Radiological Respiratory Training
RRT 010

TVA NPG

NUCLEAR TRAINING
TRAINING MATERIALS COVERSHEET

GENERAL EMPLOYEE TRAINING
PROGRAM

RADCON INITIAL AND RETRAINING	**RRT010**
COURSE	COURSE NO.

RADIOLOGICAL RESPIRATOR TRAINING	**RRT010**
LESSON TITLE	LESSON PLAN NO.

INPO ACCREDITED	YES		NO	**X**
MULTIPLE SITES AFFECTED	YES	**X**	NO	

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NUCLEAR TRAINING

REVISION/USAGE LOG

REVISION NUMBER	DESCRIPTION OF CHANGES	DATE	PAGES AFFECTED	REVIEWED BY
0	New lesson plan to coincide with implementation of CBT GET. Lesson material follows guidance of ACAD 93-009. Training Process Comment: This LP is primarily for CBT use. The standard format requirements are waived for "user friendly" purposes.	01/12/96	All	J.R. Waldrep N. E. Scott
	Corrected errors in review exercises and answer sheet.	02/28/96	22,24	N. E. Scott
	Added references.	04/12/96	2,3,25a	N. E. Scott
	Editorial corrections and clarifications.	Effective 11/01/96	2,4,14,18,20,23	N. E. Scott
1	Lesson plan revised to implement Windows Based CBT Program. This LP may be utilized for self-study, classroom lecture or CBT. Note: items contained in brackets are Not contained in CBT program.	05/20/97	All (1-30)	
2	Lesson plan revised to incorporate change request received since revision 1 and to incorporate 10CFR20 changes.	Effective 2-4-00	All	Sarah Reed
3	Revised to include 10CFR20.1703(f) details concerning the requirement for standby rescue persons and to include additional inspection criteria for supplied air respirators	Effective 2-9-04	All	Tom Shirley
4	Changed description of filters on air purifying respirator. Added statement on protection factors for full face respirator and bubble hood. Enhanced summary information on assigned protection factors, industry events and human performance tools.	Effective 05/08/06	2, 6, 9, 15, 20, 22	Tom Shirley

TRAINING AIDS:

A. Computer (for CBT)

B. Air-Purifying Respirator (optional for initial training)

C. Powered Air-Purifying Respirator with Full Facepiece

D. Powered Air-Purifying Respirator with Tyvek Hood

E. Air-Supplied Respirator with Regulator

F. Manifold with Personnel Hoses

G. Bubble Hood

H. Spider Glasses

I. White board with Markers (optional for initial training)

TRAINING MATERIALS:

Attachment 1- Optional Performance Check Sheet (for initial training)

REFERENCES:

A. 10CFR20, "Standard for Protection Against Radiation", 2000

B. ANSI Z88.2, "Practices for Respiratory Protection", Mine Safety and Health Administration, U.S. Department of Labor, 1980

C. ANSI Z88.2, "American Standard for Respiratory Protection", 1992

D. NUREG 0041, "Manual of Respiratory Protection Against Airborne Radioactive Materials", USNRC, 10/76

E. ACAD 00-007, "Guidelines for Radiation Worker and Radiological Respiratory Protection Training", 04/00

F. Nuclear Power Training Manual TRN-2, "General Employee Training", Revision 12

G. OE16368 - "Airline Breathing Hood Fitting Disconnects Unexpectedly"

H. OE16239 – "Separation of Air Line Coupling on Supplied Air Hood"

I. Canada 851-030415-1 – "Wearing A Beard Under A Protective Mask"

new screen

INTRODUCTION

Upon completion of this presentation, participants shall acknowledge understanding of the engineering controls and work practices to minimize airborne radioactivity, methods for monitoring and recording exposure from airborne radioactivity, and principles of respiratory devices. Understanding of the Radiological Respirator Program will be achieved by passing a written exam with a score of ≥80%. Initial Training participants shall be required to complete a practical exercise for inspecting, donning, performing a negative pressure test and removing a respiratory device. Failure to achieve an 80% or greater on the exam will eliminate your ability to be issued a respirator.

This lesson plan may be utilized for self-study, classroom lecture, or Computer Based Training (CBT).

Screen raobj

OBJECTIVES

State the purpose of the Radiological Respiratory Protection Program.

State the qualification requirements that must be met prior to using a respirator.

State the purpose of a Fit Test.

Screen raobj1

State the factors that can affect the fit of a full-face respirator.

State when a negative pressure test is required.

Identify the primary methods used to control airborne radioactivity.

Screen raobj2

Explain the mechanism for selection of the appropriate type of respirator.

Describe the procedure for issue and return of respirators.

Describe how to perform pre-operational checks and don, test, operate, and remove required respiratory protective equipment for each type of respirator the student will be qualified to use.

screen raoIntro

RADIOLOGICAL RESPIRATORY PROGRAM

The Radiological Control (RADCON) group monitors three types of radiological hazards. These hazards are radiation, contamination, and airborne radioactivity.

Screen raointro1

This part of your training will focus on ways you will be protected from exposure to airborne radioactivity during your employment at this nuclear plant. Although airborne hazards like asbestos and toxic chemicals can be encountered, this course will concentrate on protection from airborne radiological hazards. There are many jobs that can cause radioactive material to be suspended in air. Utilities are required to maintain personnel exposures “as low as reasonably achievable” (ALARA). To achieve this goal, controls for limiting the inhalation or ingestion of radioactive materials may need to be invoked to ensure that the total risk to workers from internal and external radioactive material is ALARA.

Screen raointro2

This course will discuss the methods in place for controlling exposure from inhalation and ingestion pathways. A major part is wearing respiratory protection equipment. Part of this course will involve familiarization with the equipment you may be asked to wear. Other parts of the program include monitoring the air to determine the need for respiratory protection, use of engineering controls and work practices to minimize airborne radioactivity and recording each worker's exposure to airborne radioactivity.

Anytime that a respiratory protection device is used, workers should be conservative in their decision making. Unexpected radiation exposure can occur if the equipment is used improperly or fails to function properly.

When working in groups, utilize peer checking to ensure that your protective equipment is being worn correctly and that everyone in the group understands the scope of the work and any actions to take if respiratory equipment malfunctions or team members can not complete their assigned task.

When working alone, have someone ensure you are wearing your protective equipment correctly, prior to entering the work area.

Utilize the 2 minute rule prior to entering the work area to ensure you are entering the correct area and that you are wearing the correct respiratory equipment for the area and the job.

Screen purposea

Purpose of the Radiological Respiratory Program

State the purpose of the Respiratory Protection Program.

The Radiological Respiratory Protection Program is required by federal law and its primary goal is to limit the inhalation of airborne radioactive contamination. Using a respirator is just one technique available to protect workers.

Screen purpose1

Our program also takes advantage of engineering controls, which will be covered later in this course. Air monitoring is also an important part of our program. Airborne contamination is usually identified by continuous air monitors (CAMs) located throughout the plant or by routine and job specific air samples performed by or under the direction of RADCON.

Respirators may also be used for protection against non-radioactive gases, vapors, and particulate contaminants.

Screen purpose

Using a RESPIRATOR is one way to protect ourselves from inhaling contaminants such as airborne radioactive material. Let's look at the type of respiratory hazards faced in a nuclear plant.

screen HazClas1

Classification of Hazards

There are TWO types of respiratory hazardous atmospheres:

Oxygen deficient

Gas, vapor and particulate contaminants

screen HazClas2

OXYGEN DEFICIENT

Normal oxygen content in air is about 21%

<19.5% = Oxygen Deficient

Oxygen levels LESS THAN 19.5% are considered to be oxygen deficient.

Screen HazClas3

Physiological effects of oxygen deficiency are:

- Increased breathing
- Very faulty judgment
- Very Poor muscular coordination
- Nausea
- Vomiting
- Unconsciousness
- Spasmodic Breathing
- Convulsions
- Death within minutes

screen HazClas3a

NONE of the respirators described in this training course are approved for use in oxygen-deficient atmospheres or any other environments that are immediately dangerous to life and health (IDLH). Only a self-contained breathing apparatus (SCBA) may be used in such cases and training on the use of such equipment is covered in a SEPARATE COURSE.

Screen HazClas4

GAS VAPOR, AND PARTICULATE CONTAMINANTS

Gases and vapors or particulate contaminants such as dusts, fumes, mist, smoke, and sprays are examples of this type of hazard.

Screen HazClas5

Gases or particulates may be radioactive or non-radioactive.

Concentrations of non-radioactive gases and particulates in air are compared to Threshold Limit Values (TLV).

Concentrations of radioactive gases and particulates are compared to Derived Air Concentration (DAC).

Screen HazClas5a

Airborne radioactive material, once breathed into the body, results in internal exposure. Particulate contamination is made up of tiny particles which travel freely through the air. Since the particles are denser than air, they tend to settle out over time. The particles may easily become airborne again if agitated through such activities as welding, burning, or grinding. Gaseous contamination mixes easily with air and does not settle out. It will usually remain evenly mixed at all times.

Screen HazClas6

CLASSIFICATION OF CONCENTRATIONS

Threshold Limit Values (TLV)

Derived Air Concentration (DAC)

Screen HazCl6a1

Threshold Limit Values (TLVs)

The TLV is the maximum amount of a NON-RADIOACTIVE substance in the air to which it is believed that nearly all workers may be exposed day after day WITHOUT ADVERSE health effects.

Screen HazCl6a2

Adverse health effects ABOVE the TLV range from mild irritation to death.

Screen HazCl6a3

Specific adverse health effects can be determined using the Material Safety Data Sheet for the substance.

Screen HazCl6b1

Derived Air Concentration (DAC)

The concentration of airborne radioactivity is expressed in Derived Air Concentration (DAC). If you breathed airborne radioactivity at a concentration of 1 DAC for 40 hours per week, 50 weeks per year, you would get 2000 DAC-hrs maximum allowed intake of radioactivity in your body. This maximum allowed intake is officially called the Annual Limit on Intake (ALI). The DAC and ALIs for the different isotopes of radioactive material are found in 10CFR20. Tritium represents both external and internal exposure by inhalation and absorption. If material is absorbed it is tracked by DAC-hrs. also.

Screen HazCl6b3

DAC-hours are the product of the number of DAC and the time of exposure in hours.

If a worker was in a room at 3 DAC of a radioactive gas, staying in that room for 2 hours would result in 6 DAC-hours of exposure.

Screen HazCl6b4

Radiation EXPOSURE to airborne radioactive materials is measured in DAC-hours.

Screen HazCl6b5

Things to Remember:

2000 DAC-hr = 5 rem (Committed Effective Dose Equivalent, CEDE)

1 DAC-hr = 2.5 mrem.

Screen HzCquiz

QUESTION: Radiation Exposure to airborne radioactive materials is measured in:

MPC-hours or DAC-hours

Screen HzCquizC

ANSWER: DAC-hrs. DAC-hrs are used to measure exposure to airborne radioactive materials.

Screen QualReq

Qualification Requirements

State the qualification requirements that must be met prior to using a respirator.

Prior to using a respirator, all radiation workers must be QUALIFIED. To qualify as a respirator user, individuals must successfully complete the following:

Screen QualReq1

MEDICAL EVALUATIONS

Medical evaluations are performed to ensure the worker is physically fit to perform work in a respirator. The code given to this type of medical evaluation is S-3. An S-3 medical clearance is based upon routine physical stress. An S-3 medical clearance is required annually for those workers qualified to wear the respirators addressed in this lesson.

Screen QualRe1a

TRAINING

Must complete this training as well as Radiation Worker Training. Retraining in both courses is required annually.

Screen QualRe1b

FIT TEST

Fit testing ensures a snug facial seal can be maintained while wearing the various mask-type respirators used. Loose fitting respiratory devices do not require a fit test. The radiological fit test is required annually. The respirator fit test for asbestos workers is required semi-annually.

Screen QualRe1b

WHOLE BODY COUNT

Performed to establish a baseline for how much radioactive material is present.

Screen QuRquiz

QUESTION: A fit test must be performed prior to becoming qualified to use a full facepiece respirator.

True or False

Screen QuRquizC

ANSWER: True. A fit test is required before using a full facepiece respirator.

Screen FitTest

Purpose of a Fit Test

State the purpose of a Fit Test.

Part of this qualification requires performance of a fit test. The fit test determines the size that aids in worker comfort and ensures the proper seal can be attained by respirator users.

To avoid excessive leakage into the respirator, anything that could interfere with or break the facial seal must be prevented. There are several factors that can affect the seal or fit.

Screen FitFact

FACTORS AFFECTING SEAL OR FIT

State the factors that can affect the fit of a full-face respirator.

Facial Hair:
Workers needing a fit test must be clean shaven and allow no facial hair to come between the mask's sealing surface and the skin.

On 15 April 2003 at Gentilly Unit 2 in Canada, it was discovered that an operator had received a committed tritium dose of 94 mrem over the period from March 6 to April 30, while performing maintenance on the fueling machine. The tritium concentration in air was greater than 5 MPC and it increased at various times because of heavy water spill problems. This operator wears a beard, which is in violation to the Radiation Protection Procedures. He worked over 40 hours of overtime during the period. Wearing a mask with a beard was the main cause of the committed dose.

Screen FitFact2

Unusual Facial Features:
Large scars or prominent bone structure could affect the fit of a full face respirator. Full dentures do not interfere with the seal area but can alter facial structure. If the fit test is conducted with full dentures in place, then the dentures must be worn thereafter when using a full facepiece respirator.

Screen FitFact3

Corrective Lenses:
The temple bars on glasses will interfere with the seal of a full face respirator.

Screen FitFact4

Prescription lenses in special mounting frames (spider glasses) or contact lenses must be used inside the respirator. The respirator user is responsible for obtaining spider glasses through his/her supervisor.

Some safety equipment and protective clothing such as hard hats, face protection, welding goggles, and surgeon or skull caps can interfere with the seal area.

You are required to have the appropriate corrective eyewear during your fit test.

Screen FitFreq

A fit test should be performed once per year or whenever there have been changes that could affect the mask fit caused by situations such as:

Screen FitFreq1a

▷ Significant changes in body weight

Screen FitFreq1b

▷ New facial scars

Screen FitFreq1c

▷ Facial, oral, or dental surgery

▷ Damage to the ear drum

Screen FitFreq1d

Or any other condition that has resulted in a change to the facial structure.

Screen Fitquiz

QUESTION: One advantage of a full face respirator is that facial hair will not affect the facial seal.

True or False

Screen FitquizC

ANSWER: False. Hair can indeed affect the facial seal of a full face respirator.

Screen NegPress

Negative Pressure Test

State when a negative pressure test is required.

One other type of test that must be performed PRIOR TO EACH USE of a full face respirator is the negative pressure test. To perform this test:

Screen NegPre1a

▷ cover all inhalation openings to the mask

Screen NegPre1b

▷ gently inhale with the mask on

Screen NegPre1c

▷ hold your breath for about 10 seconds

Screen NegPre1d

▷ the mask should stay collapsed toward your face

Screen NegPres2

If leakage is detected, the following steps should be taken:

Screen NegPres2a

▷ re-snug one or more straps

Screen NegPres2b

▷ re-adjust the mask

Screen NegPres2c

▷ re-perform the negative pressure test

Screen NegPres2d

If the mask will not pass this test, consult with RADCON!

Screen objecap

Recall the objective of our respiratory protection program: to LIMIT the inhalation of airborne contaminants.

The negative pressure test is required prior to entering any area requiring the use of a respirator. This test ensures the respirator is properly sealed.

Screen ContMeth

Control Methods

Identify the primary methods used to control airborne radioactivity.

According to Federal Regulations, engineering and process controls shall be the primary method used to control airborne radioactivity.

Screen ContMet2

Examples of engineering and process controls:

Screen ContMe2a

- filtered ventilation (HEPA filters)

Screen ContMe2b

- isolation by tents and containments

Screen ContMe2c

- posting areas to keep unauthorized personnel out

Screen ContMe2d

- decontamination of equipment and work areas

Screen ContMe2e

- preplanning of work

Screen ContMe2f

- wetting of equipment or materials to be worked

Screen ContMet3

After every reasonable effort has been made to apply engineering and process controls to limit airborne contamination, other precautions such as increased surveillance, limiting work time, using respirators shall be employed.

Screen ContMet4

Respiratory protection equipment may be used while engineering controls are being evaluated or instituted.

Screen RespSel

Respirator Selection

Respirator selection for air supplied, full face, bubble hood, positive pressure or negative pressure is contingent on the type of respiratory hazard and job related factors.

Screen RespSel2

Type of Respiratory Hazard

Explain the mechanism for selection of the appropriate type of respirator.

- gas, vapor, particulate contaminants (radioactive or non-radioactive)

Job Related Factors

- external dose rates in the work area
- environmental conditions
- assigned protection factor of the respiratory device

Screen RespSel3

After consideration of the factors that determine respirator selection PLUS consideration of the type of work to be accomplished, RADCON will then decide whether respirators will be used or not and which type.

Screen RespSe3a

This will be indicated on the Radiation Work Permit (RWP). Workers MUST review the RWP prior to working in the area. It is recognized that working in respirators reduces workers efficiency by as much as 25%, thereby increasing time spent on a job and exposure to external radiation.

Screen RespSe3b

Respiratory equipment will be issued and used consistent with maintaining the total exposure from internal and external sources ALARA and when air monitoring indicates engineering controls or work practices have proven inadequate or have been used to the fullest extent practical.

Screen RespSe3c

An important rule of thumb is "a rem is a rem is a rem." This means that one rem of external exposure is no different form one rem of internal exposure as far a biological risk is concerned.

Screen RespSel4

An area will be posted as an "Airborne Radioactivity Area" if the level of airborne radioactivity is greater than or equal to 30% of the DAC value. A respirator is NOT ALWAYS used for entry into a posted airborne area. It is used only if its use will MINIMIZE OVERALL RISK TO THE WORKER.

Screen Respl_l

Respirators are obtained at the RADCON issue station.

Screen Respl_2

Respirator Issue & Inspection

Describe the procedure for issue and return of respirators.

RADCON will verify you are QUALIFIED prior to issuance and that you are CLEAN SHAVEN (if a mask is requested). You will be required to wear the corrective eyewear that you wore during your fit test.

Screen Respl_l2

If everything is in order, RADCON will issue you the proper respirator. It is the responsibility of the individual requesting the respirator to inspect the equipment prior to use.

Screen MaskInsp

<u>AIR PURIFYING RESPIRATOR INSPECTION</u>

The following steps are necessary for the proper inspection of an air purifying respirator:

Screen MaskIns3

Ensure the respirator has a smooth sealing surface and check for missing or broken parts. Check the rubber parts (especially the straps) for deterioration.

Screen MaskIns4

Check the facepiece for cracks or scratches that may impair vision. NEVER remove or adjust the filter canisters.

Screen MaskIns5

Hold the respirator up to your face and get a good seal. Breathe in and out several times ensuring proper operation. Finally, perform a negative pressure test. Report any discrepancies or damaged respirators to RADCON.

Screen PAPRIns1

<u>POWERED AIR PURIFYING RESPIRATORS (PAPRs) INSPECTION</u>

The following steps are necessary for the proper inspection of a powered air purifying respirator:

<u>Using Full Face Respirator</u>

- Check for any abnormalities with the belt, blower assembly, and breathing tube.
- Perform the same checks as for the air purifying respirator.

Screen PAPRIns2

Using a Tyvek hood (SQN and WBN only)

- Check for any abnormalities with the belt, blower assembly, and breathing tube.

Screen PAPRInsa

- Check the Tyvek hood for rips and tears, inspect the breathing tube connection point-o-ring, and ensure the hood has an installed head band.

Screen PAPRIns3

AIR SUPPLIED RESPIRATORS INSPECTION

The following steps are necessary for the proper inspection of an air -supplied respirator:

- Perform the same checks as for the air purifying respirator.
- Inspect the hose.

Screen Bubbln2b

The following steps are necessary for the proper inspection of a Bubble Hood respirator:

- Check the hood for rips and tears.
- Check the belt for abnormalities.

Screen RespInsp

If any problems are discovered, return the respirator to RADCON, describe the problem, and get another respiratory device. DO NOT USE A DAMAGED OR MALFUNCTIONING RESPIRATOR!

Screen Respquiz

QUESTION: It is not necessary to inspect an air purifying respirator prior to use since RADCON performs inspections prior to issuance.

True or False

Screen RespquizC

ANSWER: False. It is necessary to inspect respiratory devices prior to use, even if RADCON performed an inspection before issuance.

Screen ResDon

Respirator Donning

Describe how to perform pre-operational checks and don, test, operate, and remove required respiratory protective equipment for each type of respirator the student will be qualified to use.

Air Purifying Respirator

&

Air Supplied Respirator

Screen ResDon1

AIR PURIFYING RESPIRATOR

The next few steps illustrate what will be involved in the donning process.

Screen ResDon1a

Step1. Loosen the straps all the way out and fold them back over the facepiece. Then place your chin in the chin rest.

Screen ResDon1b

Step2. Pull straps back over your head, making sure that hair and protective clothing is out of the seal area.

Screen ResDon1c

Step3. Straighten the respirator on your face.

Screen ResDon1d

Step4. While holding the mask against your face, tighten the lower (chin) straps first. Tighten the middle (temple) straps next and tighten the upper (head) strap last. The mask should fit firmly, but not tight enough to leave deep indentations on your face.

Screen ResDon1e

Step5. Perform a negative pressure test before entering the area.

Screen ResDon1f

If the mask does not pass the negative pressure test, return it to the respirator issue point and report the problem.

Screen ResDon1g

POWERED AIR PURIFYING RESPIRATOR (PAPR)

Using Full Face Respirator

Place the support belt around the waist and adjust for comfort. Don the facepiece in the same manner as described before. Connect the breathing hose after the satisfactory negative pressure test. Turn the blower switch on and let the air flow through the breathing tube for a few seconds before hand tightening the breathing tube to the facepiece.

Screen ResDon1h

Using Tyvek Hood (SQN and WBN)

- Remove the head band from the Tyvek hood, adjust the band around the head for a snug fit. Then reinstall in hood.
- Secure breathing tube to the hood connection point.
- Turn the blower assembly on and allow air flow to the hood for a few seconds.

Screen ResDon1i

- Grasp the hood collar and pull over the head. Adjust the hood as necessary.
- Flatten and smooth out the bibs of the hood. Never insert the bibs within the coveralls.

Screen ResDon1j

- Obtain assistance and have bibs taped down to the back/shoulder/chest using a cross-the-heart taping pattern.

Screen ResDon2a

AIR SUPPLIED RESPIRATOR

Using Full Facepiece

- Connect the flexible hose to the respirator and don the mask.
- Perform a negative pressure test.
- Connect the flexible hose to the manifold hose.
- Adjust the flow control valve until the air flow is comfortable.
- Inspect all couplings and fittings for tightness.

Screen ResDon2

Bubble Hood Respirator

RADCON or laborers will assist in donning a Bubble Hood and assure that it is connected to an approved breathable air source.

On April 23, 2003, a worker performing Control Rod Drive Mechanism replacement activities at Hope Creek lost air to his supplied-air respirator (bubble-hood) when one of the fittings unexpectedly became disconnected. The worker successfully exited the area in accordance with contingency plans discussed at the pre-evolution briefing. Preliminary investigation revealed that the fitting became disconnected due to physical contact with the individuals clothing or surrounding environment.

On May 13, 2003, reactor head penetration inspections were being performed during a scheduled refueling outage at St. Lucie Unit 2. At approximately 0240, a worker wearing a Nuclear Power Outfitters supplied air hood was performing tasks in a lay down area (on the outside of the reactor head) and experienced a loss of air supply to the hood. Radiation protection personnel responded and quickly removed the hood. The worker was not injured. A subsequent investigation revealed that the quick connect coupling on the supply air line had unthreaded from the valve body.

Screen R_R

Respirator Removal and Return

Describe how to perform pre-operational checks and don, test, operate, and remove required respiratory protective equipment for each type of respirator the student will be qualified to use.

Air Purifying Respirator

&

Air Supplied Respirator

Screen R_R1a

AIR PURIFYING RESPIRATOR

Step1. Exit the area.

Screen R_R1c

Step2. Bend at the waist and grasp the speaking diaphragm being careful not to touch your skin.

Screen R_R1d

Step3. While bent at the waist, pull respirator down, out, and away from your face.

Screen R_R1e

Step4. Place used respirators in the hampers designated for respirators at the step-off pad.

Screen R_R1f

If using the PAPR will full facepiece respirator:

- Turn the blower off.
- Disconnect hose from the facepiece.
- Remove respirator as described before.

Screen R_R1g

The only respiratory protection equipment removed from the areas of use and carried to RADCON are powered air motor blower assembly and breathing tubes from PAPR units. These are bagged and removed from contamination zones in a manner similar to removing other potentially contaminated equipment from contamination zones.

Screen R_R1h

Removal of a PAPR using a Tyvek Hood:

- Assistance is required for removal.
- Assistant will remove tape from the hood, turn the blower assembly off and disconnect the breathing tube from the hood.

Screen R_R1i

- Wearer will bend at the waist while the assistant folds the bib over the head, then grasping the hood at the top, pulls the hood straight out and away from the head. Dispose of the hood.

Screen R_R2

AIR SUPPLIED RESPIRATOR

Air Supplied With Full Facepiece Respirator

- Disconnect the flexible hose from the manifold hose.
- Lean forward and remove the facepiece, grasping the area where the hose is attached to the respirator.
- Take care not to contaminate the hose connections. Bag the connections and hang the end of the hose up. Do not leave it on the contaminated surface.

NOTE: Standby rescue persons are required whenever one-piece atmosphere supplying suits or any combination of supplied air respiratory devices and personal protective equipment are used from which an unaided individual would have difficulty extricating himself or herself. The standby person must be equipped with respiratory protection devices or other apparatus appropriate for the potential hazards. The standby rescue person shall observe or otherwise maintain continuous communication with the workers (visual, voice, signal line, telephone, radio or other suitable means) and be immediately available to assist them in case of failure of the air supply or for any other reason that requires relief from distress. A sufficient number of standby rescue persons must be immediately available to assist all users of this type of equipment and to provide effective emergency rescue, if needed.

Screen R_R2b

Bubble Hood Respirator

- RADCON or laborers will assist in removal of a bubble hood
- Use caution not to contaminate the end of the supply line.
- Dispose of the bubble hood in the proper waste receptacle.

Screen R_R3

Remember, any respirator damaged during use must be reported to RADCON.

Screen summary

SUMMARY

- Radiological respiratory protection program purpose: to limit the inhalation of airborne radioactive contamination consistent with maintaining the total exposure to personnel from internal and external radioactivity ALARA.
- Respirator hazards may be classified as either oxygen deficient or gas, vapor and particulate contaminants.

Screen summary1

- Concentrations of non-radioactive gases and particulates in air are compared to Threshold Limit Values (TLV). Concentration of radioactive gases are compared to Derived Air Concentration (DAC).

Screen summary2

- To be qualified to wear a respirator for radiological purposes, three items must be completed annually: medical evaluation, training, and a fit test.
- A fit test is performed to ensure a good seal can be maintained between the face and mask.
- Facial hair, unusual facial features, and temple bars on standard glasses will affect the seal or fit of a full face respirator.

Screen summary3

- A negative pressure test is performed prior to each use of a full face respirator.
- Engineering and process controls are used first, and only as a last resort are respirators used.
- The type respirator selected for a job depends on the type of respiratory hazard, the job related factors, and the type of work to be performed.

Screen summary4

- If the RWP requires a respirator, go to the issue point and obtain the device.
- Inspect ALL respirators prior to use.
- Follow plant guidelines when donning respiratory devices.
- If a respirator does not pass the negative pressure test, return it to the respirator issue point and report the problem.

Screen summary5

- Laborers or RADCON will assist the user in donning bubble hoods.
- Respirators damaged during use must be reported to RADCON.
- PAPR blower assembly and breathing tubes must be returned to RADCON. Bubble hoods are disposed of after use.

Screen obj1

RESPIRATOR OPERATION

Objectives

- Define “assigned respirator protection factor”.
- Describe the basic operating principles of an air purifying respirator.
- Define the general application of an air purifying respirator, and state the limitations of its use.

Screen obj2

- Describe the basic operating principles of an air-supplied respirator.
- Define the general application of an air-supplied respirator and state any limitations of its use.
- State the actions to be taken if a respirator malfunctions or if physical or psychological distress occurs while wearing a respirator.

Screen respop

Assigned Protection Factor

In this section of the course, information will be provided on the basic principles of respirator operation.

Screen profact

Define "respirator assigned protection factor".

The degree of protection provided by a respirator is called the assigned protection factor (APF):

$$\text{Assigned Protection Factor} = \frac{\text{Outside Concentration}}{\text{Inside Concentration}}$$

Screen profacta

The assigned protection factor of a respirator is based upon laboratory leakage studies and field experience. Assigned protection factors for all types of respirators are found in the Code of Federal Regulations.

Screen profact1

Assigned Protection Factor for Supplied Air with Full Face Respirator = 1000

Assigned Protection Factor for Bubble Hood = 1000

Screen pfexmpl1

For example

A worker wearing a respirator with an assigned protection factor (PF) of 1000 will breathe 1/1000 of the concentration of contaminants that exist outside the respirator.

The higher the assigned protection factor, the better the respirator is at protecting the user from radioactive materials.

Screen aprd1a

Operating Principles of Air Purifying Respirators

Describe the basic operating principles of an air purifying respirator.

The air purifying respirator is the most commonly used respirator. This respirator has twin canisters that filter the air containing airborne contaminants. This type of respirator CANNOT be used on IDLH (IDLH means Immediately Dangerous to Life or Health) atmospheres.

Screen aprd1b

Air flows in through the filters and is exhaled through an exhaust valve located in the mask.

Screen aprd2

Air purifying masks are either NEGATIVE PRESSURE or POSITIVE PRESSURE respirators.

Screen aprd3

In NEGATIVE pressure mode, breathable air is fed into the mask by the user INHALING. In this mode, any leakage will be INTO the mask, since it's at a lower pressure than the surrounding air.

Screen aprd4

In the POSITIVE pressure mode, breathable air is drawn through a filter and fed into the mask by a battery powered blower.

In this mode, a slight positive pressure is maintained inside the face piece, usually leakage will be into the surrounding atmosphere, NOT into the respirator.

Screen apra1

Air Purifying Respirators Advantages

Define the general application of an air purifying respirator, and state the limitations of its use.

Air purifying respirators are lightweight and they are easy to put on and take off. PAPRs provide some facial cooling and are less likely to fog.

Screen apra2

Mobility is not restricted.

Screen aprdis1a

Air Purifying Respirators Disadvantages

Cannot be used in IDLH environments.

Screen aprdis1

Can become plugged and cause difficulty in breathing.

Screen aprdis2

In-leakage can occur if face-piece seal is broken or cartridge gaskets are damaged on a negative pressure respirator. PAPRs cannot be used in an explosive or potentially explosive atmosphere. Should not be used at temperatures less than 40 degrees F because cold will shorten the life span of the battery.

Screen aprdis3

- Once the battery discharges or power is turned off on positive pressure respirators (PAPR), they revert back to negative pressure mode of operation.
- Air purifying respirators (both negative pressure and PAPR) do not provide protection from radioactive gases.
- Air purifying respirators may increase work time, thereby increasing the potential dose.
- PAPRs usage is limited to length of charge on battery pack.

Screen aprdid

Did you know…

- Negative pressure air purifying respirators provide an assigned protection factor of 100 when used with particulate filters.
- Positive pressure respirators (PAPR) provide an assigned protection factor of 1000 with the blower motor running.

Screen asr1

Operating Principles of an Air Supplied Respirator

Describe the basic operating principles of an air-supplied respirator.

Portable air compressors supply breathing air which is fed through a manifold and hoses. The high pressure hose used to connect the service air to the breathing air manifold is white at SQN and WBN and red at BFN. The quality of the air used for breathing is checked periodically.

Screen asr1a

The respirator operates in a CONTINUOUS FLOW mode, which results in positive pressure inside the respirator. Any leakage will be into the surrounding atmosphere, NOT into the respirator.

Screen asr2

An air supplied respirator can be either a mask type or a bubble hood.

Screen asr3

A bubble hood is a loose-fitting enclosure that covers the head, neck, and entire shoulders. Breathable air flows into the hood and out from the gathered aprons below the arms and around the chest.

Screen asrad

Air Supplied Respirators Advantages

Define the general application of an air-supplied respirator and state any limitations of its use.

- Bubble hoods can be worn by workers who cannot wear tight fitting face pieces due to facial abnormalities or eye glasses.
- Positive pressure due to continuous flow mode greatly reduces in-leakage concerns.
- Increased assigned protection factor of 1000 with full face respirator and 1000 with bubble hood.
- Maximum protection from radioactive particulates and gases and some facial cooling.

Screen asrdis1

Air Supplied Respirators Disadvantages

Mobility can be restricted to the length of the air hose.

Screen asrdis2

Air hoses can become kinked, damaged or tangled.

Screen asrdis3

The wearer is dependent upon an external source for air. The air supplied respirator may not be used in atmospheres that are immediately dangerous to life and health. Also, the wearer may be "tricked" into thinking that he/she is cool when in fact he/she is overheated.

Screen rp1

Respirator Problems

State the actions to be taken if a respirator malfunctions or if physical or psychological distress occurs while wearing a respirator.

All respirators are periodically inspected; however, there is always a chance of failure or other problems. Symptoms include…

Screen rp1a

- Procedural or communication failure.

Screen rp1b

- Unusual odor or taste.

Screen rp1c

- Leakage or any equipment malfunction.

Screen rp1d

- Irritation

Screen rp1e

- Significant deterioration of operating conditions.

Screen rp2

- Difficulty in breathing.

Screen rp2a

- Inhalation of extremely hot air.

Screen rp2b

- Any feeling of nausea or dizziness.

Screen rp2c

- Physical/psychological distress (for example, claustrophobia) or any other condition that might require relief.

Screen rp3

- Breaks from respirator use should be discussed among workers, supervisors, and RADCON before entering the work area.
- If respirator relief is required, leave the area immediately, and properly remove the respirator

Screen rp4

- If a respirator failure or sickness occurs suddenly, properly remove the respirator, leave the area immediately, and notify RADCON. Recall that an atmosphere containing airborne contaminants is NOT immediately dangerous to life or health. The few seconds it takes for individual to exit the area without a respirator will not be hazardous to their health.

Screen rrpsum

SUMMARY

- Assigned protection factor is the degree of protection provided by a respirator.
- Air purifying respirators are light in weight and do not restrict mobility.
- In a negative pressure respirator, air is fed into the mask by the user inhaling.
- Negative pressure air-purifying respirators provide an assigned protection factor of 100. Positive pressure air-purifying respirators (PAPRs) provide an assigned protection factor of 1000 (SQN assumes 100). PAPRs operating under a negative pressure utilize an assigned protection factor of 100.

Screen rrpsuma

- With a positive pressure respirator, air is drawn through filters and fed into the mask by a battery powered blower motor. This causes the pressure inside the face piece to be slightly greater than atmosphere pressure.
- Air supplied respirators are supplied with fresh air through a hose from an air system and operate in a continuous flow mode.

Screen rrpsumb

- Bubble hood respirators are loose-fitting enclosures that cover the head, neck, and entire shoulders.
- Advantages of air supplied respirators are the reduction of in-leakage concerns due to positive pressure and the high assigned protection factor.
- An advantage of the bubble hood respirator is that workers who can not wear tight-fitting face pieces can use it.

Screen rrpsumc

- Air supplied respirators with a full facemask have an assigned protection factor of 1000.

Screen rrpsumd

Perform preoperational checks, don, test, operate, and remove required respiratory protection equipment.

INSTRUCTOR NOTE: Practical completion is indicated on the roster. The instructor can complete the optional Attachment Performance Check Sheet for each individual. If you observe a trainee experiencing undue stress, they should be referred to Medical. Referral may be by the instructor o r by the trainee's supervisor.

PRACTICAL EXERCISE

After completion of your exam, you will satisfy this objective:

- Perform preoperational checks, don, test, operate, and remove required respiratory protection equipment.

This exercise will be coordinated by your instructors.
You will demonstrate the proper procedure for donning, using, and removing respiratory devices.

Attachment 1
Performance Check Sheet

Name: _____

SSN: _____

Date: _____

Accomplished			Practical Factor
Air-Purifying		Supplied	
_____	/	NA	Demonstrated proper visual inspection of respiratory device to assure that it is in good condition and has no missing parts.
_____	/	NA	Demonstrated proper method of donning the respiratory device.
_____	/	NA	Demonstrated proper method of performing a negative pressure test.
_____	/	NA	Demonstrated proper removal technique.

_____/_____
Instructor Date

The instructor's signature verifies the student has satisfactorily completed the tasks. Trainees exhibiting undue distress while wearing a respiratory device are to be referred to Medical for further evaluation. Referral may be by the instructor, or the trainee's supervisor.