Hurricane Katrina Disaster Site Worker Course

Lesson 7

Respiratory Protection

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Overview

This lesson covers the use of respiratory protection by disaster site workers.

The disaster site worker must be properly protected from chemical, biological, dust and other hazards present at a disaster site. The use of respiratory protection by disaster site workers must meet the proper protection requirements. The selection of the correct type of respirator is critical. The respirator user must be familiar with the assigned respirator, be able to pass medical and fit testing requirements, and be able to perform proper maintenance (i.e., changing filters and cleaning of the respirator).

The respirator represents the last line of defense against airborne hazards for the disaster site worker. If the correct respirator is not used or is used improperly, the health and safety of the user will be compromised. If filters are not changed at the proper intervals on an air-purifying respirator, the respirator will be become ineffective. If the respirator is not cleaned properly and periodically, it will not perform adequately.

This lesson will take approximately **3.5 hours**.

Objectives

This topic will enable the participant to recognize and demonstrate proper use of respiratory protective equipment. Specifically, participants will be able to:

- Explain the importance of wearing respiratory protection
- Give examples of common disaster-site respiratory hazards
- Recognize respiratory protective equipment
- List the limitations of air-purifying respirators
- Explain how to clean and store an air-purifying respirator
- Demonstrate proper use of respirators by correctly:
  - inspecting an appropriate air-purifying respirator,
  - donning the respirator,
  - performing a user seal check, and
  - doffing the respirator

Materials Needed for This Lesson

Trainer/Facilitator Requirements	Worker/Participant Requirements
Flipchart and markers A selection of N-95 respirators that can be used for mold exposure Full-face and ½-face APRs for discussion of respirator elements and demonstration of seal checks PAPR At least one ½-face APR equipped with triple cartridges (high efficiency particulate filter/acid gas/organic vapor) for every 2 students Full complement of cartridges and filters for display Portacount fit test system with probed full-face APR (optional) Video - *Respiratory Protection: Air Purifying*, Summit Training Sources,10 min. (optional) ***See also** the OSHA Safety and Health Bulletin "A Brief Guide to Mold in the Workplace" (in the Trainer Background Reference section of Lesson 5—Health Hazards) for guidance on respirators for exposure to mold*	Student handouts: • "Fact Sheet for Workers in Secondary Response and Other Supporting Roles", NIOSH • "Respiratory Protection Performance Test" • "Suggested Respirator Cleaning and Sanitation Procedures", NIOSH

Instructor Lesson Outline

1. Why wear a respirator?
    - Your respiratory system
    - Common disaster-site respiratory hazards
    - Hazards harm lungs
2. How do respirators work?
    - Face piece
    - Headbands
    - Filters
    - Inhalation valve
    - Exhalation valve
3. Types of respirators used by disaster-site workers
    - ½-face APR
    - Full-face APR
    - Full-face PAPR
4. Filters and Cartridges
    - Particulate filters
    - Chemical cartridges
    - Combinations
    - Changing
5. Certifications
    - NIOSH
    - CBRN
6. Wearing the respirator
    - Medical screening
    - Assuring good fit
        - Fit tests
            - Qualitative (QLFT)
            - Quantitative (QNFT)
        - Fit issues
        - Seal checks
            - Negative pressure
            - Positive pressure
    - Inspection
        - APR
        - PAPR
    - Maintaining the respirator
        - Cleaning
        - Storage
7. Inspecting, Donning, and Doffing Half-Face Air-Purifying Respirators (performance test)
8. Personal Theme Worksheet

Lesson Sequence

Objectives	• Review lesson objectives
Why wear a respirator?	• Discuss using handout, video or PowerPoint • Discuss Handout: *Fact Sheet for Workers in Secondary Response and Other Supporting Roles*
How do respirators work? **--(Demonstration)** **(Demonstration includes half-face, full-face APRs and PAPR)**	• Function of each respirator element • Illustrate with full-face APR, half-face APR, and PAPR • Supplement with PowerPoint or handout, if desired
Types of respirators used by disaster-site workers	• (Optional) Video - *Respiratory Protection: Air Purifying*, 10 min. • Operation, limitations, capabilities, and use of the APR and PAPR • Include situations in which respirator malfunctions • Illustrate with actual respirators
Filters and Cartridges	• Uses and limitations of the various filters and cartridges, with emphasis on triple cartridges • Changing • Have a full complement of filters and cartridges on display
Certifications	• NIOSH testing and certification • Labeling and marking systems
Medical Screening	• Reasons for and importance of medical screening • Medical conditions that may affect a person's ability to wear a respirator • Medical screening process – what to expect
Fit Tests **--(Demonstration)** **--(Demonstration optional)**	• Importance of good fit • Select proper type and size • How to put on, adjust for best fit, and remove the respirator • QLFT and QNFT • Why we will use QNFT • QNFT demonstration using Portacount system
Fit Issues	• Issues that must be considered to achieve a good fit; e.g., corrective glasses or goggles or other PPE, facial hair, dentures, chewing gum or tobacco

Seal Checks **--(Demonstration)**	• Demonstrate negative and positive-pressure seal checks
Inspection **--(Demonstration)** **--(Class Exercise)** **(Performance test with each student on inspecting, donning and doffing APR with triple cartridges.)**	• Demonstrate inspection procedures for APR and PAPR • Students, working in pairs under guidance of instructor, will demonstrate inspection of a ½-face APR • Instructor must have available at least one ½-face APR for every 2 students, equipped with triple cartridges (high efficiency particulate filter/acid gas/organic vapor) • Evaluate students using *Respiratory Protection Performance Test* Checklist
Maintenance **(Optional demonstration of proper cleaning procedures)**	• Importance of proper cleaning and storage • When to clean? • How to clean? • Where to store? • Handout: *Suggested Respirator Cleaning and Sanitation Procedures*
Review **--(Verbal quiz)**	• Ask students questions about the lesson content to gauge learning
Personal Theme Worksheet	• Ask the students to record at least one thing discussed in this lesson that is their personal responsibility when working at a disaster site.

Tips for Worker/Participant Interaction

1. Ask students to discuss the types of jobs that required them to wear respirators in the past.
2. Ask students if they had any unusual experiences or tips to share with class.
3. Ask for volunteers to assist in classroom demonstrations.

References

1. Trainer Background Reference – Respiratory Protection.
2. Respiratory Protection: A Manual and Guideline (3rd Edition). L.M. Brousseau, C.E. Colton, and L. R. Birkner (eds.). American Industrial Hygiene Association. 2001.

3. ANSI/AIHA Z88.7-2001 Color Coding of Air-Purifying Respirator Canisters, Cartridges, and Filters. American Industrial Hygiene Association. 2001.

Trainer Background Reference

RESPIRATORY PROTECTION

Many valuable lessons were learned from the response to the World Trade Center, Pentagon, Oklahoma City and the anthrax attack concerning respiratory protection. Especially at the World Trade Center, responders had not previously worked at a scene that presented the multitude of hazards to the worker. The Rand Corporation developed a report "Protecting Emergency Responders: Lessons Learned from Terrorist Attack". The report analyzes the PPE and respiratory protection problems and the interoperability concerns. The report addresses both first responders and disaster site workers.

The disaster site worker must be aware of the different types of respirators and the circumstances in which they are used. The disaster site worker also must also be able to demonstrate proper use of respirators and knowledge of fit testing, maintenance and cleaning procedures.

Instructors need to know the requirements of OSHA's respiratory standard. Sections covering selection, medical evaluation, fit testing, use, maintenance and care are of particular importance for this training.

OSHA's respiratory protection standard (29 CFR 1910.134), applies to General Industry (Part 1910), Shipyards (Part 1915), Marine Terminals (Part 1917), Longshoring (Part 1918), and Construction (Part 1926).

SELECTION OF RESPIRATORS

Overview

When selecting respirators, employers must consider the chemical and physical properties of the contaminant, as well as the toxicity and concentration of the hazardous material and the amount of

oxygen present. Other selection factors include the nature and extent of the hazard, work rate, area to be covered, mobility, work requirements and conditions, as well as the limitations and characteristics of the available respirators.

Respirators that are selected for use by disaster site workers must be certified by the National Institute for Occupational Safety and Health (NIOSH).

Air-purifying respirators use filters or sorbents to remove harmful substances from the air. They range from simple disposable masks to sophisticated devices. They do not supply oxygen and must not be used in oxygen-deficient atmospheres or in other atmospheres that are immediately dangerous to life or health (IDLH).

> "Oxygen deficiency" means an atmosphere with an oxygen content below 19.5% by volume.
>
> "IDLH" means 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.

Atmosphere-supplying respirators are designed to provide breathable air from a clean air source other than the surrounding contaminated work atmosphere. They include supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

The time needed to perform a given task, including the time necessary to enter and leave a contaminated area, is an important factor in determining the type of respiratory protection needed. For example, SCBAs, gas masks, or air-purifying chemical-cartridge respirators provide respiratory protection for relatively short periods. On the other hand, an atmosphere-supplying respirator that supplies breathable air from an air compressor through an air line can provide protection for extended periods.

If the total concentration of atmospheric particulates is low, particulate filter air-purifying respirators can provide protection for long periods without the need to replace the filter. Where there are higher concentrations of contaminants, however, an atmosphere-supplying respirator such as the positive-pressure SAR offers better protection for a longer period.

SARs eliminate the need for concern about filter breakthrough times, change schedules, or using end-of-service-life indicators (ESLI) for airborne toxic materials, factors that must be considered when using air-purifying respirators.

Respirators must not impair the worker's ability to see, hear, communicate, and move as necessary to perform the job safely. For example, atmosphere-supplying respirators may restrict movement and present other potential hazards. SARs with their trailing hoses can limit the area the wearer can cover and may present a hazard if the hose comes into contact with machinery. Similarly, a SCBA that includes a back-mounted, compressed-air cylinder is both large and heavy. This may restrict climbing and movement in tight places, and the added weight of the air cylinder presents an additional burden to the wearer.

Another factor to consider when using respirators is the air-supply rate. The wearer's work rate determines the volume of air breathed per minute. The volume of air supplied to meet the breathing requirements is very significant when using atmosphere-supplying respirators such as self-contained and airline respirators that use cylinders because this volume determines their operating life.

The peak airflow rate also is important in the use of a constant-flow SAR. The air-supply rate should always be greater than the maximum amount of air being inhaled in order to maintain the respiratory enclosure under positive pressure. Higher breathing resistance of air-purifying respirators under conditions of heavy work may cause the user breathing difficulty, particularly in hot, humid conditions. To avoid placing additional stress on the wearer, use the lightest respirator possible that presents the least breathing resistance.

SCBAs and some chemical canister respirators provide a warning of remaining service time. This may be a pressure gauge or timer with an audible alarm for SCBAs or a color ESLI on the cartridge or canister. The user should understand the operation and limitations of each type of warning device. For the many gas masks and chemical-cartridge respirators with no ESLI devices, the employer must establish and enforce a cartridge or canister change schedule. In addition, employees should begin each work shift with new canisters and cartridges.

Air-Purifying Respirators

The type of respirator most widely used by disaster site workers is the air-purifying respirator (APR). Air-purifying respirators clean the contaminated atmosphere. Ambient air passes through an air-purifying element that can remove specific gas and vapors, particulates or a combination of these contaminants. The APR is limited in its use to those environments where there is sufficient oxygen to support life and the contaminant's airborne concentration level is within the maximum use concentration of the device. The most common APR facepieces used by disaster site workers are the half-face (under the chin) and the full facepiece.

Particulate-Filter Respirators

Particulate-filter respirators offer respiratory protection against airborne particulate matter, including dusts, fibers, mists, and fumes, but they do not protect against gases, vapors, or oxygen deficiency. These respirators are equipped with filters to remove particles from the air.

There are nine classes of nonpowered, air-purifying particulate-filter respirators certified by NIOSH. The nine classes are divided into three filter series based on the reduction in the ability of the filter to remove particles as a result of the presence of oil aerosols in the work environment. The three categories of resistance to filter efficiency degradation are labeled N, R, and P. To help you remember the filter series, use the following guide:

N for ***N***ot resistant to oil

R for ***R***esistant to oil

P for oil ***P***roof

There are three levels of filter efficiency within each category – 95%, 99%, and 99.97% - designated as 95, 99, and 100.

A matrix of the nine classes of nonpowered, air-purifying particulate-filter respirators certified by NIOSH is shown below:

N	R	P
100	100	100
99	99	99
95	95	95

The class of filter will be clearly marked on the filter, filter package, or respirator box. For example, a filter marked N95 would mean an N-series filter that is at least 95% efficient. Chemical cartridges that include particulate filter elements will carry a similar marking that pertains only to the particulate filter element.

The service life of all filters is limited by considerations of hygiene, damage, and breathing resistance. All filters should be replaced whenever they are damaged, soiled, or causing noticeably increased breathing resistance. Additionally, filters should be used in accordance with the manufacturer's time-use limitation recommendations.

Gas/Vapor Removing Respirators

These air-purifying respirators protect against certain gases and vapors by using various chemical filters to purify the inhaled air. They differ from particulate-filter respirators in that they use cartridges or canisters containing sorbents, generally carbon, to remove harmful gases and vapors. Sorbents are granular, porous materials that interact with the gas or vapor molecule to clean the air. In contrast to particulate filters, which are effective to some degree no matter what the particle, cartridges and canisters are designed for protection against specific contaminants (such as ammonia gas or mercury vapor) or classes of contaminants (such as organic vapors). Activated carbon is commonly used for removal of organic vapors.

When the sorbent's capacity is exhausted, "breakthrough" occurs as the contaminant passes through the cartridge or canister and

into the respirator. Cartridges and canisters should be changed before breakthrough occurs. To do this, change schedules must be established based on the expected service life time for the particular workplace environment that the cartridge is being used in. When the breakthrough point is reached, the worker should exit to a clean area and replace the cartridges or canister. Cartridges are similar to canisters. The basic difference is the volume of the sorbent, not the function. Canisters have the larger sorbent volume.

Combination Particulate Filter/Gas or Vapor-Removing Respirators

These respirators use particulate-removing filters with a chemical cartridge or canister for exposure to multiple contaminants or more than one physical form (for example mist and vapor). The filter is generally a permanent part of the canister, but can be either permanent or replaceable on the chemical cartridge. Replaceable filters are sometimes used because the filter and chemical cartridge are not exhausted at the same time. This allows for disposing only of the part that is in need of changing. Filters used in combination with cartridges must always be located on the inlet side of the cartridge. This way, any gas or vapor adsorbed onto a filtered particle is captured by the sorbent as it desorbs from the particle.

For work on disaster sites, a common choice for the air-purifying device is a triple cartridge consisting of particulate, acid gas and organic vapor removal elements.

Powered Air-Purifying Respirators

Powered air-purifying respirators (PAPRs) protect against particulates and/or gases and vapors. The air-purifying element may be a filter, chemical cartridge, combination filter and chemical cartridge, or canister. PAPRs use a power source (usually a battery pack) to operate a blower that passes air across the air-cleaning element to supply purified air to the respirator user. The great advantage of the powered air-purifying respirator is that it supplies air at positive pressure (relative to atmospheric) so that any leakage from the facepiece is outward.

The only particulate filter available for PAPRs is the high efficiency filter. This filter is also known as a high efficiency particulate air (HEPA) filter.

Certifications

OSHA requires that employers select a NIOSH-certified respirator. The respirator must be used in compliance with the conditions of its certification.

All certified respirators are contained in the NIOSH Certified Equipment List (CEL). An identification number preceded by the "TC" designation is assigned to each certified respirator. The approval label provided with each respirator contains this identification number and the type of hazard the respirator is approved to protect against. Additional information on the label indicates limitations and identifies the component parts approved for use with the basic unit. The CEL is available at the NIOSH home page (www.cdc.gov/niosh).

NIOSH recently began testing and certifying respirators for use in atmospheres that contain chemical, biological, radiological, and nuclear (CBRN) respiratory hazards. The approved units have a unique label and marking system that indicates they are compatible with CBRN environments.

OSHA Respirator Selection Requirements

Some of the requirements of 29 CFR 1910.134 regarding selection are:

- Must select a respirator certified by the National Institute for Occupational Safety and Health (NIOSH) which must be used in compliance with the conditions of its certification.

- Must identify and evaluate the respiratory hazards in the workplace, including a reasonable estimate of employee exposures and identification of the contaminant's chemical state and physical form.

- Where exposure cannot be identified or reasonably estimated, the atmosphere shall be considered immediately dangerous to life or health (IDLH).

- Respirators for IDLH atmospheres:
  - Approved respirators:
    - full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or
    - combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.
  - All oxygen-deficient atmospheres (less than 19.5% O_2 by volume) shall be considered IDLH.

    Exception: If the employer can demonstrate that, under all foreseeable conditions, oxygen levels in the work area can be maintained within the ranges specified in Table II (i.e., between 19.5% and a lower value that corresponds to an altitude-adjusted oxygen partial pressure equivalent to 16% oxygen at sea level), then *any* atmosphere-supplying respirator may be used.

- Respirators for non-IDLH atmospheres:
  - For protection against gases and vapors, the employer shall provide:
    - an atmosphere-supplying respirator, or
    - an air-purifying respirator, provided that:
      - respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or
      - if there is no ESLI appropriate for conditions of the employer's workplace, the employer implements a change schedule for canisters and cartridges that will ensure that they are changed before the end of their service life and describes in the respirator program the information and data relied upon and basis for the change schedule and reliance on the data.
  - For protection against particulates, the employer shall provide:
    - an atmosphere-supplying respirator; or
    - an air-purifying respirator equipped with high efficiency particulate air (HEPA) filters certified by NIOSH under 30 CFR Part 11 or with filters certified for particulates under 42 CFR Part 84; or

- an air-purifying respirator equipped with any filter certified for particulates by NIOSH for contaminants consisting primarily of particles with mass median aerodynamic diameters of at least 2 micrometers.

MEDICAL EVALUATION

Disaster site workers assigned to tasks that require respirator use must be physically able to perform the work while using the respirator. The local physician or licensed health care professional (PLHCP) will determine what health and physical conditions are pertinent.

The medical evaluation can be performed by a PLHCP by using a medical questionnaire or by a medical examination that provides the same information as the questionnaire provided in Appendix C of the OSHA standard. This evaluation must be done before the employee is fit tested and uses the respirator in the workplace. The employer must obtain a written recommendation from the PLHCP for each employee's ability to wear a respirator. Additional medical evaluations must be provided whenever health-care professionals deem them appropriate.

Some of the requirements of 29 CFR 1910.134 regarding medical evaluation are:

- Must provide a medical evaluation to determine employee's ability to use a respirator, before fit testing and use.

- Must 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 (information required is contained in mandatory Appendix C).

- Must obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP.

- Additional medical evaluations are required under certain circumstances, e.g.:

- employee reports medical signs or symptoms related to ability to use respirator;
- PLHCP, program administrator, or supervisor recommends reevaluation;
- information from the respirator program, including observations made during fit testing and program evaluation, indicates a need; or
- change occurs in workplace conditions that may substantially increase the physiological burden on an employee.

- Annual review of medical status is not required.

FIT TESTING

Different types of respirators and even different brands of the same type of respirator have different fit characteristics. No one respirator will fit everyone. Some employees may be unable to get an adequate fit with certain respirator models of a particular type of respirator. This is why employers must provide a sufficient number of respirator models and sizes to ensure that every employee can select an acceptable respirator that fits properly.

Fit testing is required for tight-fitting facepiece respirators. You can test the effectiveness of the fit of the facepiece two ways: qualitatively and quantitatively.

Qualitative fit testing involves the introduction of a harmless odoriferous or irritating substance into the breathing zone around the respirator being worn. If no odor or irritation is detected by the wearer, this indicates a proper fit.

Quantitative fit testing offers more accurate, detailed information on respirator fit. While the wearer performs exercises that could induce facepiece leakage, a fit testing instrument numerically measures the amount of leakage into the respirator. This testing can be done either by generating a test aerosol as a test atmosphere, using ambient aerosol as a test agent, or using controlled negative pressure to measure any leakage. Detailed instructions for

performing qualitative and quantitative fit testing is contained in Appendix A of the OSHA respiratory protection standard.

Some of the requirements of 29 CFR 1910.134 regarding fit testing are:

- All employees using a negative or positive pressure tight-fitting facepiece respirator must pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT).

- Fit testing is required prior to initial use, whenever a different respirator facepiece is used, and at least annually thereafter. An additional fit test is required whenever the employee reports, or the employer or PLHCP makes visual observations of, changes in the employee's physical condition that could affect respirator fit (e.g., facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight).

- The fit test must be administered using an OSHA-accepted QLFT or QNFT protocol, as contained in mandatory Appendix A.
  - <u>QLFT Protocols</u>:
    - Isoamyl acetate
    - Saccharin
    - Bitrex
    - Irritant smoke
  - <u>QNFT Protocols</u>:
    - Generated Aerosol (corn oil, salt, DEHP)
    - Condensation Nuclei Counter (PortaCount)
    - Controlled Negative Pressure (Dynatech FitTester 3000)

- QLFT may only be used to fit test negative pressure air-purifying respirators (APRs) that must achieve a fit factor of 100 or less.

- If the fit factor determined through QNFT is ≥100 for tight-fitting half facepieces, or ≥500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

Note: If a particular OSHA standard (e.g., 29 CFR 1910.1001 Asbestos) requires the use of a full facepiece APR capable of providing protection in concentrations up to 50 times the Permissible Exposure Limit (PEL), this respirator must be QNFT. This is because a protection factor of 50 (50 X PEL) multiplied by a standard safety factor of 10 is equivalent to a fit factor of 500.

The safety factor of 10 is used because protection factors in the workplace tend to be much lower than the fit factors achieved during fit testing. The use of a safety factor is a standard practice supported by most experts to offset this limitation. This is discussed in the record at 63 FR 1225.

USE OF RESPIRATORS

Proper use of respirators is essential to protect disaster site workers. For example, corrective eyeglasses worn by employees present a problem when fitting respirators. Special mountings are available to hold corrective lenses inside full facepieces. A qualified individual must fit the facepiece and lenses to provide good vision, comfort, and proper sealing.

Tight-fitting respirators cannot provide proper protection without a tight seal between the facepiece and the wearer's face. Consequently, beards and other facial hair, the absence of normally worn dentures, facial deformities, or jewelry or head gear that projects under the facepiece seal can also seriously affect the fit of a facepiece. To ensure proper respiratory protection, check the facepiece each time you wear the respirator. You can do this by performing either a positive-pressure or negative-pressure user seal check. Detailed instructions for performing these user seal checks are in Appendix B-1 of the OSHA respiratory protection standard.

Some of the requirements of 29 CFR 1910.134 regarding use are:

- Tight-fitting respirators shall not be worn by employees who have facial hair or any condition that interferes with the face-to-facepiece seal or valve function.

- Personal protective equipment shall be worn in such a manner that does not interfere with the seal of the facepiece to the face of the user.
- Employees shall perform a user seal check each time they put on a tight-fitting respirator using the procedures in mandatory Appendix B-1 or equally effective manufacturer's procedures.
- Procedures for respirator use in IDLH atmospheres are stated. In addition to these requirements, interior structural firefighting requires the use of SCBAs and a protective practice known as "2-in/2-out" — at least two employees must enter and remain in visual or voice contact with one another at all times, and at least two employees must be located outside. (Note that this is not meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.)

MAINTENANCE AND CARE OF RESPIRATORS

It is important to inspect all respirators for wear and tear before and after each use, giving special attention to rubber or plastic parts that can deteriorate or lose pliability. The facepiece, headband, valves, connecting tube, fittings, and cartridges, canisters or filters must be in good condition. A respirator inspection must include checking the tightness of the connections.

Users must inspect SCBAs at least monthly and ensure that air and oxygen cylinders are fully charged according to the manufacturer's instructions. The inspection should include a check of regulator and warning devices to ensure their proper function. Employers must keep records of inspection dates and findings.

Users should replace chemical cartridges and gas mask canisters as necessary to provide complete protection, following the manufacturer's recommendations. In addition, they should replace mechanical filters as necessary to avoid high resistance to breathing.

Only an experienced person is permitted to make repairs, using parts specifically designed for the respirator. This person must consult the manufacturer's instructions for any repair and no attempt should be made to repair or replace components or make

adjustments or repairs beyond the manufacturer's recommendations.

The employer must ensure that respirators are cleaned and disinfected as often as necessary to keep them sanitary. In addition, the employer must ensure that emergency-use respirators are cleaned and disinfected immediately after each use.

Respirators should be washed in a detergent solution and then disinfected by immersing them in a sanitizing solution. Cleaner-sanitizers that effectively clean the respirator and contain a bactericidal agent are available commercially. The bactericidal agent frequently used is a quaternary ammonium compound. Strong cleaning and sanitizing agents and many solvents can damage rubber or plastic respirator parts. Use these materials with caution or after consultation with the respirator manufacturer.

Users must store respirators in a way that protects them against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals. When packed or stored, each respirator should be positioned to retain its natural configuration. Facepieces and exhalation valves should rest in a normal position to prevent the rubber or plastic from deforming.

Some of the requirements of 29 CFR 1910.134 regarding maintenance and care are:

- Must clean and disinfect respirators using the procedures in Appendix B-2, or equally effective manufacturer's procedures at the following intervals:
  - as often as necessary to maintain a sanitary condition for exclusive use respirators,
  - before being worn by different individuals when issued to more than one employee, and
  - after each use for emergency use respirators and those used in fit testing and training.

TRAINING AND INFORMATION

Training is essential for correct respirator use. Employers must teach supervisors and workers how to properly select, use, and maintain respirators. All employees required to use respiratory protective equipment must receive instruction in the proper use of the equipment and its limitations. Employers should develop training programs based on the employee's education level and language background.

Training must be comprehensive enough for the employee to demonstrate a knowledge of the limitations and capabilities of the respirator, why the respirator is necessary, and how improper fit, usage, or maintenance can compromise the respirator.

Users should know that improper respirator use or maintenance may cause overexposure. They also should understand that continued use of poorly fitted and maintained respirators can cause chronic disease or death from overexposure to air contaminants.

Some of the requirements of 29 CFR 1910.134 regarding training are:

- Must provide effective training to respirator users, including:
  - why the respirator is necessary and how improper fit, use, or maintenance can compromise the protective effect of the respirator
  - limitations and capabilities of the respirator
  - use in emergency situations
  - how to inspect, put on and remove, use and check the seals
  - procedures for maintenance and storage
  - recognition of medical signs and symptoms that may limit or prevent effective use
  - general requirements of this standard

- Training required prior to initial use, unless acceptable training has been provided by another employer within the past 12 months.

- Retraining required annually and when:
  - workplace conditions change,
  - new types of respirator are used, or
  - inadequacies in the employee's knowledge or use indicates need.

- The basic advisory information in Appendix D shall be provided to employees who wear respirators when their use is not required.

SUMMARY

The respirator represents the last line of defense against airborne hazards for the disaster site worker. If the correct respirator is not used or if it is used improperly, the health and safety of the user will be compromised. If filters are not changed at the proper intervals on an air purifying respirator, the respirator will be become ineffective. If the respirator is not cleaned properly and periodically, it will not perform adequately. Following the requirements set forth in OSHA's Respiratory Standard will protect disaster site workers from airborne hazards.

Selected Instructor Presentation Products

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Worker/Participant Handouts/Exercises/Demos/Worksheets

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