

PROTECTING THE WORKER:
RESPIRATORS AND PROTECTIVE CLOTHING

Instructor's Notes:

Respirators and protective clothing can be a complicated subject within themselves. They are even more difficult when they pertain to the complex asbestos abatement industry and its unique problems. Therefore, it is important for the presenter(s) of this module to be familiar with these devices as they should be used in asbestos abatement work.

The objective of this module is to give the participants an overview of respirators and protective clothing, then proceed to be specific on their use, maintenance, and limitations as they apply to the phases of asbestos jobs. OSHA, and good practices, require that workers be given training for the specific respirators which they will use. This module will cover a variety of respirators, but it does not include all available models. Neither does it afford an adequate opportunity for handling or being fit tested with the respirators. For these and other reasons, persons who will wear respirators will still need specific training for their respirator even after attending this lecture. This point should be made clear.

There are several advantages to having respirators and protective clothing for display during this lecture. One of the advantages is allowing an opportunity for the participants to actually view and handle the units.

It is usually impossible for participants to remember all the important points of this module after hearing it just once. Therefore, they should be encouraged to study the

notebook material and do the take-home assignment. The difficult and/or critical points of this module should also be reviewed during the review sessions.

Slide

Script

No. 1, Title and Objective Slide

We have already heard the reasons we need to protect ourselves from asbestos exposure. Our protection will include respirators and disposable clothing. The objective of this presentation is to provide an overview of the use, maintenance, and limitations of respirators and protective clothing.

No. 2, Respiratory Protection

An adequate respirator program involves much more than just choosing and issuing a respirator. Therefore, we will discuss essential elements such as:

- o Need for respirators
- o Operating principles
- o Use and limitations
- o Proper fit and fit-testing
- o Protection factors
- o Establishing an effective program.

No. 3, Warning: Breathing May
Be Hazardous To Your Health

This illustration, similar to the one on cigarette packs, reminds us that many jobs involve potential hazards to our

Slide

Script

No. 4, Variety of Respirators

lungs. Certainly, asbestos abatement work is included in this hazard category.

Even selecting an appropriate respirator can be difficult. These are just a few of the many available models. As we will see, only a few of the available models are appropriate for asbestos protection. Even then, the appropriateness depends on several variable factors which we will discuss.

No. 5, Through the G.I. Tract

*Lead,
Mercury*

*< 8 x 10⁶ f/l
should resp.
little hazard*

Before we talk about respirators and protective clothing specifically, we should review some basic considerations of occupational health. One consideration is how the toxic substances enter the body. There are three possible routes of entry. One route is through the G.I. tract. Fortunately, we don't have too much concern about asbestos entering through this route. In fact, some public water supplies contain millions of asbestos fibers per quart. The scientific and medical specialists tell us that based on the best available data, we don't need to be concerned about this asbestos consumption.

Slide

Script

No. 6, Through the Skin

* largest organ of the body
~ 19 ft² surface area

Examples:
cyclohexanone
mercury
acrylonitrile
methyl alcohol

A second route of entry is through the skin.

Again, we don't have to be concerned with asbestos entering the body this way. Medical specialists tell us asbestos does not cause skin cancer or skin diseases. However, there are other reasons we don't want asbestos to get on the skin. The primary reason is the risk of asbestos getting back into the air.

No. 7, Through the Lungs

not wetting suit
not cleaning up
too fast

Improper vent
system
surface area ~
300-1000 ft²

As we heard during the health effects lecture, the risks from asbestos result from breathing in airborne fibers. These airborne fibers can come from work practices, from being on the skin, and from several other sources. Therefore, we look for ways to minimize fibers getting in the air, and to filter them out before the air gets into our lungs.

No. 8, The Respiratory System

25-100 million bacteria

Understanding the respiratory system also helps to understand the need and use of respirators and protective clothing. Here we see the overall structure of our breathing system. Air -- with or without toxic substances -- enters through our mouth or nose. Then it proceeds toward our lungs through a large tube called the trachea (windpipe). As the trachea

Slide

Script

25-100 million ←
~ 300 million alveoli
surface area alveoli
8 ft²

nears our lung lobes, it divides into bronchial branches. These branches divide many more times inside the lung lobes, similar to the branches of an upside down tree. There are air sacs (called alveoli) at the ends of the bronchial branches. These air sacs look like miniature grape clusters. It is in these air sacs that the oxygen and carbon dioxide exchange takes place.

* This slide also reminds us of the locations where asbestos diseases develop. Asbestosis is a scarring in the air sacs of the lungs which develops after the fibers lodge there. Lung cancer develops in the lung lobes, especially at the locations where the bronchus divides into smaller branches. Mesothelioma forms in the membranes which cover the outside of the lung lobes, inside of the lung cavity, diaphragm, and abdominal cavity.

No. 9, Side View of Trachea

Fortunately, the lungs are equipped with natural cleansing mechanisms. This slide, showing a very enlarged view of the right side of the trachea, shows two related cleansing mechanisms. The projections marked "cilia"

Slide

*Rate of movement
is ~ 1"/min*

Script

are minute hair-like extensions. They are also present in the upper part of the bronchial tree. Mucous material is secreted from the mucous glands such that it forms a moist, sticky layer over the cilia. As we breathe in and out, the mucous layer traps foreign particles. The cilia under the mucous layer move up quickly and down slowly (ILLUSTRATE WITH YOUR FINGERS AND HAND), moving the mucous layer and trapped material up to the throat. Once it arrives there, we either swallow it or spit it out.

* Unfortunately, smoking tobacco products causes temporary paralysis of the cilia and reduces the cleansing action. The cilia recover while we sleep and then become inactivated once we wake and start smoking again. This is probably one of the reasons the combination of smoking and asbestos exposure yields a much higher rate of disease than does either smoking or asbestos exposure by themselves.

No. 10, Heart and Lung Diagram

This slide reminds us of the critical relationship between our respiratory and circulatory systems. The purpose of our lungs is to get

Slide

No. 11, At Rest

Script

oxygen into the blood so the heart can circulate it to the cells where it will allow metabolism. The blood carries carbon dioxide, a metabolic by-product, back to our lungs where it is released and breathed out.

As the lungs become diseased or damaged -- as with asbestos -- the heart must work harder to get the needed oxygen to the cells. In severe cases of diseased lungs, the heart grows even larger to increase its circulation capacity. In fact, many asbestosis and lung cancer patients end up dying from heart attacks because the heart becomes severely overloaded trying to compensate for the damaged lungs.

Our breathing rate, like our heart rate, varies according to our level of bodily activity. In a resting condition, we breathe about 5-7 liters of air per minute. Remembering back to the pre-course quiz, 5-7 liters per minute equals 5,000-7,000 cubic centimeters of air per minute. Each liter contains 1,000 cubic centimeters.

Slide

No. 12, Working

$$\begin{array}{r} \text{EXP} \\ 25-30 \times 10^3 \times 480 \times 0.01 = \\ 120,000 \text{ fibers/8 hrs} \\ 144,000 \end{array}$$

EXP

$$\begin{array}{l} .1 \text{ f/cc} : 1.2 \text{ mil} - 1.4 \text{ mil} \\ .2 \text{ f/cc} : 2.4 - 2.8 \times 10^6 \text{ f/cc} \\ 1 \text{ f/cc} : 12 - 14 \text{ million fibers/cc} \end{array}$$

No. 13, Short Periods of
Tremendous Exertion

No. 14, Respiratory Hazards

No. 15, Oxygen Deficiency

Script

While working, our breathing volume increases to 25-30 liters per minute. That equals 25,000-30,000 cubic centimeters per minute. We present these breathing rates to help illustrate our lung functions and the potential numbers of fibers we might breathe at different exposure levels. Remember the problem on the pre-course quiz?

Our lungs are even capable of pumping 150-200 liters of air per minute for short periods of time. Hopefully, we never reach this level of exertion during asbestos abatement work.

Continuing with our general considerations of occupational health hazards before we discuss respirators and protective clothing, we should always keep in mind two categories of potential respiratory hazards. Those categories are:

- o Oxygen Deficiency, and
- o Toxic Contaminants

We don't generally have oxygen deficiency hazards during asbestos abatement work. However, we must always consider the possibility and take precautions when appropriate.

Slide

* mention "VA has confined space standard"

Script

For example, there could be insufficient oxygen in a steam tunnel, manhole, or other confined space where we have to remove asbestos. Normal air contains about 21% oxygen. Breathing air should always have an oxygen content in the 19.5 - 23.5% range.

No. 16, Identification

Toxic contaminants can be subdivided into three categories:

- o Gases - CO
- o Vapors, and
- o Particulates

⁷⁵
100 ppm - workplace
20 ppm - supplied air
16

There is the potential for one or more hazards from each of these subcategories during asbestos abatement work. For example, there can be carbon monoxide gas in the air from oil-lubricated compressors and other sources. There can be solvent vapors from encapsulants, lock-down materials, paints, and spray gloves, among other sources. And of course, there can be asbestos fibers, dusts, and other particulates.

No. 17, Hazard Control

We usually take a three-step approach to controlling these hazards. First, we use air

Slide

Script

*First evaluate
degree of hazard*

sample results to determine what and how much is present in the air. It makes a big difference for control purposes if the asbestos concentration is 10 f/cc rather than 1 f/cc.

Second, we reduce the hazards by engineering and administrative means when possible. For

*rotation of employees
no longer permissible*

example, we hang plastic, wet the materials, use negative air machines, follow special cleaning techniques, and use several other means to keep the airborne fiber levels as low as possible. When our best efforts still leave the airborne concentrations too high, we must proceed to the third step -- providing and using respirators. They are necessary during almost all phases of asbestos removal. In fact, the government requires respirators and protective clothing be used during asbestos abatement. Therefore, we should consider our respirator choices. They are available in many styles and models.

No. 18, Types of Respirators

Respirators are categorized two ways. One way is by their method of protection. There are three methods of protection:

Slide

Script

- o Air Purifying
- o Air Supplied
- o Self-Contained

All three types can be used during some phases of asbestos abatement. We will look at and discuss all three types. However, air supplied is becoming the preferred type, so we will discuss it the most.

No. 19, Knowledge of Respirators

Respirators are also categorized by the amount of coverage they cause on the face and head of the wearer. Here they are listed in an order from the least to the most coverage.

There are respirators which do not cover the face at all. The wearer merely breathes in and out through a mouthpiece. However, these are mainly limited to use in mines and are never used during asbestos abatement work.

Quarter masks sit on the front of the chin and go up to the bridge of the nose (ILLUSTRATE WITH YOUR HANDS). These were commonly

Slide

Script

used in industry 10 or 15 years ago, but are used very little now. They also are not used in your type of work.

Next is the half-mask facepiece. It covers from under the chin up to the bridge of the nose (ILLUSTRATE). These are used in certain phases of asbestos abatement.

Still increasing in facial coverage, the full facepiece is next. It covers from under the chin, out around the cheeks, and up to the hair line (ILLUSTRATE). These facepieces are used very commonly for asbestos work.

The greatest amount of head and face coverage is provided by the helmet and hood. The helmet covers the head like a hardhat with a facepiece added, and the hood covers the head, face, and top part of the shoulders. These respirators are also used during asbestos abatement.

As we will discuss later, the degree of protection for a respirator goes up with the amount of face coverage. This is especially true for tight fitting facepieces.

Slide

*Filters
Cartridges
Specific Air Contaminant
do not assure Oxygen Content*

No. 20, Air Purifying Equipment

Script

When we describe a respirator, we usually use a combination of one term from both of these categories. For example: half mask/air purifying; full face/air purifying; full face/supplied air; and other combinations.

We will now show and discuss respirators as they relate to asbestos work using both categories. First, we will look at the air purifying category, then supplied air, and last, the self-contained.

In general, air-purifying respirators have filters or cartridges attached to either a half mask or full facepiece. When the filter or cartridge is correctly selected and used, it will remove the toxic contaminant from air as it is breathed. Here we see contaminated air on the left side moving through a filter and being cleaned. These types of respirators only remove the specific toxic agent or agents for which the filter/cartridge is designed and they do nothing to assure the proper oxygen content of the air. Therefore, selecting and using them correctly is highly dependent upon the type of hazards, level of hazard, sufficient oxygen, and other factors.

Slide

No. 21, Air-Purifying Equipment

*Mechanical filter
chemical cartridges
GAS MASKS*

Script

They provide their air purification by one or a combination of two ways: mechanical filters and chemical cartridges. Some respirators offer a combination of both at the same time -- such as gas masks. We would select a high efficiency filter cartridge to protect against particulates, a chemical cartridge to protect against most gases and vapors, and a combination of filter and chemical cartridge when toxic agents are present in multiple categories.

No. 22, Air-Purifying Respirators

** 3rd artist rendition
of new air
purifying resp*

The top left box here shows quarter mask respirators. The top right box shows two half masks with a full facepiece between them. The bottom right box shows three configurations of gas masks. All three boxes show air-purifying respirators. However, in addition to Type C, the only styles used in your work are those in the top right box. Now we will look at air-purifying respirators in more detail.

No. 23, Green, Flat, Foam
Respirator with Two Holes

This is another air-purifying respirator. It has actually been used for protection during asbestos removal. Some of the workers said they really liked it. As you can see, or guess,

Slide

Script

it is merely a thin piece of foam with a hole near each end for your ears. The workers said it was easy and comfortable to wear, and even easy to push up to allow smoking! However, I suspect you would get about the same amount of protection with it around the back of your head as you would with it over your face.

(EMPHASIZE STRONGLY) This slide leads us to one of the most important points of this lecture. Any time a respirator is required, or even made available as an option, only use NIOSH/MSHA-approved respirators!! This is not, and never could be, a NIOSH-approved respirator. Don't even allow unapproved respirators on your work site.

No. 24, NIOSH/MSHA Approved

*NIOSH
MSHA
1971 TEST & APPROVAL
Complete Unit*

NIOSH stands for the National Institute for Occupational Safety and Health -- a sister agency to OSHA. MSHA stands for Mine Safety and Health Administration. In 1971, NIOSH took over respirator testing and approval from the Bureau of Mines. NIOSH tests the respirators as a complete unit. If they pass the tests, they and MSHA grant a joint approval for the whole assembly -- no

Slide

*Note that although resp app
for dust & mist including asbestos;
respirable type is NERX*

No. 25, Worker Wearing Disposable
Respirator

*20 YEARS
Approved &
Not Approved -*

Script

part can be substituted or removed without
voiding the approval.

Approval involves the granting of a "TC"
number to the unit (WRITE ON BOARD).
These numbers are shown and described in
your notebook. The "TC" represents tested
and certified, and will be followed by several
other numbers and another letter for your
specific hazard. The TC number should either
be on the respirator itself, or on the package
and instructions. It should always be printed
on the filter and cartridges. Make sure your
respirators all have a TC number, and a cor-
rect one for asbestos and other hazard
protection.

Disposable respirators are a special type of
respirator in the air-purifying category which
came on the market nearly 20 years ago. They
are available as approved and non-approved
units. This particular one is approved; the TC
number is printed on the outside near the
mouth area.

Slide

Script

Disposable respirators have many valid and advantageous uses. (EMPHASIZE.) However, NIOSH and several other specification writers and safety and health authorities strongly recommend against using them to protect against asbestos since it is a proven human carcinogen. We don't know what their acceptability will be next year or five years from now. This is still one of the many unresolved issues for our industry. However, for now, we recommend against their use for asbestos.

No. 26, Half-Mask Respirator
Model Showing Components

Most permanent facepiece respirators have similar components. Here we see labels for some of the important components of a half mask air-purifying respirator. The next slide shows a similar respirator disassembled.

No. 27, Disassembled Half Mask
Respirator

In the center, we see the molded half mask facepiece. They are available in either ~~natural~~ or synthetic rubber. This one is a synthetic rubber. To the right and left are the cartridge/filter cups, gaskets, inhalation valves, and assemblies. At the bottom are the exhalation valve, valve assembly, and assembly cover (THE COVER IS IMPORTANT).

Slide

No. 28, Model of Full Face
Respirator with Components
Labeled

Script

Above is the yoke assembly with a neck strap, head strap, and head yoke. Several approved models don't have a head yoke for the head strap. All components must be kept in place and used for the respirator to still be considered approved.

Full face air-purifying respirators have components similar to half mask models. They do have more than two straps -- sometimes as many as seven. Now is a good time to explain how to put on a full face respirator. Open the straps all the way, put your chin into the chin cup, rotate the respirator back against your face, and (EMPHASIZE) tighten the straps going from the bottom to the top. Remove any hair which is caught under the face seal.

Note the full facepiece gives an added advantage of some eye protection. That is good since you can't wear regular or safety glasses with them. If you need corrective lenses, you will either have to wear contact lenses (IF YOUR DOCTOR PERMITS) or get a special lens holder to go inside the facepiece. Under some conditions, there is a problem with the

Slide

No. 29, Half Mask Respirator

Being Worn

Strap Position
Two or more sizes

No. 30, Full Face Respirator

Being Worn

Combination
Filter/Cartridge

HEPA vs
Other

Script

lens fogging on full facepiece respirators. Nose cups molded into the facepiece as shown here often help. Of course, the unit must be approved -- you can't just make and add one.

This is the same respirator we saw disassembled. Note the correct position of the straps -- the head strap and the neck strap. As seen here, the straps don't have to be uncomfortably tight if the respirator fits the person correctly. Manufacturers often make these facepieces in two or more sizes to help in proper fitting. As indicated by the "S/M" just above the plastic yoke on the facepiece, this is a small/medium size. Also, it is ~~not~~ possible to wear glasses and a hard hat with a proper fitting half mask.

This is a full face, dual cartridge/filter, air purifying respirator with a built-in nose cup. However, even though the filter/cartridges are NIOSH approved for asbestos, they are not the high efficiency type. Since they are available in the high efficiency type, we recommend you not use anything less than the high efficiency model.

Slide

No. 31, Front View of Person
Wearing Air Hat

*Helmet
PAPR*

No. 32, Side View of Person
Wearing Air Hat

*Raised
Face Piece*

Script

This is another special type of air-purifying respirator which has been available for about 15 years. They are called Powered Air-Purifying Respirators -- PAPRs. This is a helmet or "air hat" model of a PAPR. PAPRs go a step beyond air-purifying respirators and they all have similar operating principles. We will look at that in a moment.

As you can see, on some models the facepiece can be raised if you want to do so. This can be an advantage and disadvantage. You get no respiratory protection with the facepiece up. It could be a problem with employees.

Now for how they work. Note the blue pack on his side. That is a rechargeable battery. Follow the wire from the battery up to the back of the helmet. The battery powers an air pump inside the rear of the helmet. The intake for air is on the bottom just behind the wire. This next slide shows what is inside.

Slide

No. 33, Air Hat Being Taken Apart

*Filter on
Belt*

Script

See the wire leading to the air pump. The air is sucked in at the bottom of the air pump and blown through the white filter in the top toward the facepiece. The plastic interliner and head harness can just barely be seen on the right.

Some PAPRs have the battery, air pump, and filters all down on the belt as a single assembly. Then they pump the filter air to a helmet, hood, half mask, or full facepiece through a hose.

These units take air in directly from the worker's breathing zone and then only filter it, so they are still air-purifying respirators. However, since they don't depend on the person's breathing action to pull the air through the filter or cartridge (they blow it through), thus, they are called Powered Air-Purifying Respirators.

Three years ago, we thought PAPRs would be a real blessing for asbestos work and provide a much higher degree of protection than the other air-purifying respirators. However,

Slide

Script

No. 34, Hood Respirator

This is a hood respirator built in with a helmet. Some PAPRs and other types of respirators use this configuration for their head piece.

No. 35, Types of Air-Purifying Respirators

Half mask
Full Face
PAPR'S

Now a quick review of air-purifying respirators before we look at the air-supplied and self-contained categories. Remember they are available in all these types. The half mask, full face mask, and PAPR types are the kinds used during asbestos work. Hopefully you remember what they look like when we say a dual cartridge, full face, air-purifying respirator; a full face, PAPR; or any of the other types. Now we will look at Air-Supplied Respirators.

No. 36, Air-Supplied Equipment

1. required in 1926.58 →
since exp unknown
2. required in some
contract specs
3. provide better protection
than air purifying

For several reasons, this is the most important category of respirators for asbestos abatement work. Rather than air supplied, it is often

Slide

No. 36, Air-Supplied Equipment

No. 37, Constant Flow Air-Line
Respirators

No. 38, Respirator in Use

Continuous Air
Flow

Full FACE
Fit
Eye Protection

Script

called a Type C respirator. (EMPHASIZE.) A Type C respirator is an air-supplied unit and only an air-supplied respirator. No cartridge respirator is Type C.

Up to this point, we have looked at respirators which only filter impurities out of the air surrounding the employee. We will now spend a few moments discussing air-supplied equipment and respirators. In the next presentation, we will spend an hour talking about air-supplied systems, but we want to get an overview here.

An air-supplied respirator, or "Type C" as they are frequently called, provides a continuous flow of air from an external source (i.e., outside the work area) during inhalation and exhalation.

This person is wearing a Type C (supplied-air) respirator. The full face masks are recommended for two reasons. First, the full face mask provides double the protection since the worker receives a better "fit" of the respirator to the face. Secondly, eye protection is

Slide

Script

provided. The fogging of the face shield is not a problem since the air blows across the inside of the shield and does not allow fogging. (Note: Eyeglasses with temple bars cannot be worn with a full face mask since this breaks the seal of the respirator to the face. Special clip-in frames are available from most manufacturers.)

No. 39, Respirator/Brick Wall

In this slide, we see a relatively new (1983) style of respirator. Note the square black filter cartridge at the belt. This works just like an ordinary airline respirator when attached to an airline with proper pressure (not to exceed 125 psi). If disconnected from the airline or if the air stops flowing (due to compressor failure, for example), the worker breathes through the HEPA filter cartridge. This type of mask permits work at heights where the airline may be secured to the scaffolding and worker climb unhindered by an airline. It also permits travel through the decon unit without dragging airlines through the air locks.

No Fogging

Air Supplied
Air purifying
Heights + Movement
Decon + Air Locks

Slide

No. 40, Hood (White)

Beard
Hood:
6 ft³ air/minute

loose fitting hood
$$\frac{50 \text{ CFM}}{6 \text{ CFM/person}} = 8 \text{ people}$$

15-20 CFM
equivalent to
4-5 SAE

Script

What about the worker that wants to keep a beard? The answer is a Type C hood respirator such as this slide shows. This type of respirator requires more air to be delivered to the worker. The hood type respirator requires a minimum of 6 cubic feet of air per minute (CFM), while a tight-fitting mask requires a minimum of 4 CFM.

REVIEW: Ask participants how many workers wearing a tight-fitting Type C respirator may work from a compressor that delivers 50 CFM. Answer: 50 CFM divided by 4 CFM per worker = 12.5. Therefore, no more than 12 workers may be used at any one time.

This slide also shows the application of a vortex tube to cool incoming breathing air. A vortex tube requires even more air to be delivered to the worker. If the air is properly processed, as discussed in the next section on breathing air systems, vortex tubes are not needed since the air is cooled during purification.

Slide

No. 41, Air-Purifying Unit

Script

In this slide, we see an air purification unit. This unit receives air from the compressor. The unit cools the air and removes certain impurities before allowing it to be delivered to the worker. The operation of the air purification system is discussed in greater detail during the next presentation on Type C systems.

No. 42, Self-Contained Breathing Apparatus

Another form of air-supplied respirators is the self-contained breathing apparatus, or S-C-B-A. If we were divers, we would use a self-contained underwater breathing apparatus or SCUBA gear.

No. 43, SCBA in Use

*15-20 Pounds
30 minutes of Air*

Here is a person wearing a typical SCBA. As you can see, it is rather bulky, weighs about 15-20 pounds, and only provides about 30 minutes of air. This is not very practical on asbestos abatement projects for use by workers. However, inspectors, building owners, architects, and others may use them since it provides greater mobility (i.e., beyond the limit of an air line; for example).

Slide

No. 44, OSHA Standards

29 CFR 1926.58
asbestos 1910.1001
vinyl chl. 1910.1017
lead 1910.1025
const. as b. 1926.58

No. 45, Respirator Program

Script

There are numerous occupational safety and health standards that apply to asbestos abatement projects. In this section, regarding respirators, we are primarily concerned with the respirator requirements of the OSHA Asbestos Standard (29 CFR 1910.1001) and the OSHA Respiratory Protection Standard (29 CFR 1910.134). The OSHA Asbestos Standard requires we use respirators on these types of projects. In short, if you follow the recommended practices presented in this course, you will be in compliance with the respirator requirements of the Asbestos Standard. The OSHA Respiratory Protection Standard has other requirements, however. Let's look at these.

This slide illustrates the requirements for a respiratory protection program which conforms to the OSHA regulations (1910.134). These are sometimes called the 11 commandments of a successful respirator program. Let's quickly review them.

1. Written Program - Any employer who makes respirators available to their

Slide

Written Statement of Company Policy

A. Program Responsibilities

1. Employer
2. Respirator Program Admin
 - purchasing approved resp
 - issuing respirators
 - controlling resp
3. Worker
 - follow instructions & training

User Training:

• nature of hazards of asbestos & its potential health effects

• how asbestos enters body and what happens when it does

• how cigarette smoking & risk

• why resp are needed

• consequences of not wearing

- legal
- health
- disciplinary

• why particular resp selected

• ~~how~~ uses, limitations, hands on exp for fitting

• insp & maintenance → see notes

• classroom & field or simulated field

training in recognizing & coping

• medical & other emergencies

• cleaning & disinfecting resp

• purpose of medical

Script

employees must have a written respirator program. Each of the remaining 10 "commandments" must be detailed in this written program.

2. Selection Based on Hazard - The respirator selected should be based on the hazard anticipated. For example, you would not use a gas mask to protect against asbestos ... and vice versa. Not only do you select a respirator based on the type of hazard (i.e., asbestos), but also on the degree of hazard. For example, a cartridge respirator is usually appropriate for a glovebag job where asbestos levels could be very low. Type C ^{SAR} would be used for a brief demolition where asbestos concentrations would be higher.

3. User Trainer - Anyone who wears a respirator must be properly trained on its use, limitations, proper fitting, and maintenance. In the back of your notebooks are two NIOSH publications on respirator training. One is designed for the employer, and one for the employee. You

Slide

Supervisor Resp Training :

- basic respiratory protection practices
- selection & use of resp to protect workers
- structure & oper of resp program
- legal requirements

* Cont'dges

start 2
break #1 2
Lunch 2
break #2 $\frac{2}{8}$ / day

If employee leaves area ≈ 7 times / shift, must clean each time
* (also ~~resp~~ replace filters) or have extra units available.

Home made disinfectants :

1. 50 ppm hypochlorite soln - add 2 tablespoons chlorine bleach to 1 gal H₂O
2. Iodine soln (50 ppm) - add 1 teaspoon tincture iodine in 1 gal H₂O.

Script

may find them helpful during respirator training.

4. Individual Respirator Assignment -

Although not specifically required by OSHA, it is good hygienic practice to assign a specific respirator to each employee. In this manner, an employee who wears (has been fitted with) a large size mask does not pick up a medium or small that does not fit properly.

Cover decon unit - white book

5. Cleaning & Disinfecting - All respirators

must be cleaned and disinfected after each use. While the worker normally cleans his/her respirator in the shower of the decon, it is a good idea to have the employee who often works in the "clean room" be responsible for disinfecting each respirator. Packages of disinfectant, mixed in a pail of warm water are available from most manufacturers and suppliers for this purpose.

6. Clean, Convenient, Sanitary Storage - It

is the contractor's responsibility to pro-

Slide

Script

vide a clean location to store the respirators when not in use. This may be in lockers in the clean room or a nearby equipment trailer at the job site.

7. Inspection & Repairs - Each respirator should be inspected by the user each time it is put on. A good practice is to have the employee in the clean room also check each respirator as the employee exits the shower. In addition to these inspections, a regular inspection of all respiratory equipment should be conducted by the job superintendent.

8. Work Area Surveillance - This is a very simple part of the program ... NO ONE SHOULD WORK IN THE WORK AREA ALONE. Again, this should be common sense.

9. Program Auditing - The written respirator program and practices followed should be periodically updated. "Periodically" is a great word, isn't it!?! As a rule of thumb, this should be an annual (documented)

Transparency →

Slide

Script

review and update. You would also change the program when a new type of respirator is purchased. Obviously, the maintenance, training, etc. would be altered if you purchased some PAPRs for a particular purpose or project.

Basic

- History
- Questionnaire
- Examination
 - pulmonary function
 - chest x-ray

10. Medical Determination - Before you put an employee in a respirator, you must have a medical determination made that the employee is capable of wearing a respirator. This is discussed in greater detail in the section entitled, "Establishing a Medical Surveillance Program."

11. Approved or Accepted Respirators - Any respirator used must be approved by NIOSH and/or MSHA. For Type C systems, not only are the respirators approved, but the air lines as well. Remember, they are approved as an operating unit and you cannot interchange parts from different models of respirators.

TC 21C
Testing & certified
TC 21C For particulates
including asbestos

-31-

Cover donning & removal in
serious rooms

TX Tiner
RMC0035874

**TABLE VIII-1.
SUGGESTED RESPIRATOR SELECTION FOR PROTECTION
AGAINST ASBESTOS WHEN PROPERLY FITTED FOR
USE AND PROPERLY MAINTAINED**

Respirator Selection	PF	Maximum airborne fiber concentration outside the respirator to maintain exposure inside the respirator below 0.01 fibers/cc		1926.58 OSHA PF
		<u>AHERA</u>		
High efficiency cartridge filter type (half mask)	10	10	0.1 fibers/cc	10
High efficiency cartridge filter type (full face mask)	50	50	0.5 fibers/cc	50
Powered-air purifying (PAPR) helmet type	(25-100)*	25	--	100
Powered-air purifying (PAPR) tight-fitting half mask	(25-100)*	50	--	100
Powered-air purifying (PAPR) tight-fitting full face mask	(25-100)*	--	--	100
Type C continuous-flow supplied air (half mask)	100	50	1 fiber/cc	100
Type C continuous-flow supplied air (full face or hood type)	100		1 fiber/cc	100
Pressure-demand Type C (full face respirator)	1,000		10 fibers/cc	1,000

*Note: Studies are currently underway by NIOSH and others to estimate the protection factors for PAPRs. Values supplied are conservative estimates for properly operated units.

3M studies of mil. dust PF 3 PAPR (Ahera):

6M 5370 - 5547

5th %ile 762 - 877

Slide

No. 46, Protection Factor

$$\text{Protection Factor} = \frac{\text{Outside Mask}}{\text{Inside Mask}}$$

No. 47, Protection Factors

Script

Note to Instructor: Stop and ask if the participants have any questions concerning an effective respirator program.

In the next few minutes, we will cover an extremely important topic ... Protection Factors. The protection factor or "PF" is a number (actually a ratio) obtained by dividing the concentration of a contaminant outside the mask by the concentration inside the mask. For example ... if a respirator has a PF (protection factor) of 10, this means the concentration of asbestos fibers would be reduced by a factor of 10 inside the mask. Therefore, if the concentration outside the mask is 2 fibers per cc, then the concentration inside the mask would be what? ... Right! 0.2 fibers per cc. We'll work some more on these problems, but first let's look at some typical protection factors for different types of respirators.

This slide illustrates protection factors assigned to different types of respirators determined by laboratory tests where concentrations of a test material (usually silica flour

Slide

Script

or DOP) were measured inside and outside the respirator. Protection factors actually will vary for each individual person. The better the "fit" of the respirator to the face, the higher the protection factor will be. For our purposes, we will use the numbers before you.

(Note to Instructor: Go through this slide slowly. Participants should be able to know these protection factors. Using an example of each type of respirator ... hold it up and ask the class for the approximate PF value.)

Now ... government agencies and academic types often debate "how clean is clean" when a project is completed. We don't have this luxury ... we have to do the job now or in the near future. So let's decide "how clean is clean" ... i.e., at what level (fiber count) do you permit unprotected people into the building after the project? Let me hear some numbers! (Note to Instructor: The most common number should be (usually) 0.01 fibers per cc.) OK ... not to get carried away debating this subject now, let's say the "clearance level" is 0.01 fibers/cc. Does anyone have any great difficulty with that?

Clean 0.01 f/cc
inside Resp - 0.01 f/cc

Slide

Script

Now ... what's the highest level you should permit INSIDE the respirator? Right! 0.01 fibers/cc.

Let's say we are doing a removal on a boiler which has 50% chrysotile and Amosite. Our air monitoring tells us the fiber count in the work area is 10 fibers per cc. What type of respirator should we use?

Note to Instructor: Using a chalkboard, step through the calculation.

$$PF = \frac{\text{concentration outside mask}}{\text{concentration inside mask}}$$

$$PF = \frac{10 \text{ fibers per cc}}{0.01 \text{ fibers per cc}}$$

$$PF = 1000$$

This means the protection factor of the respirator chosen must be 1000 or greater. What type of respirator has this much protection? Right! Type C has a protection factor of 1000 or 2000 depending on whether it is a half-mask or full face mask.

PT.

TX Tiner
RMC0035879

Slide

Script

Let's try a little different problem. Workers are doing a typical "wet and scrape" job in a high school. The personal air sampling results come back and show the airborne fiber concentration (outside the mask) is 2 fibers per cc. The workers are wearing dual cartridge half-mask air-purifying respirators. What is the fiber concentration inside the mask?

Remember...

$$PF = \frac{\text{concentration outside mask}}{\text{concentration inside mask}}$$

This equation can be rearranged so that:

$$\text{Concentration inside the mask} = \frac{\text{concentration outside}}{PF}$$

Remember ... the PF for a half-mask air-purifying respirator is 10. Then ...

$$\text{Concentration inside the respirator} = \frac{2 \text{ fibers per cc}}{10}$$

$$\text{Concentration inside} = 0.2 \text{ fibers per cc the respirator}$$

Is this a safe level? Probably not.

Note to Instructor: Participants often have a difficult time understanding the concept of

Slide

Script

protection factors. Additional examples may be needed.

THIS IS A GOOD TIME TO STOP FOR A FEW MINUTES, TURN ON THE LIGHTS, AND TAKE A SHORT (3-5 MINUTES) "STAND-UP" BREAK.

No. 48, Fit and Protection

The respirator must fit the wearer properly.
A good fit equals protection.

No. 49, Respirator Fit-Testing

There are two major types of fit-testing.
These are qualitative and quantitative fit-testing. Quantitative fit-testing involves measuring the concentration of some test material (such as corn oil) inside the mask while the user stands in a test booth which has a high concentration of the test material in the atmosphere. This is the best method, but is expensive and normally not used by asbestos abatement contractors.

The other type of fit-test is qualitative fit-testing. Irritant smoke is usually used to perform this test. We will discuss this further in a moment. Let's first look at positive and

Transparency - Where resp leaks

*99.97% for ASPA = 3,333 PF.
allows = 9.97% leakage around face piece
to face seal*

*Which resp have to be
fit tested under 1926-58
§55.502*

Slide

Positive test -
+ Neg test -
Not for Type C

No. 50, Negative Pressure Test

No. 51, Positive Pressure Test

No. 52, Negative Pressure, Full
Face Mask

No. 53, Positive Pressure,
Full Face Mask

Script

negative pressure fit tests. These are simple tests used every time a respirator (cartridge type) is put on. It cannot be used for Type C respirators.

The negative pressure test is performed every time the respirator is put on. The palms of your hands are placed over the filter cartridges (latex gloves may need to be used on certain models). The user then inhales. The respirator should collapse onto the face with no air leaks.

The positive pressure test is performed in a similar manner. The palm of the hand (or latex glove) is used to cover the exhalation valve while the worker exhales into the mask. The mask should "ride up" on the face with little or no leakage.

The negative pressure test may be performed on the full face mask as well.

... and the positive pressure test.

Slide

No. 54, Irritant Smoke Test

OSHA:
fit testing required only
for 1/2 mask air purifying
FF ~~is~~ required must fit QNT

Transparency on
comp of QNFT methods

OSHA says
6 mos

Script

The most common method of respirator fit-testing is the irritant smoke test. Wearing the respirator (full face or half mask air-purifying), the worker sits under a shroud. A clear 6 mil disposal bag-works well. With eyes closed, an irritant smoke is generated using a smoke tube and aspirator bulb. If the respirator leaks, the smoke will force an involuntary cough. The irritant smoke test is performed for each worker whenever issued a respirator, and annually thereafter (or whenever a different model respirator is issued).

Note to Instructor: If a workshop is not to be conducted which includes respirators, you may wish to pass out a number of respirators and have each participant perform each of the fit-tests including irritant smoke.

No. 55, Inspection and Maintenance

Just a reminder ... all respirators and associated equipment must be inspected and maintained. Equipment that becomes contaminated or broken will not provide the needed protection.

Slide

No. 56, Medically Capable

Script

Another reminder ... all employees must have a determination made that they are medically capable of wearing a respirator before they are issued one.

No. 57, Make Sure ...

The right respirator for the job...
Fit and test before each use...
Care for the respirator properly.

No. 58, Protective Clothing

Let's spend the next few minutes talking about protective clothing.

Why do we need to wear protective clothing?

The clothing is used primarily to keep gross contamination off the body, hair, etc. Asbestos abatement work is dirty work by its nature. Besides asbestos, there may be other fibers (fiberglass, mineral wool) and binders (cement) to irritate the skin. A 2 or 3 minute shower is not going to be sufficient to remove all the asbestos from the body if protective clothing is not worn.

What is the proper sequence for putting clothes on? First, all street clothes are removed. A tight-fitting bathing suit (prefer-

Slide

Script

ably nylon) may be worn beneath the protective clothing. The disposable coveralls are put on. If the booties are not attached, these go on next and are taped at the ankles. The wrists are then taped to keep material from falling into the opening here. Finally, the respirator is put on and the hood put on over the respirator straps. We'll talk about the sequence to exit the work area in a few minutes.

What types of protective garments are available? In this type of work, there are basically two types of disposable clothing. These are breathable and non-breathable. Both cost approximately \$2.00-2.25 each. The breathable fabrics are recommended for use on projects where heat stress might present a problem.

Other Protective Equipment? Besides disposable clothing, you will need some form of foot protection. In many situations, slip-on deck shoes with non-skid soles will work fine. You may need greater protection in a boiler room for example. In these cases, steel-toed or

Slide

Script

steel shank, all rubber boots are available. These items should be left in the work area each day. Deck shoes are about \$7-8.00 per pair and can be thrown out at the end of the project as asbestos-containing waste. Other protective equipment might include a hard hat, goggles, and cotton or leather gloves.

No. 59, Worker Dressed-Out

Here is a worker dressed-out in disposable coveralls with attached hood and booties (not visible). This particular brand of coverall has strong elastic at the wrist ... tape should still be used. Note how the respirator straps are not visible and the eye protection afforded by the Type C full face respirator.

No. 60, Training

Just as we will do in a few minutes, have each employee dress and undress outside the work area. Some contractors have their workers wear disposable clothing and respirators during their training sessions so the employee becomes accustomed to it.

No. 61, Taped Ankles

Here we see the tape used at the ankles to secure the booties to the legs of the disposable coveralls.

Slide

No. 62, Disposing of Clothing

Script

In this slide we see the worker immediately outside the decon shower undressing. The disposable clothing is removed, but the respirator remains ON. The respirator is only removed in the shower after he has washed thoroughly ... including his hair and fingernails (a brush works well to clean the fingernails).

Note to Instructor: Have each class participant dress-out putting the disposable clothing on over their street clothes. This exercise may be eliminated if it is to be done in a workshop setting.

BE SURE TO ALLOW SUFFICIENT TIME FOR ANY AND ALL QUESTIONS. NO QUESTIONS REGARDING WORKER SAFETY OR HEALTH SHOULD REMAIN UNANSWERED.