



# RESPIRATORY PROTECTION

## NPC TRAINING PROGRAM

### STUDENT HANDOUT



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# RESPIRATORY PROTECTION

## *Course Objective*

### **The objectives for this course are:**

- To identify different types of Atmosphere-Supplying Respiratory equipment.
- To explain the differences among types of Atmosphere-Supplying Respiratory equipment.
- To provide workers with information and practical skills required to use, care for, and maintain their Atmosphere-Supplying Respiratory equipment effectively.



## INTRODUCTION

You can go weeks without food and days without water, but only precious minutes without air.

Inhalation (breathing) is the quickest way for contaminants to enter your blood stream. That's why it's so important to protect your respiratory system (lungs) if you work in a contaminated atmosphere (dirty air).

- The air can be contaminated by:
  - dusts
  - sprays
  - fumes
  - vapors
  - smoke
  - harmful gases

In order to work safely in contaminated atmospheres, workers need to protect their lungs by using Atmosphere-Supplying Respiratory equipment. This section of the training is designed to explain the selection, use and care of Atmosphere-Supplying Respiratory equipment (ASR).





## WRITTEN PROGRAM

An employer must include in the Personal Protective Equipment (PPE) written program a section for respiratory protection equipment, which includes worksite-specific procedures for:

- Hazard Assessment, which identifies:
  - Chemical composition of contaminants
  - Physical states of the contaminants
  - Adverse health effects
- ASR selection
- Medical evaluation
- Fit testing
- Training
- ASR use
- ASR care and maintenance

### **NOTE:**

A person qualified by training and/or experience must be appointed to administer, oversee and evaluate program effectiveness. The program must be made available for workers to read and refer to when they need it.



## HAZARDOUS ATMOSPHERES

- Hazardous Atmospheres fall into two basic categories:
  - Oxygen-deficient - when an atmosphere contains less than 19.5% oxygen by volume at sea level.
    - ❖ Silos
    - ❖ Boilers
    - ❖ Tanks
    - ❖ Ship holds
    - ❖ Sewers
  - Contaminated – atmosphere contains hazardous gases/vapours. This type of atmosphere is also known as Immediately Dangerous to Life and Health (IDLH).
    - ❖ Hydrogen sulphide
    - ❖ Sulphur dioxide
    - ❖ Chlorine
    - ❖ Benzene
    - ❖ Ammonia



# ATMOSPHERE-SUPPLYING RESPIRATORS

## *Criteria for selection of Atmosphere-Supplying Respirators:*

- Results of workplace atmospheric sampling
- The activities the worker is expected to perform while wearing the respirator
- The amount of time spent on a specific job task

## *Four types of Atmosphere-Supplying Respirators:*

### **The first type - Air Line Respirators or Supplied Air Respirator (SAR)**

- Uses a compressor and a hose to supply breathable air to the wearer.
- The maximum allowed hose length is 90 meters.
- The length of the hose limits user's freedom of movement.
- Supplies air for an unlimited length of time.
- Compressed breathing air is very dry. A worker needs a break to replenish his fluids after 2 to 4 hours of breathing compressed air.
- An example of a task for which SAR is used is sand blasting.



## **The second type – Emergency Escape Breathing Apparatus (EEBA)**

- Provides up to 5 minutes' air supply through a small compressed air cylinder.
- EEBA is designed only for emergency exits from a hazardous environment.



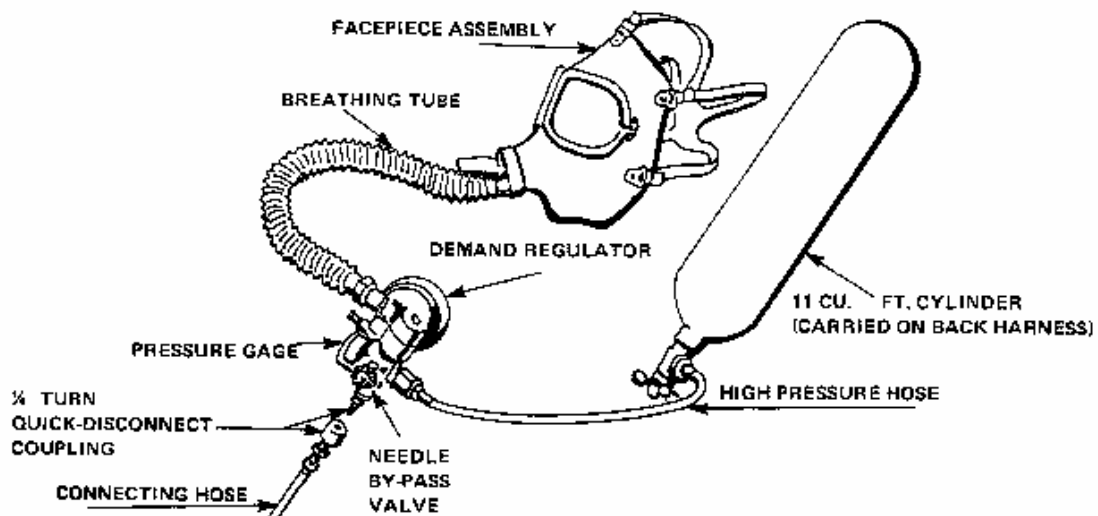
## **The third type - Self Contained Breathing Apparatus (SCBA)**

- Is primarily used for rescue or emergency response situations in hazardous atmospheres.
- Provides 30 to 60 minutes' air supply (must provide breathable volume air for at least 30 minutes).
- Must be equipped with a functioning remaining service indicator that alarms when the air supply is reduced to 25% capacity.
- Breathable air is supplied to a full-face mask by a cylinder attached to the body harness. The full-face mask provides an airtight seal against the hazardous environment.
- Wearers must be well trained to use it.
- Allows the wearer to talk when wearing it.
- Provides total freedom of movement.



## The fourth type - Supplied Air Breathing Apparatus (SABA)

- Is primarily used when work tasks subjects the employee to long-term risk of exposure to toxic gases.
- Is a combination of SCBA and SAR.
- Uses a compressed air cylinder, a compressor and a hose, or a combination of these two options, to supply breathable air to the wearer.
- When using a compressed air cylinder, this equipment provides 5 to 15 minutes' air supply only (must provide respirable volume air for at least 5 minutes).
- When using a compressor, the maximum allowed hose length is 90 meters.
- Wearers must be well trained to use it.





## MEDICAL EVALUATION

Employers must provide free medical evaluations to employees before fit testing is conducted, to determine if employees are able to wear ASR.

- This medical evaluation must be performed by a medical doctor.
- Additional medical evaluation is required if:
  - Worker reports unusual medical signs or symptoms.
  - Medical doctor, health care professional, supervisor or program administrator advises the employee that he/she needs to be re-evaluated.
  - Changes in the workplace occur that may increase worker's exposure.
- Annual review of medical status is *not* required.



## FIT-TESTING

Atmosphere-Supplying Respirators rely on a face-to-mask seal for complete protection from hazardous atmospheres. Fit-testing is required to assure a proper fit.

### *Factors affecting a proper fit:*

There are many factors that can prevent a good, safe fit:

- sideburns
- beards
- moustaches
- additional PPE (glasses, goggles, earpieces, etc.)
- type of clothing
- changes in facial structure
- weight loss
- surgery

### ***Types of Fit-Testing:***

An ASR can only be considered ready for use when its fit has been tested on the intended user by both of the following fit-testing methods:

#### **Qualitative Fit-Testing**

- It is a pass/fail test to assess the adequacy of respirator fit to the user.
- In this testing, a challenge agent (vapour, smoke or aerosol) is released around the respirator wearer.
- Qualitative test relies on the individual physical characteristics of the intended user and his/her response to the test agent. Fit is considered inadequate if the wearer detects the presence of the challenge agent through:
  - odour
  - taste; or
  - nasal Irritation
- The theory underlying a qualitative fit-test is that, if the respirator is effective in protecting the wearer from the challenge agent, it also will be effective in protecting the wearer from hazardous atmospheric contaminants.



## Quantitative Fit-Testing

- Performs an assessment of how efficient the respirator is on a specific user.
- This fit-testing measures the actual levels of the challenge agent outside and inside the respirator facepiece.



- The user must be fit-tested annually or more often as required by facial changes.
- Before a user enters a hazardous atmosphere, the negative and positive pressure tests that were covered in the lesson on PPE must be performed.



## IDLH ATMOSPHERES

### *Procedures for Operations in IDLH Atmospheres:*

- When working in an IDLH atmosphere, at least one employee must be located outside the IDLH atmosphere.
- Visual, voice, or signal line communication must be maintained between the worker(s) inside the IDLH atmosphere and at least one worker outside the IDLH atmosphere.
- Worker(s) located outside the IDLH atmosphere must be trained and equipped to provide effective emergency rescue assistance to the worker(s) inside the IDLH atmosphere.
- A supervisor or other appropriate person in authority must be notified before any worker outside the IDLH atmosphere enters it to conduct an emergency rescue.
- The supervisor or other person in authority, once notified, must provide necessary assistance appropriate to the situation.
- Workers located outside the IDLH atmosphere must be equipped with:
  - SCBA or SAR with auxiliary SCBA (SABA); and either
  - Appropriate retrieval equipment for removing employees who entered the IDLH atmosphere. The retrieval equipment should contribute to the rescue of employees and should not increase the overall risk resulting from entry; or
  - Equivalent means for rescue where retrieval equipment is not available outside.

**NOTE:**

Rescue and retrieval equipment will be detailed in Topic 18.

- In case of structural firefighting activities:
  - At least two employees must enter the space that is on fire and remain in visual or voice contact with one to another at all times.
  - At least two employees must be located outside the burning structure in case a need for rescue arises.
  - One of the employees located outside the burning structure may be assigned an additional role (e.g., incident commander), as long as this role does not interfere with their assistance or possible rescue activities.

## CARE AND MAINTENANCE

The care and maintenance of Atmosphere-Supplying Respirators should concentrate on four points:

- inspecting for defects
- repairing
- cleaning and disinfecting
- storing

### *Inspecting for Defects:*

You are responsible for inspecting your respirator, at least once a week, for any visible damage or missing components. You should check for the following:

- holes in the filters
- tears in the head straps and hoses
- broken or loose connectors and fittings
- missing parts
- cracked or scratched face pieces
- detergent residue or dirt in the valves
- general cleanliness
- worn or aging rubber parts
- cylinder hydrostatic pressure use-by date
- signs of cylinder exposure to high heat sources or open flames (paint turned brown or black, missing decals, melted gauge lens, etc.)
- large dents on cylinders

If the equipment is damaged, do not use it. Replace it immediately

### ***Repairing Atmosphere-Supplying Respirators:***

- Release the pressure in the hose between the cylinder/compressor and the mask by breathing the air remaining in it.
- Disconnect all components.
- Re-inspect the equipment thoroughly, piece by piece, for any visible damage components.
- If any part of the equipment is damaged, replace the damaged part immediately
- Tighten connection between the coupling on the hose pressure regulator and the cylinder valve outlet.
- *Never* use a wrench (spanner) to tighten up the connection between the coupling on the hose pressure regulator and the cylinder valve outlet. To avoid over-tightening, this connection can be tightened up only by hand.
- Replace the empty/partially empty cylinder with one that is fully charged.
- Do not try to repair the equipment, unless you are qualified to do so.

### ***Cleaning and Disinfecting ASR:***

- List of Materials and Supplies:
  - bucket
  - warm water (40°C)
  - soft brush and sponge
  - neutral detergent (no lanolins or oils - most dish detergents will work)
  - ethyl, methyl or isopropyl alcohol; or hypochlorite (household bleach); or iodine solution
- Cleaning procedure:
  - Fill the bucket with fresh warm water (maximum temperature 40°C).
  - Dismantle respirator, removing external accessories (such as communications, hoods, head harness and eye lens. Do not remove valves, because they are easy to lose).

- Immerse respirator components in a warm cleaning solution of neutral detergent and water. Scrub the parts with a soft brush or sponge (do not brush eye lenses).
- Rinse the clean parts in fresh running warm water. Thorough rinsing is important to keep detergents from drying on the respirator parts.
- Disinfecting procedure:
  - Fill the bucket with a solution of one of the following:
    - 70% of ethyl, methyl or isopropyl alcohol and 30% of fresh warm water (maximum temperature 40°C)
    - 2 tablespoons of chlorine bleach per 1 gal (4 L) of fresh warm water (maximum temperature 40°C)
    - 1 tablespoon (15 ml) of tincture of iodine per 4 litres of water
  - Disinfect respirator components by immersing them in one of the solutions described above (never mix solutions when disinfecting Atmosphere-Supplying Respirators. Use only one type of the solution).
  - Replace disinfectant solution after approximately 20 respirators have been disinfected or as needed.
  - Rinse the clean parts in fresh running warm water. Thorough rinsing is important to keep disinfectants from drying on the respirator parts.
  - Allow the respirator to air dry in a non-contaminated environment. Do not dry with heaters or in sunlight.

### ***Storing Atmosphere-Supplying Respirator:***

- Place your respirator in an individual plastic bag.
- Store respirators where they will be protected from:
  - dust
  - sunlight
  - heat
  - cold
  - moisture
  - chemicals
- When storing Atmosphere-Supplying Respirators, make sure that:
  - Equipment is completely dried.
  - Air cylinders are fully charged.
  - Cylinder valve and by-pass valve are completely closed.
  - Main line valve is fully open.
- Always store masks with the exhalation valve and breathing tubes in a natural, undistorted position.
- Place Atmosphere-Supplying Respirator in its original storage container and the container in an area where it is immediately accessible in case of emergency.

Remember, if in doubt, mask up





## SUMMARY

You can go weeks without food and days without water, but only precious minutes without air.

Take the extra time to follow the proper procedures in respirator use and maintenance and be alert to the dangers around you.

The training you will receive as part of your company's Respiratory Protection Plan is critical in helping you pick the right respirator for the job and learning the safety guidelines for proper and effective use.