DUPONT

PLAINTIFF'S EXHIBIT
RMC-117

RESPIRATOR FIT TESTING

INDUSTRIAL HYGIENE
HASKELL LABORATORY

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RESPIRATOR FIT TESTING

" A QUALITATIVE PROTOCOL

USING

ISO-AMYL ACETATE "

E. I. DU PONT DE NEMOURS & COMPANY, INC.
HASKELL LABORATORY
Newark, Delaware

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FOREWORD

Personal protective equipment must provide protection for the user without sacrificing comfort. Uncomfortable equipment will be worn improperly or not at all. In either case, its protective capabilities are diminished. The comfort and fit of respirators is particularly important since leakage through the face seal determines respirator efficiency. Respirators must be selected to conform to many facial configurations. An assortment of respirator sizes is necessary to assure that an adequate fit can be found.

OSHA's standard CFR 1910.134 mandates that the respirators be fit tested to assure they provide a reasonable degree of conformation to the face. Section (e)(5) states: "Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its facepiece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere."

Since no clear definition has been proposed as to what constitutes a test atmosphere or suitable protocol for conducting qualitative-fit tests, we offer the following protocol. In our experience this method is simple to utilize, inexpensive, effective, and suitable for any size respirator program. In this ongoing program, we welcome your comments.

Orrin T. Skretvedt
Joseph G. Loschiavo
E. I. du Pont de Nemours & Company
Haskell Laboratory
Newark, Delaware 19711
(302) 366-5280

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RESPIRATOR FACEPIECE-FIT TESTING
STANDARD OPERATING PROCEDURES

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RESPIRATOR FACEPIECE-FIT TESTING
QUALITATIVE PROTOCOL
DIRECTIONS FOR USE

This protocol describes a qualitative method for conducting respirator facepiece-fit tests. It verifies the test subject's ability to detect a nominal concentration of the test agent and exposes him to a test atmosphere of known concentration. The protocol is based on offering a variety of respirator sizes so that each user can find a respirator that provides a good face seal without causing discomfort. The program 1) tests each subject's ability to detect 1 ppm of the test agent; 2) helps the test subject select a comfortable respirator, and; 3) tests respirator fit using a test atmosphere of known concentration. If odor is not detected and the fit remains comfortable, the respirator is considered to have an adequate facepiece fit. Detection of odor indicates inadequate fit. The test subject's odor sensitivity is rechecked and another respirator is selected for testing. Once the fit test has been passed, a minimum protection factor of 100 (ten times that permitted by OSHA for a half-mask and twice that permitted for a full facepiece) can be assumed. However, use of negative-pressure half-mask or full facepiece respirators are still limited by law to concentrations less than 10 or 50 times the PEL, respectively.

I. Initial preparation would consist of the following:

- o Review the entire contents of the protocol.
- o Order supplies as needed - see each protocol for necessary items.
- o Decide on respirator brands and models you will use. Most manufacturers offer three sizes for each model. Order several of each size and model along with a supply of organic vapor cartidges. Don't forget to include full facepieces.
- o Locate areas suitable for conducting the fit tests. You'll need two areas, one at least 12' x 20' while the other can be as small as 6' x 6'. Both rooms should be well ventilated but not connected to the same recirculating ventilation system. The smaller room will house the fit-test chamber, so preferably this room should exhaust directly outside. A bathroom or a room with a lab hood works well.
- o Prepare cards containing odor test instructions (SOP #3), test exercises and rainbow passage (SOP #7) and the observation checklist (SOP #6).
- o Assemble the fit-test chamber (SOP #5).
- o For the orientation program you will need a synchronized slide/tape player with either audible or inaudible cue advance. Remember this orientation program does not meet all the requirements of a respirator training program. Test subjects should have completed the training requirements specified in 29 CFR 1910.134(e)(5) before being fit tested.

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II. Final preparation for testing consists of the following:

- Hang the fit-test chamber in the appropriate room (SOP #5). The test exercises and rainbow passage should be taped to the inside wall of the test chamber at eye level (SOP #7). Place the cut paper towels and the IAA bottle with eyedropper near the test chamber for easy access.

- In the larger room set up three work tables:

  a) Place the odor sensitivity test jars on one table. Tape the test instructions to the table top just in front of the two jars (SOP #3).

  b) A second table can be used for the orientation program. The data collection forms can also be placed here. Each subject should fill out the form before he views the orientation program. Have him keep the form with him as he goes through the test procedure.

  c) The last table should contain your selection of respirators. One end of this table or a fourth table can be used for respirator cleaning (SOP #6).

III. Fit testing should proceed like this:

- The test subject views the orientation program (SOP #1) and fills out the data form (SOP #2).

- Taking the data form with him he goes to the odor sensitivity test area, reads the instructions and takes the test (SOP #3). His response is recorded on the data form. If he fails the test see SOP #3.

- Moving on to the respirator selection area the instructor helps him to select the most comfortable-fitting respirator (SOP #4). The functional-fit test should be conducted (SOP's #8 and #9).

- The respirator is worn for at least five minutes and unless it is uncomfortable, is worn to the fit-test chamber.

- The test subject is asked to step inside the chamber (SOP #5). Once inside he is handed the paper towel containing the IAA (SOP #6).

- If the odor becomes noticeable inside the facepiece, the test subject, without removing the respirator, exits the test chamber. Upon returning to the selection room, the mask is removed and cleaned. The sensitivity test is repeated and another respirator is chosen.

- The procedure is repeated until the fit test is passed. Remember to record all pertinent information on the data form.

- The test subject should be informed what respirator he has been assigned.

- Fit testing should be performed at least yearly or sooner if any thing should happen that may have affected respirator fit, i.e., sizeable weight loss or gain, dentures, facial scars, etc.

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RESPIRATOR FACEPIECE-FIT TESTING
ORIENTATION PRESENTATION
STANDARD OPERATING PROCEDURE NO. 1

PURPOSE

The orientation program serves to solicit the involvement and cooperation of the test subject. Basic principles covering the proper donning of a respirator, the steps involved in conducting a fit test and the need for cooperation are highlighted.

MATERIALS

This sound/slide presentation can be purchased at a nominal cost from:

National Paint and Coatings Association
Attn: Pat Hurd
1500 Rhode Island Avenue, N.W.
Washington, DC 20005

PROCEDURE

1. Music at Head

2. Music

3. We are asking you to help us evaluate various methods of determining how well a respirator fits your face and protects you from the materials you work with.

   We appreciate your cooperation and would like to explain what you will be asked to do.

4. First, we'll have you select the respirator that fits most comfortably; then we will conduct several tests to make sure the respirator you've selected protects you adequately. These tests will include

5. a positive- or negative-pressure test on your respirator and a qualitative-fit test.

6. For the qualitative test we'll use a pleasant smelling chemical that has the odor of bananas

7. First, we would like you to select from an array of respirators the one or two that feel the most comfortable on your face. Make your selection in the following way:

8. If your job requires that safety glasses or goggles be worn, these should be worn during respirator selection and subsequent fit testing.

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9. Hold each respirator tight up against your face. If it feels as though it may fit, replace the respirator on the table but

10. turn it 90° so after you've tried on all of the respirators you can return to those that fit better.

11. The respirators you will be using are referred to as half-mask respirators because they

12. fit over the nose, mouth and chin only.

13. The respirators have a narrow and a wide end. Your chin will fit into the wider end.

14. Here are the steps involved in putting on a respirator. First, one or two cartridges may be present and should be checked to see they are tightly secured in the cartridge holder.

15. Next, with the wide end down, clip the top straps around the crown of your head.

16. Now, fit your chin into the respirator chin cup.

17. Then, clip the bottom straps around your neck.

18. Alternately adjust the straps so the respirator feels comfortable on your face.

19. Tightening the straps too much may result in as poor a fit as having the straps too loose. The facepiece should be comfortably snug against your face.

20. Once the strap tension feels adequate, seat the mask by twisting the facepiece slightly on the face.

21. Then move your head rapidly from side-to-side and

22. up-and-down while taking a few deep breaths. Each time a respirator is put on, it should be seated by making these movements.

23. Now that the respirator is seated, check to be sure the respirator does not unduly restrict your vision and that it does not feel too-tight or too-loose across the bridge of the nose. It should not feel as though it's slipping down your nose.

24. Your chin should fit firmly but comfortably within the chin cup. The respirator should allow you to move your mouth freely enough so you can speak easily.

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25. Your cheeks should make contact all around the perimeter of the respirator.

26. If the respirator continues to feel comfortable, you are ready to conduct the positive- or negative-pressure test.

27. These tests are performed by creating a negative or positive pressure within the respirator itself. The negative pressure is created by slipping a surgical glove over each end of the respirator cartridges, then gently inhaling and holding the negative pressure for five seconds. No loss of pressure or inward movement of air around the face seal should be detected.

28. A positive-pressure test is performed by covering the exhalation valve on the respirator.

This valve is located in the chin area of the mask.

29. Place the palm of your hand over the exhalation valve cover to prevent air from escaping. A slight positive pressure should be maintained within the mask for five seconds. Again, no loss of pressure or outward leakage of air around the face seal should be apparent.

30. If you have detected the loss of pressure or movement of air through the face seal as a result of these tests, please inform the instructor. These tests indicate whether this respirator is suitable for further testing. Once your respirator is on, please do not remove it or disturb its fit.

31. For the qualitative-fit test we'll use isoamyl acetate or banana oil, so named because it has a sweet, banana-like odor.

32. Before we begin this test, we will have you smell this chemical to be sure you can detect it.

33. In conducting the banana-oil test, the instructor will ask you to step into a clear polyethylene bag.

34. Once you are inside the bag, he will hand you a paper towel containing a small amount of isoamyl acetate.

35. Hook the paper towel on the ceiling of the chamber. The instructor will then ask you to perform some basic exercises. These will include breathing normally, taking deep breaths,

36. moving your head from side-to-side, and

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37. up-and-down, and reading a passage. At times he will also tell you when to breathe in and out. Please cooperate by taking deep breaths.

38. Here is the passage we will ask you to read. Please read it slowly and distinctly just as I am now speaking.

39. If, during any of the movements, you detect the banana-like odor, indicate this to the instructor by raising your hand. If the respirator begins to feel uncomfortable at any time during the tests, let the instructor know.

40. Let's review the procedure.

41. Select a respirator that fits comfortably.

42. Conduct a positive- and negative-pressure test.

43. Conduct a qualitative-fit test with banana oil. If you have any questions, please ask your instructor.

44. We thank you for your cooperation. By taking time to go through these simple tests, you will have a more comfortable respirator and you will be better protected.

45. Music up

46. Music out

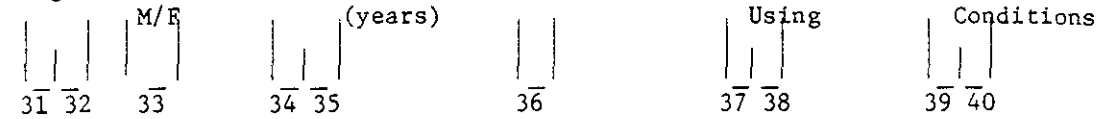
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RESPIRATOR FACEPIECE-FIT TESTING
DATA COLLECTION FORM
STANDARD OPERATING PROCEDURE NO. 2

1) I.D. | Date Yr. Mo. Day | Employee Name Last First I.



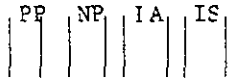
Age | Sex M/F | 2) Experience (years) | 3) Frequency | 4) Mask Now Using | 5) Unusual Conditions



4) Mask Selected



6) Qualitative Tests



1 = Passed
2 = Failed
3 = Did not run

7) IAA Sensitivity Test - Pass or Fail

8) Respirator Selection

1st Choice -
Pass Fail
2nd Choice -
Pass Fail
3rd Choice -
Pass Fail
Final Selection _____ _____
manufacturer size

9) Test Instructor

Name: _____

Comments:

Facial Conditions	x
Wrinkles	Wide-bridge
Broken Nose	Shallow-bridge
Deep Nostrils	Other
Small Face	
Narrow Face	
Wide Face	

KEY

1) Plant Identification Number

3) Frequency - How many times respirator used during week.

1) Less than 1/week
2) 2-5 times/week
3) 5-10 times/week
4) 1-4 times/day

6) Qualitative Tests

PP = Positive Pressure
NP = Negative Pressure
IA = Isoamyl Acetate
IS = Irritant Smoke

4) Masks (Block 37 - Manufacturer)

1 = Mine Safety Appliance
2 = American Optical
3 = Scott Aviation
4 = Norton
5 = Willson

Size (Block 38)
1 = Small
2 = Medium (if only size, record 2)
3 = Large
4 = Full Face

5) Unusual Conditions

1 = Beard/Heavy
2 = Beard/Light
3 = Scars
4 = Wrinkles
5 = Glasses
6 = Other
7 = Several days beard growth

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RESPIRATOR FACEPIECE-FIT TESTING
ISOAMYL ACETATE TEST
SENSITIVITY CHECK
STANDARD OPERATING PROCEDURE NO. 3

PURPOSE

For this qualitative test protocol to be effective, persons tested must be able to detect very low isoamyl acetate (IAA) concentrations. This ability can be evaluated through the following protocol.

MATERIALS

- Two medicine droppers with 0.5 and 1 cc markings. These can be made up, purchased at a drugstore or can often be found in liquid vitamin or liquid aspirin bottles.
- Isoamyl acetate, also known as isopentyl acetate. This can be purchased from Matheson, Colemen and Bell, 2909 Highland Avenue, Norwood, Ohio 45212. Stock #PX-285, 500 gram bottle at approximately $35.
- Odor-free water (approximately 25°C) - e.g., distilled or spring water. This can be purchased at a supermarket.
- Three 1-liter glass jars with metal lids (Mason or Ball jars). These are volumetrically graduated and are available at supermarkets. Non-glass jars may absorb the IAA.

PROCEDURE

The preparation of the IAA test jars should not take place in the room where the sensitivity check will be conducted. Only the 1.0 ppm and the blank jars should be taken to the sensitivity check area. Squirt 1 cc of full-strength IAA into a 1-liter jar containing 800 cc odor-free water. Screw on the lid and shake the contents of this stock solution for one-half minute. This mixture is good as a stock solution for one week. Remove lid and, with another dropper, extract 0.5 cc of isoamyl acetate-water mixture and squirt it into a second 1-liter jar containing 500 cc odor-free water. Immediately screw on lid and shake the contents for one-half minute. Allow the mixture to stand undisturbed for two to three minutes to allow the IAA concentration above the liquid to reach equilibrium. This test solution is good for a full days use. Pour 500 cc water into a third 1-liter jar (blank). The second and third jars will serve as your test jars. Label each jar 1 and 2 to identify the jars. If the labels are put on the lids you can periodically dry the lids off and switch to avoid people from assuming the same jar always has the IAA.

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Without indicating which jar contains the IAA, ask the subject to shake each bottle, then remove the lid and identify the jar having the odor of IAA. The following directions can be typed on a 5" x 7" index card to standardize this test:

> "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the instructor which bottle contains banana oil."

If the test subject smells IAA in the correct jar, proceed with the IAA qualitative-fit test. If no odor or an odor in more than one jar is detected, prepare a stronger mixture by extracting 1 cc from the stock mixture and squirt it into a jar containing 500 cc water. Again, prepare a blank. If subject detects isoamyl acetate in the correct jar, proceed with the IAA qualitative-fit test. The test subject should be told that this is the level of odor perception that he should be looking for inside the respirator when the fit test is being conducted. If no odor, or an odor in more than one jar is detected, proceed with an irritant smoke test. If the test subject cannot detect isoamyl acetate, he should be reexamined to be certain he can detect the odor of the contaminant(s) he will be working with.

The mixtures used in the IAA odor detection test must be prepared in an area separate from where the test is performed. This separation will prevent olfactory fatigue from rendering a subject unable to detect the odor of IAA. Fatigue can occur at very low background levels. To achieve proper results, the jars should be tightly covered and shaken well before each use.

DOCUMENTATION

Over 800 people have successfully indicated their ability to smell the 1 ppm concentration of IAA produced by this method. Only three people having very bad colds could not detect the 1 ppm concentration. One person could not detect the odor due to permanent loss of olfactory sense.

Repetitive preparation of the above solutions have indicated that a concentration of 1 ppm can be consistently prepared and will remain constant for an entire day's use. The mean concentrations ran 0.97 ppm. Statistically this is a 95% confidence that 95% of all odor samples taken will be in the range 0.4 to 2.4 ppm.

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RESPIRATOR FACEPIECE-FIT TESTING
SELECTION OF RESPIRATOR FOR COMFORT
STANDARD OPERATING PROCEDURE NO. 4

PURPOSE

Respirators should be selected so they provide as comfortable a fit as possible. Studies have shown that a comfortable facepiece usually provides the best fit. The importance of allowing the respirator user to evaluate the degree of comfort provided by several different models of respirators cannot be overemphasized. No single model of respirator will provide a universal fit. An acceptable-respirator program, then, must make several different facepieces available for selection.

PROCEDURE

The selection of respirators to be used at the work site should be made. The array can include not only different manufacturers' facepieces but also different facepiece types, i.e., quarter, half, or full facepieces as well as different sizes of each of the facepiece types. Most manufacturers now have two or three sizes available for each facepiece type. Two manufacturers' array will usually provide a sufficient variety to fit nearly 100% of your employees.

The selection process must be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject should be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to assess a "comfortable" respirator. A mirror should be available to assist the subject in evaluating the fit and positioning of the respirator. This should not constitute his formal training on respirator use, only a review.

Assessment of comfort should include reviewing the following points with the test subject:

- Chin properly placed.
- Positioning of mask on nose.
- Strap tension.
- Fit across nose bridge.
- Room for safety glasses.
- Distance from nose to chin.
- Room to talk.
- Tendency to slip.
- Cheeks filled out.
- Self-observation in mirror.
- Adequate time for assessment.

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The selection should proceed as follows:

1. The respirators are spread out in front of the test subject. The subject should understand that he is being asked to select the respirator which provides the most comfortable fit for him. Each respirator represents a different size and shape and, if fit properly, all are equal in the protection they will provide.

2. The test subject holds each facepiece up to his face and eliminates those which are obviously not giving a comfortable fit. Normally selection will begin with a quarter- or half-mask and if a fit cannot be found here, the subject will be asked to go to the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

3. The more comfortable facepieces are recorded; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by asking the questions listed above. If the subject is not familiar with using a respirator, he should be directed to don the mask several times and to adjust the straps each time, so that he becomes adept at setting proper tension on the straps.

4. The test subject should conduct the negative- and positive-pressure fit test according to Standard Operating Procedures #8 and #9. Before conducting the negative- or positive-pressure test the subject should be told to "seat" his mask by rapidly moving the head side-to-side and up-and-down, taking a few deep breaths.

5. The subject is now ready for fit testing.

6. After passing the fit test, the test subject should be questioned again regarding the comfort of the respirator. If it has become uncomfortable another model of respirator should be tried.

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RESPIRATOR FACEPIECE-FIT TESTING
TEST CHAMBER DESIGN
STANDARD OPERATING PROCEDURE NO. 5

PURPOSE

A simple, inexpensive chamber was designed to facilitate respirator-fit testing. The components can easily be purchased and assembled.

MATERIALS

1. A clear polyethylene bag approximately 24 inches in diameter and 60 inches long (e.g., a 55-gallon drum liner). One vendor is Franklin Fiber Company, Lamitex Corporation, 903 East 13th Street, Wilmington, Delaware 19898, (302) 652-3621. Request a polyethylene liner, 36 inches x 61 inches x 4 mils thick. Price approximately $0.75 each. Purchasable in lots of 10.

2. A 24-inch diameter disk cut from 1/4-inch plywood or heavy cardboard.

3. A 1/4-inch diameter eyebolt approximately 2 inches long with two nuts and washers.

4. A 2-inch threaded screw hook.

ASSEMBLY

1. Drill a 1/4-inch diameter hole at the center of the disk.

2. Screw one nut well up the eyebolt stem, slide one washer up to the nut, and insert assembly through the disk. Slide the second washer over stem, and tighten the second nut.

3. Place the screw hook into the disk as close to the center as possible on the side opposite the eyebolt.

4. Hold the polyethylene bag with the open end pointed down and slide the disk (with eyebolt pointed upward) up through the bag towards the closed end. The plywood disk becomes the chamber ceiling.

5. Make a small hole in the top of the bag for the eyebolt to go through. Suspend the bag from the eyebolt so the chamber ceiling is about 7 feet from the floor.

6. To allow the chamber height to accommodate subjects of various heights, the cord suspending the chamber can be run through an "O" ring on the ceiling. If the cord is then anchored at some convenient location, a slip knot can be used to adjust chamber height. The chamber should be adjusted so the chamber ceiling is 6" above the top of the test subject's head.

The unit is now ready for use as a respirator fit-test chamber for either isoamyl acetate or irritant smoke.

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RESPIRATOR FACEPIECE-FIT TESTING
QUALITATIVE TEST PROTOCOL
ISOAMYL ACETATE METHOD
STANDARD OPERATING PROCEDURE NO. 6

PURPOSE

This procedure should be followed to conduct a qualitative-fit test using isoamyl acetate (IAA) as the test agent. Only those persons who have passed the odor detection test (see SOP #3) should be fit tested by this method. Studies indicate that when this protocol is followed closely, an average challenge concentration of 150 ppm will be generated and maintained within the chamber during the test. Statistically, we have 95% confidence that 95% of the chamber concentrations maintained during a fit-test will range between 74 and 234 ppm. Use of this procedure should ensure that an employee receives a respirator that is providing a protection factor of at least 100. However, OSHA still limits the use of negative-pressure half-masks to a protection factor of 10 and full facepiece respirators to 50.

PREPARATION

The following items are needed:

1. A fit-test chamber; see Standard Operating Procedure No. 4.

2. Isoamyl acetate, also known as isopentyl acetate, Technical grade - 95% pure or better. Can be purchased from Matheson, Colemen, and Bell, 2909 Highland Avenue, Norwood, Ohio 45212. Five-hundred gram bottle for approximately $35.

3. A 1/2 cc eye dropper; which may be obtained from a drugstore or in children's liquid vitamin or liquid aspirin bottles.

4. A prepared standard atmosphere of 1-2 ppm IAA. See Standard Operating Procedure No. 3.

5. A test area with good ventilation, separate from areas where the IAA sensitivity test and mask selection are done.

6. Appropriate respirators outfitted with organic vapor cartridges. These cartridges are color-coded black. These cartridges should be changed at least weekly.

7. A paper towel or other porous absorbent single-ply material cut approximately 4" by 5", and folded in half.

8. Make a copy of the test exercises and the rainbow passage to be hung inside the test chamber. See SOP #7.

9. The respirators need to be cleaned between test subjects. They can be wiped down with any respirator manufacturer's cleaner-sanitizer or non-alcoholic antiseptic towelettes are available in lots of 1000 (approximately $12) from Med Pak Corporation, P.O. Box 548, Rock Branch Industrial Park, Poca, WV 25159 (304 755-9151).

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PROCEDURE

1. Before beginning this test, the test subject should have completed the IAA sensitivity test described in Standard Operating Procedure No. 3 and the facepiece selection process, described in Standard Operating Procedure No. 4.

2. It is important to minimize the employee's exposure to IAA to prevent his olfactory sense from fatiguing. The odor test, selection, and donning of the mask should occur in one room. The test chamber should be located in another room or should be in such a well-ventilated area that general room contamination is prevented.

3. Before the subject is taken to the IAA-test chamber, the respirator should be checked to be certain it has organic vapor cartridges. The respirator should be put on, the straps adjusted and the mask "seated" by moving the head rapidly from side-to-side, up-and-down and taking a few deep breaths. The positive- or negative-pressure test should then be conducted. The subject, with his respirator on, should be taken to the fit-test chamber.

4. When the subject has entered the test chamber, the absorbent paper should be folded in half and using the calibrated eyedropper, 1/2 cc of full-strength IAA should be applied. Hand the towel to the subject who should hang the folded saturated towel from the screw hook provided in the center of the chamber ceiling.

5. Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises, a copy of which (SOP #7) should be hung inside the test chamber. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of his cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

6. If at any time during the test the subject detects the banana-like odor of IAA, he should quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

7. Upon returning to the selection room, the subject should remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, etc. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject should wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

8. If a person cannot be fitted with the selection of half-mask respirators, include full facepiece models in the selection process. When a respirator is found that passes the test, its efficiency can be impressed upon the subject by having him break the face seal and take a breath before he exits the chamber.

9. When the test subject leaves the chamber he should remove the saturated towel, returning it to the instructor. To keep the area from becoming contaminated, the used towels can be kept in a self-sealing bag. There is no significant IAA concentration buildup in the test chamber from subsequent tests.

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RESPIRATOR FACEPIECE-FIT TESTING
TEST EXERCISE PROTOCOL
STANDARD OPERATING PROCEDURE NO. 7

PURPOSE

Respirator facepiece-fit testing should require the subject to perform exercises during the fit test. Exercises representing typical movements performed during work as well as those movements which stress usual areas of facepiece leakage should be included. The following protocol has been selected because it meets these criteria.

PROCEDURE

Before test exercises begin, the subject should have completed the fit selection protocol, Standard Operating Procedure No. 4. The respirator should have been put on properly and the subject should be ready for fit-testing. Exercises to be performed are given in Table I. Each exercise should be performed for at least 30 seconds. A copy of the exercises can be hung inside the fit-test chamber. The instructor should be certain that each exercise is correctly performed by the test subject.

TABLE I
Test Exercises

1. Normal breathing.

2. Deep breathing. Be certain breaths are deep and regular.

3. Turning head from side-to-side. Be certain movement is complete, with one turn about every second. Alert the test subject not to bump the respirator on the shoulders. Have test subject inhale when his head is at either side.

4. Nodding head up-and-down. Be certain motions are complete and made about every second. Alert the test subject not to bump the respirator on the chest.

5. Talking. The paragraph to be read is called the Rainbow Passage. Be certain the paragraph is read aloud and slowly.

   Rainbow Passage

   When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

6. Normal breathing.

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RESPIRATOR FACEPIECE-FIT TESTING
FUNCTIONAL FIT TEST
POSITIVE-PRESSURE TEST
STANDARD OPERATING PROCEDURE NO. 8

PURPOSE

This test is performed to help the wearer assess respirator function and find gross leaks between the face and facepiece. This positive-pressure test checks the presence and functioning of the respirator inhalation valves, as well as leakage that may occur due to improper cartridge seal or respirator face fit. This test or a negative-pressure test is required by 29 CFR 1910.134(e)(5)(i) prior to the use of any respirator in a contaminated atmosphere.

PROCEDURE

1. Block off the exhalation valve cover openings.

   MSA: Exhalation valve cover can be blocked with the palm of the hand.

   Norton: Exhalation valve cover has long narrow openings around its perimeter. These can be blocked by encircling the fingers around the valve cover.

   Willson: Exhalation valve cover can be blocked with the palm of the hand.

   AO: Exhalation valve cover has long slotted openings. These openings are difficult to block off with the hands. However, a small piece of flexible material such as Saran wrap or latex can be used. New models have a redesigned valve cover which can easily be covered with the palm of the hand.

   Scott: Exhalation valve covers have front openings as well as four small side openings. These openings are difficult to block off with the hands. However, a small piece of flexible material such as Saran wrap or latex can be used.

2. The person exhales gently, creating a slight positive pressure within the facepiece. The positive pressure should be maintained for at least 5 seconds.

3a. If no outward leakage is detected, the person has passed the test.

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3b. If leakage is detected (usually felt as a cool sensation against the skin or a loss in pressure), the respirator is either malfunctioning or a gross leak between the face and facepiece is present. The following should be done when a failure occurs:

- Redon or readjust the respirator.

- If the facepiece continues to lose pressure, although previous positive- or negative-pressure tests performed with that respirator had passed, it is probably malfunctioning. Consult your supervisor. It is also possible for new scars or wrinkles, beard growth, missing teeth or dentures, significant weight gain or loss, etc., to cause gross leakage into the facepiece. When such new conditions exist, reevaluation of respirator fit must be performed by exposure to a test atmosphere.

- If the person is selecting a respirator before being qualitatively-fit tested and fails either the positive- or negative-pressure test, a gross leak is probably present between the face and the facepiece. Another respirator brand or size should be chosen. (This statement can be made since respirators in a selection array are thoroughly inspected and no defects should be present.)

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RMC0002057

RESPIRATOR FACEPIECE-FIT TESTING
FUNCTIONAL FIT TEST
NEGATIVE-PRESSURE TEST
STANDARD OPERATING PROCEDURE NO. 9

PURPOSE

This test is performed to help the wearer assess respirator function and to find gross leaks between the face and facepiece. This negative-pressure test checks the pressure and functioning of the respirator exhalation valve as well as leakage due to improper cartridge seal or respirator face fit. This test or a positive-pressure test is required by 29 CFR 1910.134(e)(5)(i) prior to the use of any respirator in a contaminated atmosphere.

PREPARATION

The following items are needed:

1. Two disposable latex gloves or other soft flexible impervious material.

PROCEDURE

1. Block off the respirator cartridge inlet openings.

   MSA: Cartridges can be blocked with the palms of the hands or with disposable latex gloves.

   Norton: Cartridges can be blocked only with the gloves.

   Willson: Cartridges can be blocked with the palms of the hands or with the gloves. The Willson high-efficiency filters can be blocked only with the gloves.

   AO: Cartridges can be blocked by using the palms of the hands or the gloves.

   Scott: Cartridges can be blocked by using the palms of the hands or the gloves.

2. The person inhales gently holding that negative pressure for at least 5 seconds.

3a. If no inward leakage of air is detected, the person has passed the test.

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3b. If leakage is detected (usually felt as a cool sensation against the skin or a loss in pressure), the respirator is either malfunctioning or a gross leak between the face and facepiece is present. The following should be done when a failure occurs:

- o Redon or readjust the respirator.
- o If the facepiece continues to lose pressure, although previous negative- or positive-pressure tests performed with that respirator had passed, it is probably malfunctioning. Consult your supervisor. It is also possible for beard growth, new scars or wrinkles, missing teeth or dentures, significant weight gain or loss, etc., to cause gross leakage into the facepiece. When such new conditions exist, reevaluation of respirator fit must be performed.
- o If the person is selecting a respirator before being qualitatively-fit tested and fails either the negative- or positive-pressure test, a gross leak is probably present between the face and the facepiece. Another respirator brand or size should be chosen. (This statement can be made since respirators in a selection array are thoroughly inspected and no defects should be present.)

OTS:vlm
4/29/81

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