant they filter.

Notes:

The following visual contains a list of contaminants and the color coding for that contaminant.

Contaminant	Color Coding on Cartridge/Canister
Acid gases	White
Hydrocyanic acid gas	White with ½-inch green stripe completely around the canister near the bottom
Chlorine gas	White with ½-inch yellow stripe completely around the canister near the bottom
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with ½-inch white stripe completely around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow with ½-inch blue stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive materials, except tritium and noble gases	Purple (magenta)
Pesticides	Organic vapor canister plus a particulate filter
Multicontaminant and CBRN agent	Olive
Any particulates—P100	Purple
Any particulates—P95, P99, R95, R99, R100	Orange
Any particulates free of oil—N95, N99, or N100	Teal

Cartridge/Canister Color Codes (OSHA Bulletin, n.d.)

Notes:

Enabling Learning Objective 13-2: Define training requirements under § 1910.134(k) pertaining to the use of respirators.

Training and Information

Courtesy of CDP

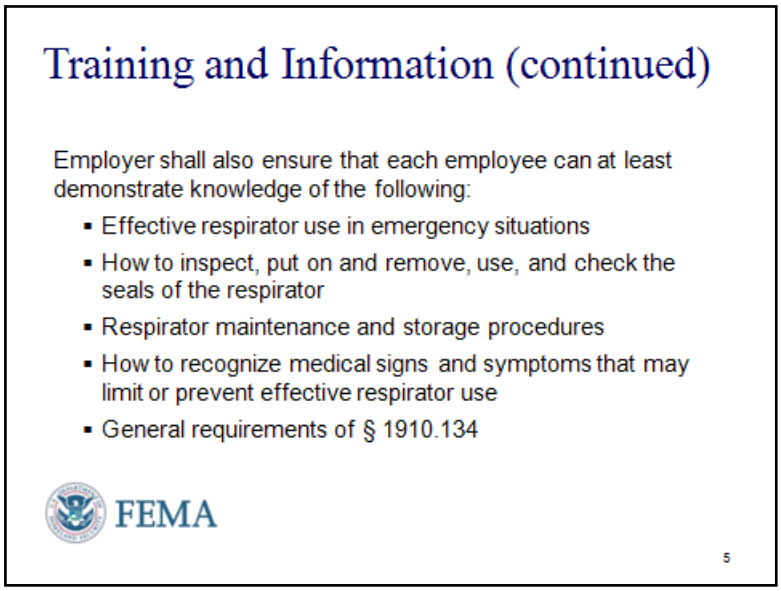
§ 1910.134(k)(1) Training and Information—Employer shall ensure that each employee can at least demonstrate knowledge of the following:

- Why the respirator is necessary
- How improper fit, usage, or maintenance can compromise the respirator's protection
- What the respirator's limitations and capabilities are

FEMA

4

Notes:



Training and Information

In order to safely use respirators in the workplace, employees need proper training on the hazards they may face as well as on the correct use and maintenance of respirators. Section 1910.134(k) states, “This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often, if necessary” (2010). The employer is required, under this paragraph, to provide the basic information on respirators in (Mandatory) Information for Employees Using Respirators When not Required Under Standard, Appendix D to § 1910.134 (2013) to employees who wear respirators when not required by this section or by the employer to do so.

Section 1910.134(k)(1), states that the employer is to ensure that each employee can demonstrate at a minimum the following:

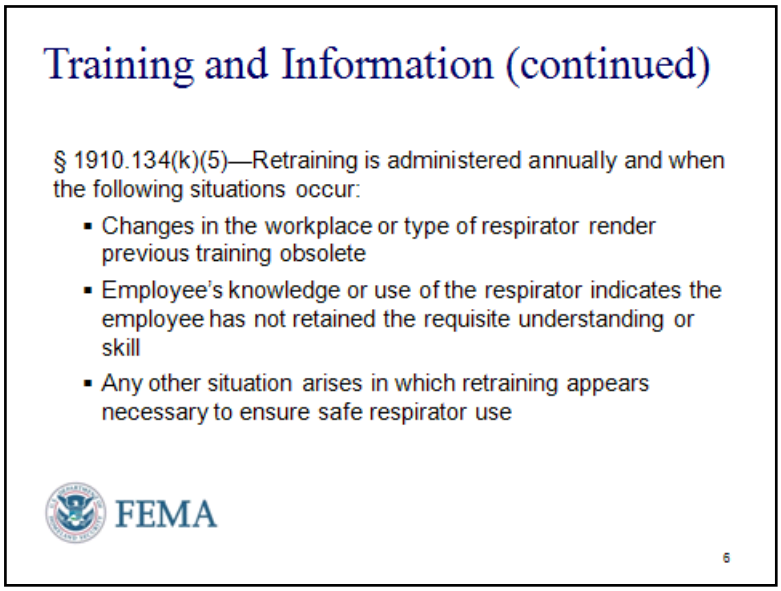
- Why the respirator is necessary
- How improper fit, usage, or maintenance can compromise the protective effect of the respirator

Notes:

- The limitations and capabilities of the respirator
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions
- How to inspect, put on and remove, use, and check the seals of the respirator
- The procedures for maintenance and storage of the respirator
- How to recognize medical signs and symptoms that may limit or prevent the effective use of the respirators
- The general requirements of § 1910.134 (2013)

The required training is to be conducted in a manner that is understandable to the employee and must take place before the employee uses a respirator in the workplace. According to § 1910.134(k)(4), if an employer can demonstrate that a new employee has received the training addressed in paragraph § 1910.134(k)(1)(i-iv) within the previous 12 months and is able to demonstrate knowledge of those elements, then the employee does not need to repeat the training. Additionally, “previous training not repeated initially by the employer must be provided no less than 12 months from the date of the previous training” (Respiratory Protection, 29 C.F.R. § 1910.134[k][4], 2013).

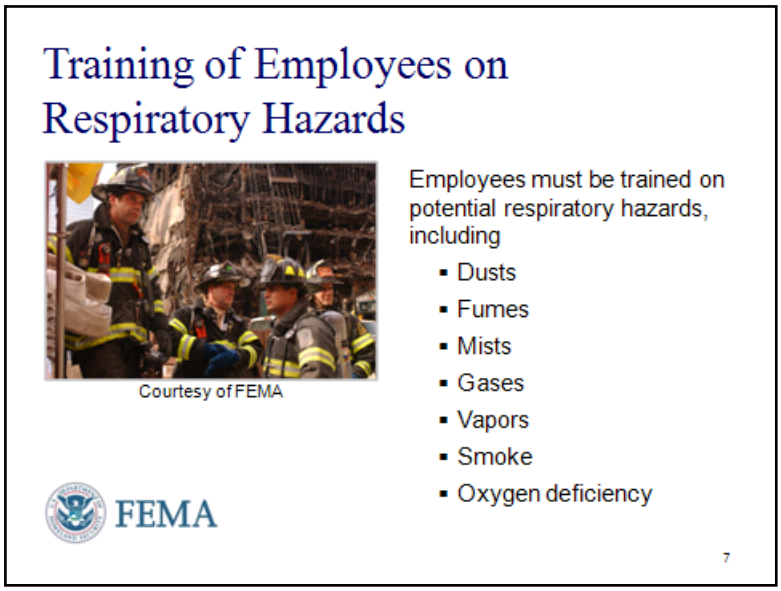
Notes:



According to § 1910.134(k)(5), retraining is administered annually. Section 1910.134(k)(5)(i-iii) are concerned with retraining employees in respiratory protection; these paragraphs provide some additional instances in which retraining is necessary. These instances include the following:

- Changes in the workplace or respirator type render previous training obsolete
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill
- Any other situation arises in which retraining appears necessary to ensure safe respirator use (Respiratory Protection, 29 C.F.R. § 1910.134, 2013)

Notes:



Training of Employees on Respiratory Hazards

As part of the nine components of a written respiratory protection plan in § 1910.134(c)(1)(vii), employees must be trained on the "respiratory hazards to which they are potentially exposed during routine and emergency situations" (2013). These potential hazards may be environmental or even presented by respirator use itself. The hazards are complicated further due to the variety of respirators, the conditions in which they may be used, and individual physiological and psychological differences.

Airborne hazards may result from either an oxygen-deficient atmosphere or breathing air contaminated with toxic particles, vapors, gases, fumes, or mists. According to the *OSHA Technical Manual* (*OTM*; U.S. Occupational Safety and Health Administration [OSHA], 2008), these hazards are generally divided into the following basic categories:

- Dusts—Dusts are particles that are formed or generated from solid organic or inorganic materials by reducing their size through mechanical processes such as crushing, grinding, drilling, abrading, or blasting.
- Fumes—Fumes are particles that are formed when a volatized solid, such as metal, condenses in cool air. This physical change is often accompanied by a chemical reaction

Notes:

such as oxidation. Examples are lead oxide fumes from smelting and iron oxide fumes from arc-welding. A fume can also be formed when a material such as magnesium metal is burned or when welding or gas cutting is done on galvanized metal.

- Mists—Mists are formed when a finely divided liquid is suspended in air. These suspended liquid droplets can be generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing. Examples are oil mist produced during cutting and grinding operations, acid mists from electroplating, acid or alkali mists from pickling operations, paint spray mists from spraying operations, and the condensation of water vapor to form a fog or rain.
- Gases—Gases are formless fluids that occupy a space or enclosure and that can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature. Examples are welding gases (i.e., acetylene, nitrogen, helium, argon, and carbon monoxide) generated from the operation of internal combustion engines. Another example is hydrogen sulfide, which is formed wherever there is decomposition of materials containing sulfur under reducing conditions.
- Vapors—Vapors are the gaseous form of substances that are normally in the solid or liquid state at room temperature and pressure. They are formed by evaporation from a liquid or solid and can be found where parts cleaning and painting takes place and where solvents are used.
- Smoke—Smoke consists of carbon or soot particles resulting from the incomplete combustion of carbonaceous materials such as coal or oil. Smoke generally contains droplets as well as dry particles.
- Oxygen deficiency—An oxygen-deficient atmosphere has oxygen content below 19.5% by volume. Oxygen deficiency may occur in confined spaces, which include, but are not limited to, storage tanks, process vessels, towers, drums, tank cars, bins, sewers, septic tanks, underground utility tunnels, manholes, and pits.

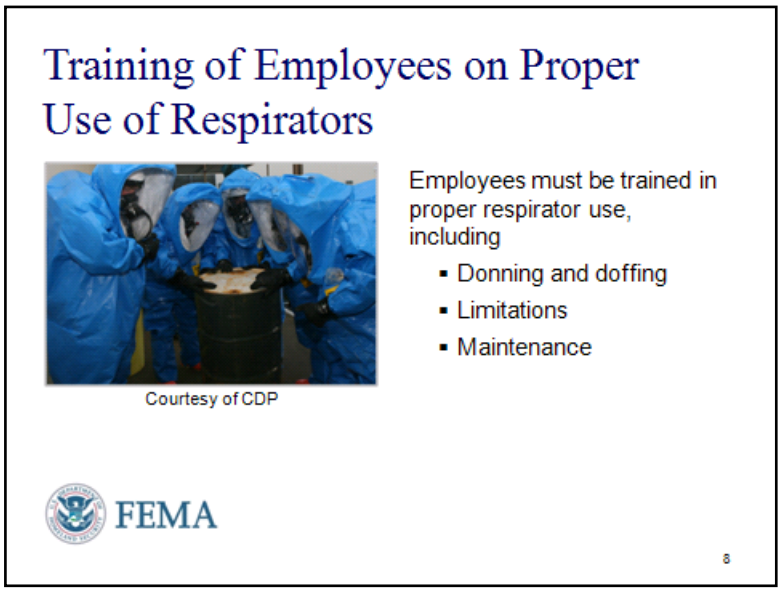
Medical aspects of wearing respirators may also cause hazards. Some medical aspects, according to the Occupational Safety and Health Administration (OSHA; 2008) to be aware of include the following:

- Cardiac stress due to the weight of the respirator—For example, a self-contained breathing apparatus (SCBA) may use compressed-air cylinders, which could weigh up to 35 pounds. Often those who use an SCBA may also need protective clothing, which may

Notes:

weigh an additional 10–25 pounds. Further cardiac stress may also result from increased body temperature due to the extra weight and the confinement of personal protective equipment (PPE).

- Senses diminished—A decrease in visual fields, voice clarity and loudness, and hearing ability may be affected by the respirator. The diminished senses may lead to reduced safety as well as a feeling of stress for the wearer.
- Minor irritation—Skin reactions may occur from wearing the respirator. Facial discomfort and headaches due to the pressure of the facepiece may also occur, especially if the fit is incorrect.



Training of Employees on Proper Use of Respirators

The Respiratory Protection Program Template, Section 8, contains information pertaining to training employees in the proper use of respirators, including putting on and removing them, limitations in their use, and their maintenance.

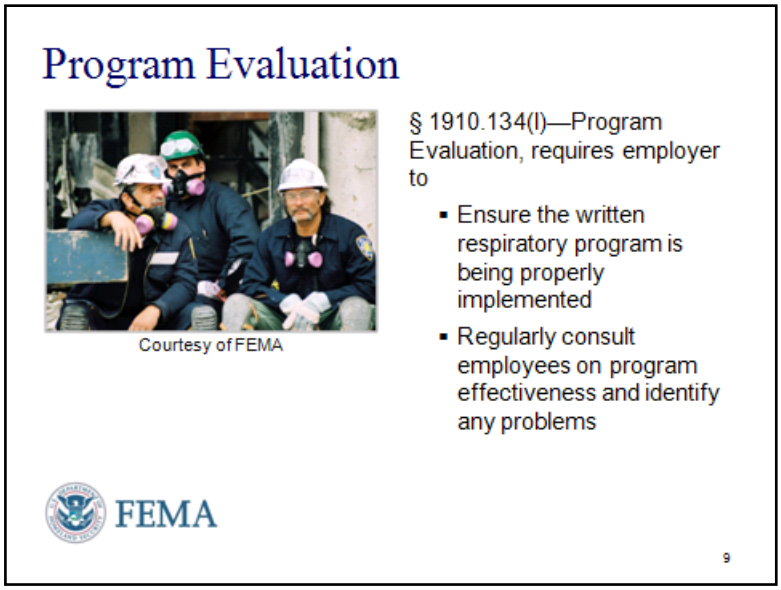
Cross-referencing Section 8 of the Respiratory Protection Program Template (on training) with Section 4 (on respirator use) provides a clearer understanding of the concept.

Notes:

Knowledge Check:

- Provide examples of when retraining appears necessary.
- When is the employer not required to train a new employee?

Enabling Learning Objective 13-3: Name respiratory protection program evaluation requirements under § 1910.134(l).



Program Evaluation

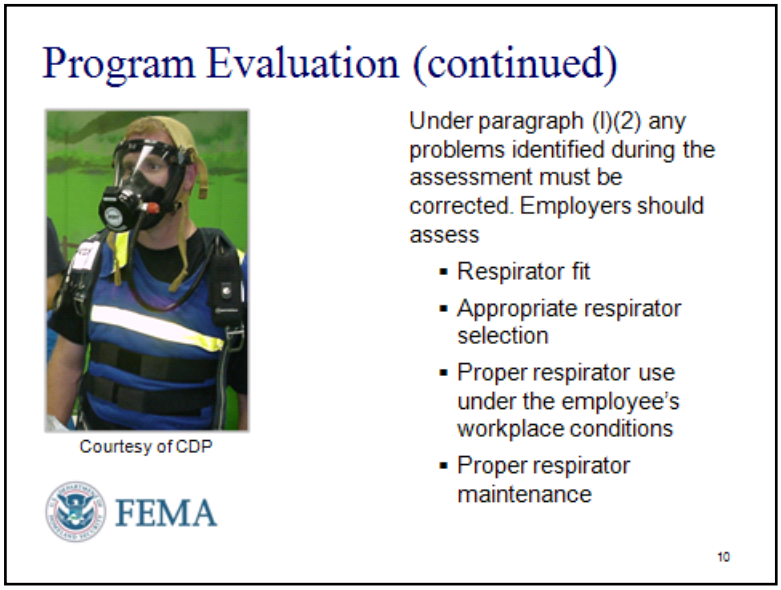
Key Point:

Section 1910.134(l) "requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult with employees to ensure that they are using the respirators properly" (Respiratory Protection, 29 C.F.R. § 1910.134, 2013).

Notes:

When performing the required evaluations, employers must ensure not only correct implementation but also a continuously effective program. Some evaluation methods include sampling data from jobs involving respiratory protection, observations by occupational safety and health professionals, walk-throughs, an annual informal audit and quality assurance audits, and regular building audits (OH Editorial Staff, 1999).

As part of the evaluation, the employer should regularly consult with employees who are required to use respirators. This allows the employer to assess the employees' views on program effectiveness and to identify any problems. Some of the most useful knowledge comes from information received in roundtable meetings with employees, time spent in the workplace, and e-mails and phone calls with questions about the program. It is important to consult with workers on all shifts because atmospheric conditions, temperatures, or the amount of work may vary depending on the time of day (OH Editorial Staff, 1999).



Under § 1910.134(l)(2), any problems that are identified during the assessment must be corrected. Factors to be assessed include but are not limited to the following:

- Appropriate respirator fit
- Appropriate respirator selection for the hazards to which the employee is exposed

Notes:

- Proper respirator use under the workplace conditions the employee encounters
- Proper respirator maintenance (Respiratory Protection, 29 C.F.R. § 1910.134, 2013)

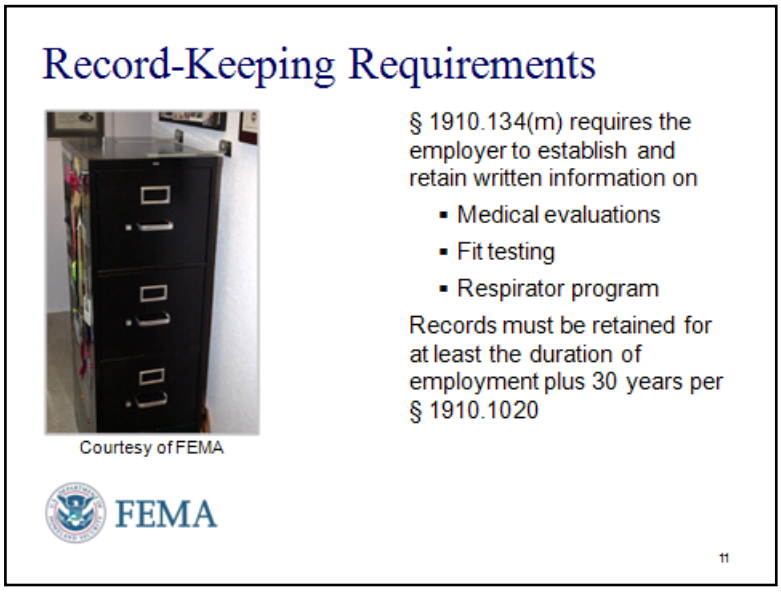
The respiratory protection program should be evaluated at least annually for each job and/or position, and the program adjusted to reflect the evaluation results.

Notes:

Knowledge Check:

What are the minimum factors to be addressed in the program evaluation requirements? Why are these factors important? What are some other factors that could be addressed?

Enabling Learning Objective 13-4: Identify respiratory protection program record-keeping requirements under § 1910.134(m) and Access to Employee Exposure and Medical Records, § 1910.1020(d).



Record-Keeping Requirements

Section 1910.134(m) addresses record keeping, “requiring the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program” (2013).

Notes:

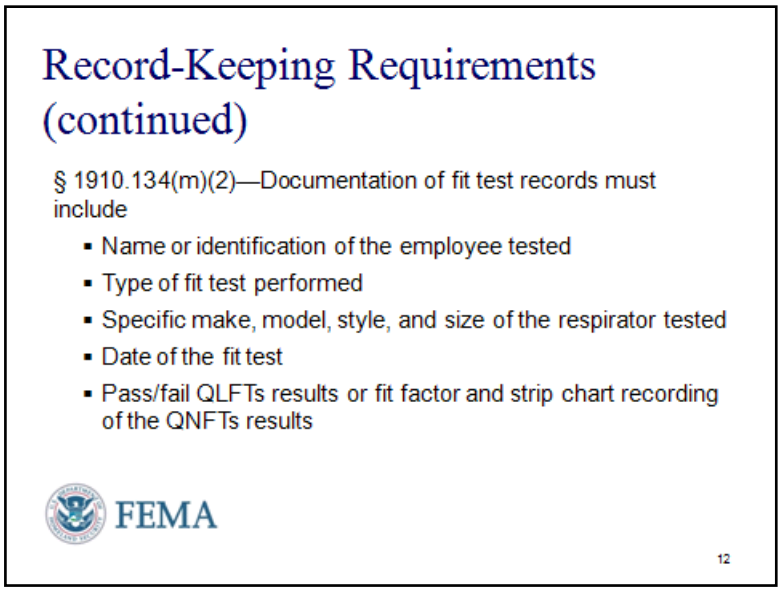
Key Point:

Section 1910.134(m)(1) directs that records of medical evaluations required by this standard be retained and made available in accordance with § 1910.1020.

Section 1910.1020(d)(1)(i) states,

> The medical record for each employee shall be preserved and maintained for at least the duration of employment plus thirty (30) years, except that the following types of records need not be retained for any specified period. (Access to Employee Exposure and Medical Records, 29 C.F.R. § 1910.1020, 2013)

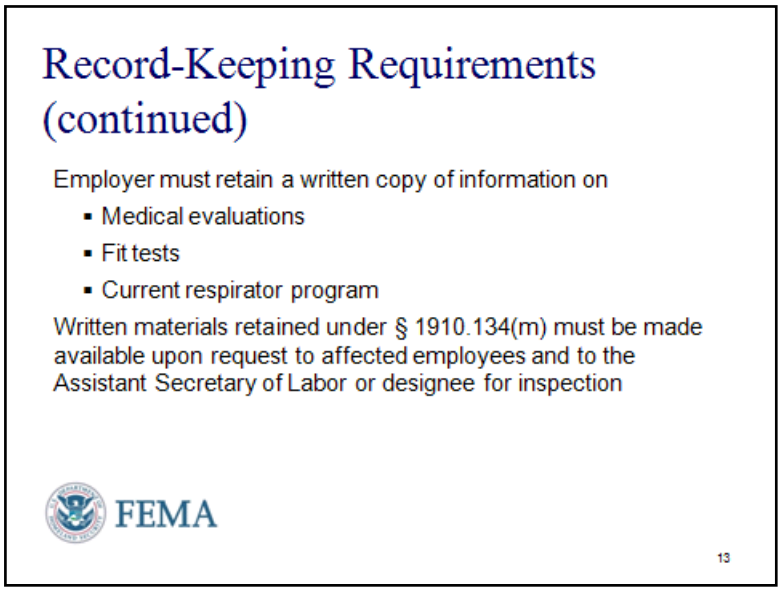
Health insurance claims, first aid records, and medical records of employees do not have to be retained for any specified period of time. However, employee exposure records must be kept for at least 30 years (Access to Employee Exposure and Medical Records, 29 C.F.R. § 1910.1020[d], 2013).



Section 1910.134(m)(2) addresses the record-keeping information for fit testing. The employer must establish a record of the Qualitative Fit Test (QLFT) and Quantitative Fit Test (QNFT) administered to an employee. A copy of this record must be retained for each respirator used until the next fit test is administered. Fit test records must include the following:

Notes:

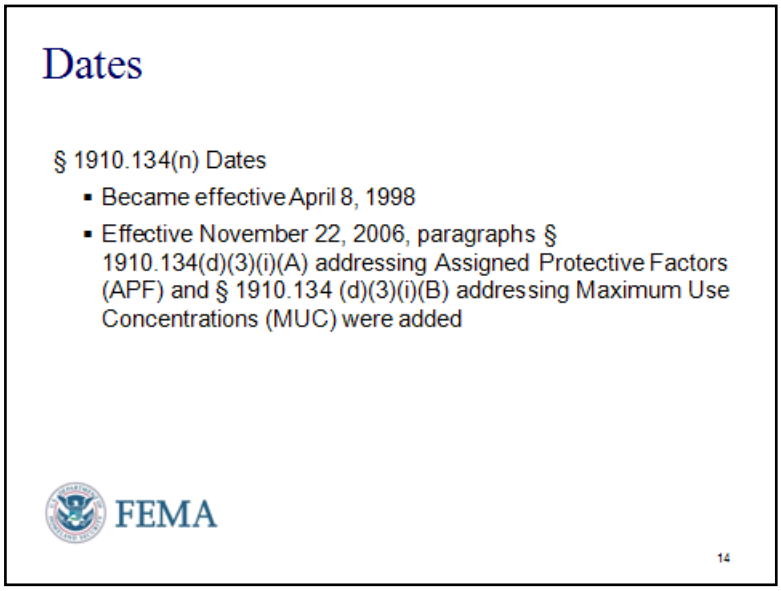
- The name or identification of the employee tested
- Type of fit test performed
- Specific make, model, style, and size of the respirator tested
- Date of the fit test
- The pass/fail results for the QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs (Respiratory Protection, 29 C.F.R. § 1910.134, 2013)



In addition to records on medical evaluations and fit tests, the employer must retain a written copy of the current respirator program. The written materials that are retained under § 1910.134(m) must, upon request, be made available to affected employees and to the Assistant Secretary of Labor or designee for inspection.

Notes:

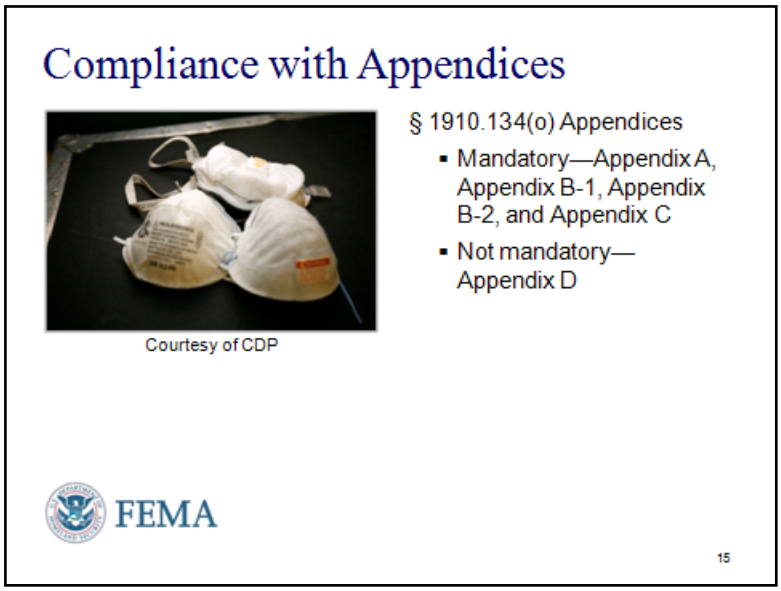
Enabling Learning Objective 13-5: Identify the effective date and the compliance of appendices with § 1910.134(n–o).



Dates

Section 1910.134(n) provides regulatory guidance on dates. The standard became effective April 8, 1998, and the obligations imposed by this section commenced on the effective date unless otherwise noted. Revisions and updates have been noted at the end of the standard. Currently, another effective date applies to paragraphs § 1910.134(d)(3)(i)(A) addressing Assigned Protection Factors (APF), and § 1910.134(d)(3)(i)(B), addressing Maximum Use Concentrations (MUC). These paragraphs became effective November 22, 2006.

Notes:



Compliance with Appendices

Key Point:

Section 1910.134(o) explains that compliance with Appendix A, Appendix B-1, Appendix B-2, and Appendix C is mandatory. Appendix D is not mandatory and is intended only as additional information.

Activity 1:

Individually answer the following questions. Justify the answer by providing the location in the standard where the information is found.

Notes:

1. The employer shall provide the _____ with a copy of the written respiratory protection program.

   a. Occupational Safety and Health Administration (OSHA) surveyor

   b. Physician of other licensed heath care professional (PLHCP)

   c. National Institute for Occupational Safety and Health (NIOSH) inspector

   d. Department administrator

2. In the control of those occupational diseases caused by breathing air contaminants, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by_____.

   a. an air-purifying respirator (APR)

   b. accepted engineering control measures

   c. an self-contained breathing apparatus (SCBA)

   d. air-purifying escape respirators (APER)

3. A filter that is at least _____ efficient in removing monodiperse particles of 0.3 micrometers in diameter is identified as a High Efficiency Particulate Air (HEPA) filter.

   a. 21.5%

   b. 25.5%

   c. 99.97%

   d. 19.5%

4. The employer shall ensure that a follow-up medical examination is provided for an employee who gives a _____ to any questions among questions one through eight in Section 2, Part A of Appendix C, or whose initial medical examination demonstrates the need for a follow-up medical examination.

   a. verbal response

   b. negative response

   c. positive response

   d. written response

Notes:

5. The employer shall obtain a _____ regarding the employee's ability to use the respirator from the PLHCP.

   a. written recommendation

   b. PPE plan

   c. checklist

   d. respiratory protection plan

6. A _____ shall be provided by the employer when such equipment is necessary to protect the health of the employee.

   a. written respiratory protection plan

   b. verbal respiratory protection plan

   c. respirator

   d. respiratory protection recommendation

7. An oxygen-deficient atmosphere means an atmosphere with the oxygen content below _____by volume.

   a. 21.5%

   b. 25.5%

   c. 99.97%

   d. 19.5%

8. If the respirator is a negative-pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a _____ if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative-pressure respirator, then the employer is no longer required to provide a _____.

   a. SCBA

   b. APR

   c. supplied-air respirator (SAR)

Notes:

d. powered air-purifying respirator (PAPR)

9. The employer shall identify a _____ to perform the medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

   a. PLHCP

   b. PLCHP

   c. PLHPC

   d. PHLCP

10. Information from the respiratory protection program, including observation made _____ fit testing and program evaluation, indicates a need for employee re-evaluation.

    a. during

    b. after

    c. before

    d. without

11. An atmosphere that poses an immediate threat to life would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere is known as a(n)_____.

    a. PPE environment

    b. IDLH environment

    c. SCBA environment

    d. Time-Weighted Average (TWA) environment

12. The _____ is required to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use.

    a. employer

    b. employer's workers compensation provider

    c. mayor

Notes:

d. department administrator

13. The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, _____ of Appendix C of this section.

    a. Part B

    b. Part C

    c. Part A

    d. Part D

14. A respiratory protection program must be administered by a suitably trained _____.

    a. fit test operator

    b. program administrator

    c. employee

    d. department administrator

15. The employee shall select a(n) _____-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

    a. OSHA

    b. High Efficiency Particulate Air (HEPA)

    c. Immediately Dangerous to Life and Health (IDLH)

    d. NIOSH

16. When the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider it a(n) _____ atmosphere.

    a. OSHA

    b. HEPA

    c. IDLH

    d. NIOSH

Notes:

17. The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the _____ deems necessary to make a final determination.

    a. employer

    b. employee

    c. PLHCP

    d. program administrator

18. The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model, or make) is used, and at least _____ thereafter.

    a. biennially (every two years)

    b. biannually (every six months)

    c. monthly

    d. annually

19. The employer shall ensure that all filters, cartridges, and canisters used in the workplace are _____ and color-coded with the NIOSH-approved label and that the label is not removed and remains legible.

    a. separated

    b. stored

    c. labeled

    d. inventoried

20. Retraining shall be administered _____.

    a. quarterly

    b. annually

    c. biannually

    d. as needed

Notes:

Activity 2:

Individually, identify the canisters with the following questions:

1. Is it NIOSH-certified?
2. Does it have a color-coded label? If so, what does the color code mean?
3. Is it CBRNE-certified?
4. Does it have an expiration date?
5. Does it have an End of Life Service Indicator (ELSI)?

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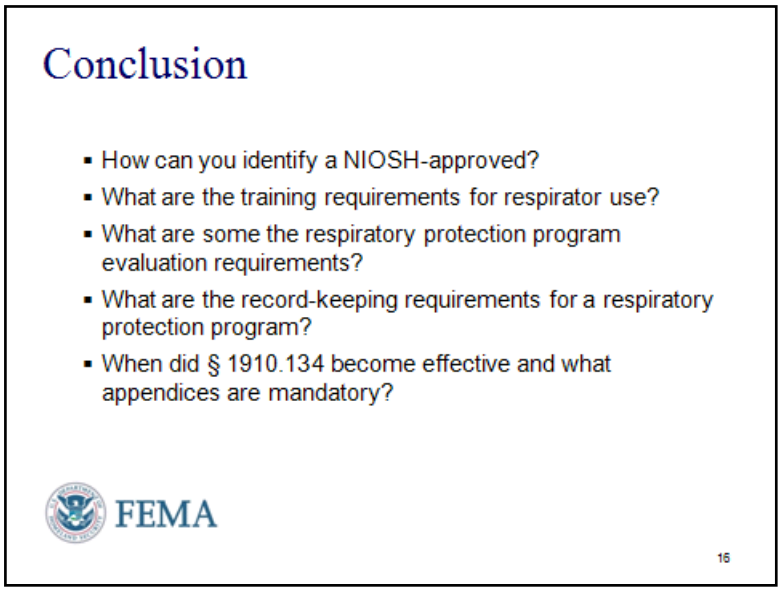


Conclusion

Employers are required to provide effective training to employees who must use respirators. Training must be comprehensive, understandable, and recur annually. Employees should be able to identify filters, cartridges, and canisters and their proper use.

Employers must evaluate a written respiratory protection program to ensure that the program is being properly implemented. It is the responsibility of the employer to conduct evaluations necessary to maintain the effectiveness of the program. A part of the evaluation should include consulting with the employees who use the respirators. This allows the employees to express their views on the program and helps the administrator to identify any problems with the written respiratory protection plan.

Record-keeping is an essential part of the written respiratory protection plan. It is also important to keep accurate and timely records concerning the fit test, the medical evaluations, and the information on the written respiratory protection program itself. These records must be made available to the affected employees as well as the Assistant Secretary of Labor or designee for examination and copying.

Notes:

The dates the regulatory standards are reviewed, updated, and changed are contained in paragraph (n). The last paragraph (o) simply addresses the compliance with the appendices. Appendices A, B-1, B-2, and C are mandatory while D is not mandatory.

Respiratory protection plan administrators are required to carefully set up a plan and then ensure that it is effective. Part 1910, Subpart I, Section 134(j), (k), (l), (m), (n), and (o) provide essential and constructive standards for this task.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

(Mandatory) Information for Employees Using Respirators When not Required Under Standard, Appendix D to 29 C.F.R. § 1910.134 (2013).

OH Editorial Staff. (1999, March 1). Is your respirator program effectively managed? *EHS Today*. Retrieved from http://ehstoday.com/news/ehs_imp_32662

Standard for Access to Employee Exposure and Medical Records, 29 C.F.R. § 1910.1020 (2013).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

U.S. Occupational Safety and Health Administration. (n.d.). *OSHA bulletin: General respiratory protection guidance for employers and workers.* Retrieved from http://www.osha.gov/dts/shib/respiratory_protection.pdf

U.S. Occupational Safety and Health Administration. (2008). Section VIII: Chapter 2 respiratory protection. *In OSHA technical manual (OTM)*. Retrieved from http://www.osha.gov/dts/osta/otm/otm_viii/otm_viii_2.html

APR Assembly, Inspection, and Storage

Duration: 1.50 Hours

Summary: Participants demonstrate how to assemble, inspect, and store a respirator according to the Respiratory Cleaning Procedures (Mandatory), Appendix B-2(G–H) to 29 *Code of Federal Regulations* (C.F.R.) § 1910.134 and the manufacturer's guidelines. This exercise is a companion exercise to Module 10, "APR Cleaning Procedures," completed on Day 2. The air-purifying respirators (APRs) are air-dried overnight as recommended per § 1910.134, Appendix B-2(F). Participants complete the study of § 1910.134, Appendix B-2. The reassembling of the APRs provides participants an opportunity to review before the post-test. Participants have the opportunity to complete a self-assessment and evaluation by peers prior to the performance evaluation.

Terminal Learning Objective: At the conclusion of this module, participants will be able to demonstrate the procedures for storing an APR in accordance with § 1910.134, Appendix B-2 and manufacturer's guidelines.

Enabling Learning Objectives:

At the conclusion of this module, participants will be able to accomplish the following:

14-1 Perform the assembly of a given respirator according to § 1910.134, Appendix B-2 and the manufacturer's guidelines.

14-2 Perform respirator inspection on a given respirator according to the § 1910.134(h)(3) and the manufacturer's guidelines.

14-3 Identify respirator storage procedures according to § 1910.134(h)(2) and the manufacturer's guidelines.

Practical Exercise: Each participant, under the direction of an instructor, demonstrates the procedures for assembling, inspecting, and storing an APR per § 1910.134, Appendix B-2 I.G–H (2013). The approximate time for this practical exercise is 45 minutes.

Risk Assessment: Low

Methods of Instruction: Participants take part in facilitated and demonstrated hands-on exercise supported by presentation visuals in a classroom environment. Reflective questioning challenges participants' critical thinking skills and reinforces module content. Participants take part in instructor-guided and collaborative knowledge checks throughout the module in which participants perform the assembly and inspection of a respirator and identify the proper storage procedures. Instructor reviews important aspects and key points of each standard addressed in the course for an overall review.

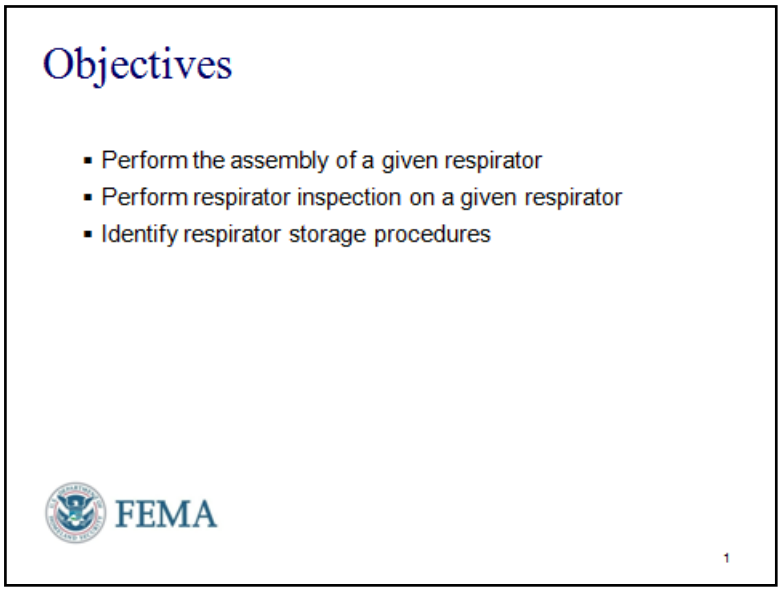
Instructor-to-Participant Ratio: 1:5

Required Reading: *Respiratory Protection: Program Development and Administration Reference Manual* [*Reference Manual*]

Evaluation Strategies: In the hands-on exercise, participants self-assess and participate in peer-to-peer evaluations. Instructors use a performance checklist to assess participants' knowledge and skills of the identified requirements for APR assembly and inspection.

Throughout the presentation of the module, the instructor uses reflective questioning and observations to informally assess participants' comprehension of key information. At the conclusion of the module, the instructor leads a discussion to review the key points presented from the content as well as address any additional participant questions.

Special Instructions: During this module, § 1910.134, Appendix B-2 is reviewed using the *Reference Manual*. Present the visuals in the main classroom and move to the breakout rooms to perform the reassembly and inspection of the APR. At the end of the module, instructors conduct a facilitated review of important course materials, which are specified in the Facilitated Review Handout.



Enabling Learning Objective 14-1: Perform the assembly of a given respirator according to § 1910.134, Appendix B-2 and the manufacturer's guidelines.

Assembly of the APR

For this course, the Mine Safety Appliances Company (MSA) Millennium® APR/CBRN Respirator is used. Inspect all pieces of the respirator to verify that they are in good repair and working order before assembling the respirator. In addition, check if all pieces are dry; if not, dry with a lint-free cloth.

1. Insert the internal drinking tube into the facepiece.
2. Insert the nosecup into the facepiece, making sure that the base of the nosecup fits securely around the apparatus holding the drinking tube and the opening for the speaking diaphragm.
3. Place the nosecup valve disc in the nosecup valve seat. (There are two of each of these parts.)
4. Place the nosecup valve seat (with the spokes facing outward) on the nosecup.

Notes:

Assembly of the APR

Courtesy of CDP

1. Insert the internal drinking tube into the facepiece
2. Insert the nosecup into the facepiece, making sure the base of the nosecup fits securely around the apparatus holding the drinking tube and the opening for the speaking diaphragm
3. Place the nosecup valve disc in the nosecup valve seat
4. Place the nosecup valve seat (with the spokes facing outward) on the nosecup

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Assembly of the APR (continued)

5. Place the inhalation valve assembly onto the deflector
6. Place the deflector (with the interior of the mask facing up) in the opening to the right of the nosecup. From the outside of the facepiece, place the spider gasket over the opening and pull the deflector through the center of the spider gasket
7. With the exterior of the facepiece facing up, place the gasket and the voicemitter in the opening to the right of the speaking diaphragm. Make sure the voicemitter has the four dots facing up, and then attach the retaining ring using the spanner wrench

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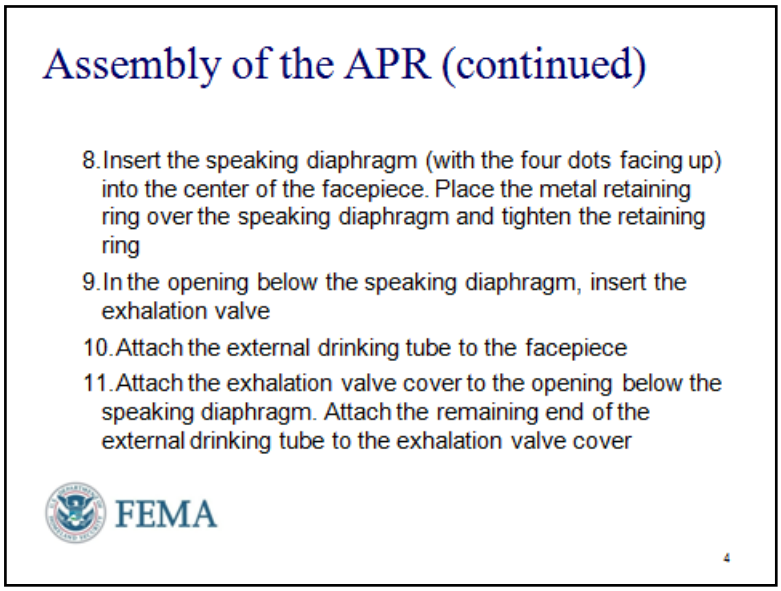
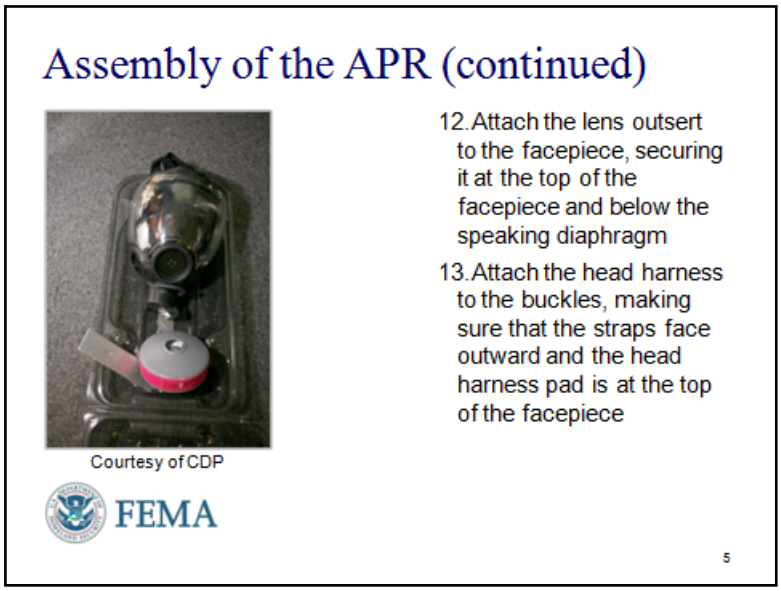
Notes:



5. Place the inhalation valve assembly onto the deflector.
6. Place the deflector (with the interior of the facepiece facing up) in the opening to the right of the nosecup. From the outside of the facepiece, place the spider gasket over the opening and pull the deflector through the center of the spider gasket.
7. With the exterior of the facepiece facing up, place the gasket and the voicemitter in the opening to the right of the speaking diaphragm. Make sure the voicemitter has the four dots facing up, and then attach the retaining ring using the spanner wrench.
8. Insert the speaking diaphragm (with the four dots facing up) into the center of the facepiece. Place the metal retaining ring over the speaking diaphragm and tighten the retaining ring.
9. In the opening below the speaking diaphragm, insert the exhalation valve.
10. Attach the external drinking tube to the facepiece.
11. Attach the exhalation valve cover to the opening below the speaking diaphragm. Attach the remaining end of the external drinking tube to the exhalation valve cover.

Notes:



12. Attach the lens outsert to the facepiece, securing it at the top of the facepiece and below the speaking diaphragm.
13. Attach the head harness to the buckles, making sure that the straps face outward and the head harness pad is at the top of the facepiece.

Enabling Learning Objective 14-2: Perform respirator inspection on a given respirator according to the § 1910.134(h)(3) and the manufacturer's guidelines.

Inspection of the APR

Follow the manufacturer's recommended procedures for the inspection of the APR (in this case, the manufacturer is MSA). As discussed in a module, inspection of the following parts should be completed before and after each use: inhalation valve disc, exhalation valve disc, harness straps, lens, cartridge/canister, facepiece blank, and accessories. Inspection should also be performed after assembly.

Notes:

Inspection of the APR

Inspection procedures for the Millennium® APR/CBRN Respirator

1. Examine the facepiece head-strap material for breaks
2. Make sure all straps, fasteners, and adjusters are in place and not damaged
3. Check the facepiece for dirt, cracks, tears, or holes
4. Check the lens for cuts, scratches, or damage, which would impair vision. Squeeze the lens, and it should easily collapse between the fingers

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Inspection of the APR (continued)

5. Examine at the shape of the facepiece for distortion due to improper storage
6. Check that the spider gasket, inhalation valve, and deflector are installed and undamaged
7. Grasp the spider gasket by the raised tabs and pull it gently out of the facepiece. The gasket must be free of cracks, tears, dirt, and distortion, and be soft and flexible
8. Remove the deflector and inhalation valve. The deflector and inhalation valve must be free of cracks, tears, dirt, and distortion. The inhalation valve must be soft and flexible

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Notes:

1. Examine the facepiece head-strap material for breaks.
2. Make sure all straps, fasteners, and adjusters are in place and undamaged.
3. Check the facepiece for dirt, cracks, tears, or holes.
4. Check the lens for cuts, scratches, or damage that would impair vision. Squeeze the lens, and it should easily collapse between the fingers.
5. Examine the shape of the facepiece for distortion due to improper storage.
6. Check that the spider gasket, inhalation valve, and deflector are installed and undamaged.
7. Grasp the spider gasket by the raised tabs and pull it gently out of the facepiece. The gasket must be free of cracks, tears, dirt, and distortion. The gasket must be soft and flexible.
8. Remove the deflector and inhalation valve. The deflector and inhalation valve must be free of cracks, tears, dirt, and distortion. The inhalation valve must be soft and flexible.
9. Set these parts aside in a clean location.
10. Insert the spanner wrench into the side voicemitter retaining ring. Turn the ring counterclockwise to unthread.
11. Remove the side voicemitter (smaller port on the side of the facepiece) from the port. The voicemitter may need to be pushed from inside the facepiece.
12. Inspect the side voicemitter for signs of damage.
13. Carefully remove the voicemitter gasket from the port. The gasket should be free of cracks, tears, dirt, and distortion, as well as be soft and flexible.
14. Set the gasket to the side, making sure that the area is clean.
15. Inspect the speaking diaphragm (large port in the center of the facepiece below the lens) for signs of damage.
16. Remove the exhalation valve cover from the exhalation valve. Lift the valve and inspect the seat and valve for cracks, tears, dirt, and distortion. The valve must be soft and flexible.

Notes:

Inspection of the APR (continued)

9. Set these parts aside in a clean location
10. Insert the spanner wrench into the side voicemitter retaining ring. Turn the ring counterclockwise to unthread
11. Remove the side voicemitter (smaller port on the side of the facepiece) from the port. The voicemitter may need to be pushed from inside the facepiece
12. Inspect the side voicemitter for signs of damage

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Inspection of the APR (continued)

13. Carefully remove the voicemitter gasket from the port. The gasket should be free of cracks, tears, dirt, and distortion, as well as be soft and flexible
14. Set the gasket to the side, making sure the area is clean
15. Inspect the speaking diaphragm (large port in the center of the facepiece below the lens) for signs of damage
16. Remove the exhalation valve cover from the exhalation valve. Lift the valve and inspect the seat and valve for cracks, tears, dirt, and distortion. The valve must be soft and flexible

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Notes:

Inspection of the APR (continued)

17. Reinstall the exhalation valve cover. Be sure that the exhalation valve cover lip surrounds the valve completely and that the tab is inserted through the exhalation valve cover
18. Remove the external drinking tube from the exhalation valve cover. Check the drinking tube for cuts, abrasions, or other signs of damage. Grasp the knurled surface and pull the tube out of the cover to check it for signs of damage. Be sure the tube is reinstalled in its port completely
19. Check the nosecup for dirt, tears, or holes

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Inspection of the APR (continued)

20. Check the internal drinking tube for cuts, abrasions, or other signs of damage
21. Reinstall the gasket in the side port. Be sure that it is flat
22. Place the voicemitter into the port
23. Thread the retaining ring into the port and tighten using the spanner wrench

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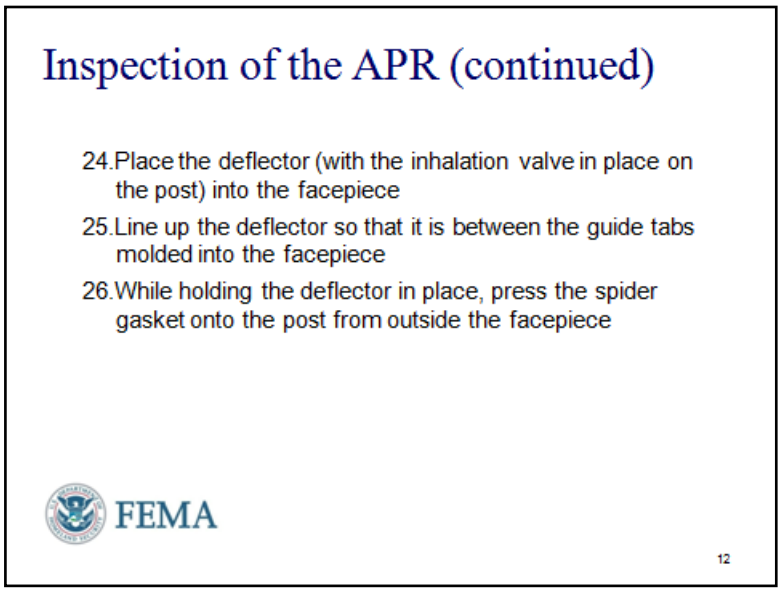
Notes:

17. Reinstall the exhalation valve cover. Be sure that the exhalation valve cover lip surrounds the valve completely and that the tab is inserted through the exhalation valve cover.
18. Remove the external drinking tube from the exhalation valve cover. Check the drinking tube for cuts, abrasions, or other signs of damage. Grasp the knurled surface and pull the tube out of the cover to check it for signs of damage. Be sure the tube is reinstalled in its port completely.
19. Check the nosecup for dirt, tears, or holes.
20. Check the internal drinking tube for cuts, abrasions, or other signs of damage.
21. Reinstall the gasket in the side port. Be sure that it is flat.
22. Place the voicemitter into the port.

NOTE: The voicemitter's crimped side faces out (up).

23. Thread the retaining ring into the port and tighten using the spanner wrench.



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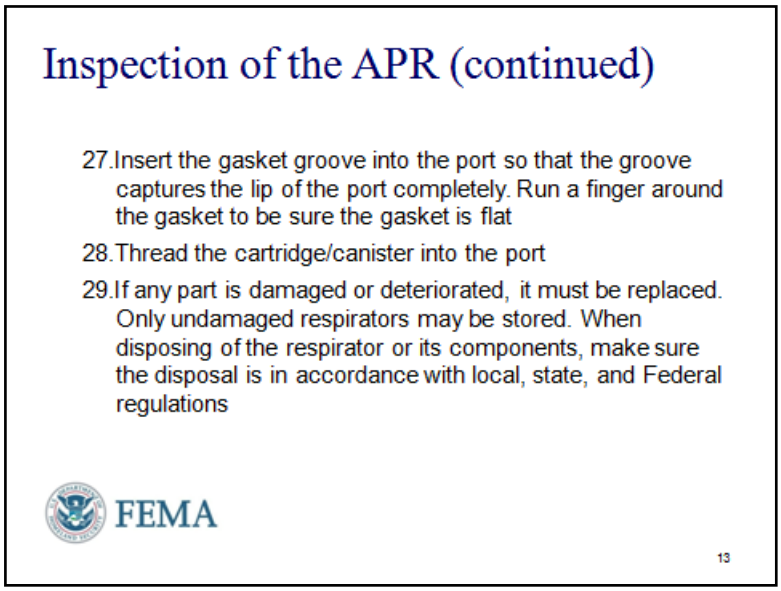

24. Place the deflector (with the inhalation valve in place on the post) into the facepiece.
25. Line up the deflector so that it is between the guide tabs molded into the facepiece.
26. While holding the deflector in place, press the spider gasket onto the post from outside the facepiece.
27. Insert the gasket groove into the port so that the groove captures the lip of the port completely. Run a finger around the gasket to be sure the gasket is flat.
28. Thread the cartridge/canister into the port.
29. If any part is damaged or deteriorated, it must be replaced. Only undamaged respirators may be stored. When disposing of the respirator or its components, make sure that the disposal is in accordance with local, state, and Federal regulations.

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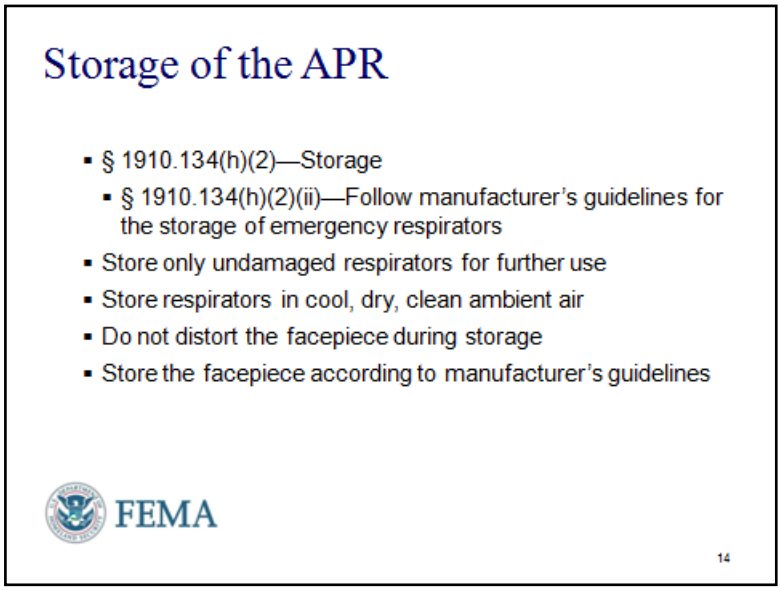
Enabling Learning Objective 14-3: Identify respirator storage procedures according to § 1910.134(h)(2) and the manufacturer's guidelines.



Storage of the APR

Section 1910.134(h)(2) provides guidelines for respirator storage. Section 1910.134(h)(2)(i) states, "All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve" (2013). Section 1910.134(h)(2)(ii) provides guidance on storing emergency respirators, which is to keep the respirator accessible, clearly marked, and stored according to the manufacturer's guidelines.

Only undamaged respirators should be stored for further use. When not in use, store respirators in cool, dry, and clean ambient air. It is important not to distort the facepiece during storage. The facepiece must be stored according to manufacturer's guidelines. According to the *MSA Millennium APR/CBRN Respirator Operation and Instructions*, the facepiece and cartridge/canister must be stored in either an extended clamshell or a standard clamshell. If the

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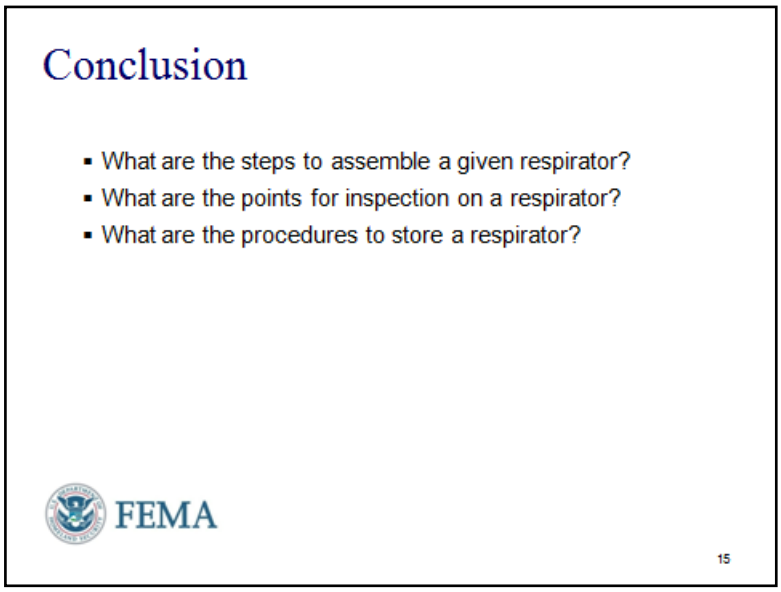
clamshell becomes damaged, it must be replaced (Mine Safety Appliances [MSA] Company, 2008).



Conclusion

This module reviewed the regulatory standard § 1910.134 and manufacturer's guidelines to do the following:

- Assemble a respirator
- Inspect a respirator
- Identify respirator storage procedures

Follow the manufacturer's recommended procedures for the inspection of the APR. Inspection of the following parts should be completed before and after each use: inhalation valve disc, exhalation valve disc, harness straps, lens, cartridge/canister, facepiece blank, and accessories. Inspection should also be performed after assembly.

Notes:

Only undamaged respirators should be stored for further use. When not in use, store respirators in cool, dry, and clean ambient air. It is important not to distort the facepiece during storage. The facepiece must be stored according to the manufacturer's guidelines.

Notes:

References

NOTE: The following were used in the development of this course. Due to the variability of content on the Internet, the time that the referenced websites remain viable is unknown.

Mine Safety Appliances Company. (2008). *Millennium APR/CBRN respirator operations and instructions* (Rev. 17). Retrieved from http://media.msanet.com/NA/USA/DomesticPreparedness/GasMasksAPR/MillenniumCBA/MillenniumManualR4.pdf

Respiratory Cleaning Procedures (Mandatory), Appendix B-2 to 29 C.F.R. § 1910.134 (2013).

Respiratory Protection, 29 C.F.R. § 1910.134 (2013).

Conclusion and After Action Review

Duration: 0.25 Hour

Summary: Participants engage in an After Action Review (AAR) of the course to discuss its strengths and areas of improvement. Participants evaluate their learning experience at the Center for Domestic Preparedness (CDP) and make suggestions for course improvement. Participants describe improvements in personal knowledge, skills, and abilities and the applicability of the training to their home jurisdictions or facilities.

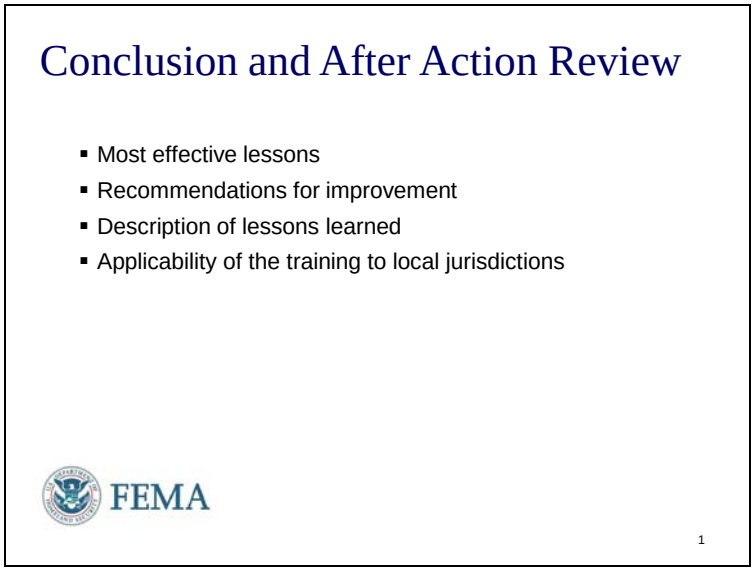
Activities: Instructors facilitate a large-group AAR in the main classroom. Participants describe course components and exercise experiences. Participants describe specific improvements in personal knowledge, skills, and abilities gained during the training and exercises and how they plan to apply the lessons learned in the performance of their duties. In addition, participants recommend how the course may be improved and evaluate their learning experience at the CDP. The large-group AAR enables participants to gain insight from their peers, instructional staff, and possible implementation ideas for knowledge, skills, and abilities gained during the Respiratory Protection: Program Development and Administration course.

Risk Assessment: Low

Methods of Instruction: Instructors use facilitated lecture and visuals to lead a discussion of the strengths and areas for improvement of the training provided by the CDP. In addition, instructors facilitate the participant-driven description of specific lessons learned during the training and exercises and how they plan to apply those lessons learned in the performance of their duties.

Instructor-to-Participant Ratio: 1:30

Required Reading: None



After Action Review

Participants engage in an AAR of the course to discuss its strongest elements and areas for improvement. Participants evaluate their learning experience at the CDP and make suggestions for course improvement. Participants describe lessons learned and the applicability of the training.

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Questions: Based on the training, answer the following questions:

- What were the strongest elements of the training course?
- What elements of the training course could be improved?
- What were the portions of the classroom work (prior to the exercise) that were most useful?
- What were the most useful elements of the exercises?
- What are the lessons learned from this course that will be most helpful to apply within the participants' own jurisdictions?
- How can the CDP improve the overall training experience?
- How could the subject matter be improved?
- How could the scope or level of the training for the target audience be improved?

Level 1—Reaction Assessments

The Kirkpatrick® Level 1—Reaction assessments provide information to the CDP to improve the quality of the training. Please complete the forms and return to any of the course's instructors.

Training Offered by the CDP

Further information concerning the available resident, nonresident, and indirect courses of the CDP may be found at https://cdp.dhs.gov/.

Notes: