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February 15, 1984

RESPIRATORY PROTECTION PROGRAM

The attached eleven (11) items represent the minimum requirements of an acceptable respirator program, as set forth in Section 1910.134 of the OSHA regulations.

In order to ensure compliance with these regulations and provide the best respiratory protection to REYNOLDS METALS COMPANY employees, enclosed is the RMC Respiratory Protection Training Program, as developed by this department.

Please review this policy to determine its applicability at your particular facility. It should be noted that OSHA requires adherence to this policy whenever respirators are issued (i.e. even for a non-mandatory situation). Consequently, the plant should review its current usage of respirators and determine whether it desires to continue issuing respirators on a non-mandatory basis.

After you have completed this determination, please notify this department, so that appropriate "Statement of Hazard" sheets can be developed for each facility.

Finally, a video cassette on respirator training and fitting is being developed and this should be available later this year. This videotape will cover all aspects of the written policy, including a demonstration of proper fit testing.

If you have any questions concerning this bulletin, please contact the Industrial Hygiene Department.

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~~Environmental and~~
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1910.134 RESPIRATORY PROTECTION

Requirements for a minimal acceptable program.

(1) Written standard operating procedures governing the selection and use of respirators shall be established.

(2) Respirators shall be selected on the basis of hazards to which the worker is exposed.

(3) The user shall be instructed and trained in the proper use of respirators and their limitations.

(4) Where practicable, the respirators should be assigned to individual workers for their exclusive use.

(5) Respirators shall be regularly cleaned and disinfected. Those issued for the exclusive use of one worker should be cleaned after each day's use, or more often if necessary. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

(6) Respirators shall be stored in a convenient, clean, and sanitary location.

(7) Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

(8) Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

(9) There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

(10) Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically (for instance, annually).

(11) Approved or accepted respirators shall be used when they are available. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it is designed in accordance with standards established by competent authorities. The U.S. Department of Interior, Bureau of Mines, and the U.S. Department of Agriculture are recognized as such authorities. Although respirators listed by the U. S. Department of Agriculture continue to be acceptable for protection against specified pesticides, the U.S. Department of the Interior, Bureau of Mines, is the agency now responsible for testing and approving pesticide respirators.

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RESPIRATORY PROTECTION TRAINING PROGRAM

STANDARD OPERATING PROCEDURES

I. ADMINISTRATIVE RESPONSIBILITIES

A. INDUSTRIAL HYGIENE DEPARTMENT

1. Conduct hazard evaluation to determine:

   a. Type of respiratory hazard(s)

   b. Nature of contaminants

   c. Concentration of respiratory hazard(s)

   d. Characteristics of hazardous job or process

2. Select appropriate respiratory protection

3. Develop Respiratory Protection Training Program

B. SAFETY DEPARTMENT

1. Assist in developing training program and maintenance instructions for Respiratory Protection Program.

2. With Industrial Hygiene Department support, train supervisors and workers, following training outline.

3. Supervise cleaning, inspection, and repair program.

4. Provide long-term retention of inspection records.

5. Periodically evaluate effectiveness of Respiratory Protection Program.

C. PERSONNEL - MEDICAL DEPARTMENTS

1. Provide pre-employment screening and medical surveillance of employees required to use respirators.

2. Maintain records of medical surveillance.

D. ENGINEERING DEPARTMENT

1. Assist in engineering evaluation of hazardous exposures.

2. Develop and implement feasible engineering controls in work areas where respiratory protection is required.

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E. EMPLOYEE RESPONSIBILITY

1. Use the provided respiratory protection in accordance with instructions and training received.

2. Guard against damage to respirator.

3. Report any malfunctioning respirator to a responsible person designated by the Respiratory Protection Training Program.

II. RESPIRATOR SELECTION

All respirators shall be selected on the basis of the hazard(s) to which the worker is exposed. The NIOSH/OSHA decision logic (Appendix I) shall be used to select the appropriate respirator.

III. STATEMENT OF HAZARD(S)

A statement of the hazard(s) encountered will be developed for each facility. This will include a discussion of the effects of overexposure, appropriate respiratory protection, and engineering controls, if any, used to reduce exposure.

IV. RESPIRATOR TRAINING

A. FITTING

Conditions which prevent a good respirator-to-face seal shall not be permitted. Such conditions may be the growth of a beard or sideburns, scars, or the absence of one or both dentures. The worker's diligence in observing these factors shall be evaluated by periodic checks. To assure proper protection, it is the wearer's responsibility to check the facepiece fit, each time he puts on the respirator. This may be done by following the manufacturer's respirator fitting instructions.

1. Rubber facepiece type air-purifying respirator with exhalation valve:

a. Place respirator on face, covering chin and nose. Narrow end of respirator fits over nose.

b. Fasten upper headband well up on the head, above the ears.

c. Fasten lower headband around neck, below ears.

d. Adjust both headbands for uniform comfortable fit and seal.

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e. Daily test for proper respirator-to-face seal:

(1) Close the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a light positive pressure can be built up inside the facepiece without any evidence of outward leakage of the air of the seal. For most respirators, this method of leak testing requires that the wearer first remove the exhalation valve cover and then carefully replace it after the test. Do not enter the contaminated area until a good fit is achieved.

2. Disposable air-purifying type respirator without exhalation valve

a. Cup respirator in hand, with nosepiece at fingertips, allowing headbands to hang freely below hand. (Note: For pleated type respirator, expand pleats completely before donning respirator.)

b. Cup respirator under chin with nosepiece up.

c. Pull top band over head and position it at top back of head. Pull bottom band over head and position it around the neck, below ears.

d. Using both hands, mold the metal nosepiece to the shape of nose.

e. Daily test for proper facepiece-to-face seal:

(1) Cover the front of respirator with both hands, being careful not to disturb the position of the respirator. Exhale sharply. A positive pressure should be felt inside respirator. If air flows around nose, tighten nosepiece. If air leaks at respirator edges, work straps along the sides of the head. Do not enter contaminated area until a good fit is achieved.

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B. ANNUAL QUALITATIVE FIT TESTING

1. On an annual basis, all employees required to wear respiratory protection shall be given a qualitative fit test. (See Appendix,) Upon achieving satisfactory fit, appropriate protection factors, as shown in Appendix II, may be used.

2. Record results of the test on enclosed form and maintain record for ___ years.

V. MAINTENANCE AND CARE OF RESPIRATORS

A. RUBBER FACEPIECE TYPE AIR-PURIFYING RESPIRATOR

1. Inspection

a. Respirator inspection shall include a check of the tightness of connections and the condition of the facepiece, headbands, valves, connecting tube, and cartridges. Rubber or elastomer parts shall be inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomer parts with a massaging action will keep them pliable and flexible and prevent their taking a set during storage. Examine air-purifying elements for incorrect cartridge, canister, or filter; incorrect installation, loose connections, missing or worn gaskets; expired shelf-life; cracks or dents in outside of filter, cartridge, or canister; and evidence of prior use.

2. Replacement of cartridges and/or filter pads

a. Replace cartridge at the first trace of contaminant odor detected inside the respirator. Discard old cartridge where it will not be re-used. Replace cartridges only with cartridges designated for that specific respirator.

b. Replace filter pad(s) daily, or whenever breathing resistance becomes excessive. Replace pad(s) only with pad(s) designated for that specific respirator.

B. DISPOSABLE AIR-PURIFYING TYPE RESPIRATOR

1. Inspection

a. Respirator inspection shall include a check of the integrity of the body of the respirator, the condition of the elastic headbands, and the presence of the moldable metal strip at the nosepiece. If any damage is evident or any part missing, the respirator shall be discarded and a new one obtained.

2. Replacement of respirator

a. Respirator shall be discarded and replaced whenever it becomes damaged or breathing resistance becomes excessive.

VI. CLEANING AND SANITIZING (RUBBER FACEPIECE TYPE)

Due to the fact that disposable respirators are to be discarded after use, there is no requirement for cleaning and sanitizing.

A. ROUTINELY USED RESPIRATORS shall be cleaned and sanitized as frequently as necessary, to ensure that proper protection is provided for the wearer. Each worker shall be briefed on the following daily cleaning procedures:

1. Remove any filters, cartridges, or canisters.

2. Wash facepiece in cleaner-sanitizer solution. Use a handbrush, if necessary, to facilitate removal of dirt.

3. Rinse completely in clean, warm water.

4. Wipe or air dry in a clean area.

5. Clean other respirator parts as recommended by the manufacturer.

6. Inspect valves, headstraps, and other parts; replace with new parts, if defective. All replacement parts shall be specifically for that respirator, i.e., do not interchange parts from other brands of respirators.

7. When inserting new filters, cartridges, or canisters, make sure seal is tight.

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VII. STORAGE

Respirators shall be packed or stored in clean plastic bags or containers, so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position. Employee lockers, departmental offices, or other clean areas will suffice as appropriate storage locations.

VIII. MEDICAL EVALUATION

Each person assigned to a task requiring the use of an air-purifying respirator may be required to take lung function and chest x-ray tests, to determine that he/she is physically able to use the respirator under the working conditions encountered. If the employee feels incapable of wearing a respirator while working, he/she should contact his/her supervisor.

IX. MONITORING

The Industrial Hygiene Department will periodically evaluate exposure levels in mandatory respirator areas. Based on these results, any necessary changes in the type of respiratory protection required will be made.

X. PERIODIC EVALUATION OF PROGRAM'S EFFECTIVENESS

The regulations concerning the use, storage, cleaning, and maintenance of respirators shall be rigidly enforced. Any worker found not complying with these requirements shall be subjected to disciplinary action.

APPENDIX I

I. GENERAL DECISION LOGIC ELEMENT

Step 1 -- Assemble Information on Substance. Assemble necessary toxicological, safety, and research information for the particular contaminant. Typically, the following are required:

A. Permissible exposure limits specified in 29 CFR 1910.100 (Tables Z-1, Z-2, and Z-3). These are the former 29 CFR 1910.93 tables.

B. Warning properties if the substance is a gas or a vapor. Refer to Part III (B) of this Logic.

C. Eye irritation potential of the substance. Refer to Part III (D) of this Logic.

D. Lower Flammable Limit (LFL) for the substance. Refer to Part III (F) of this Logic.

E. Immediately Dangerous to Life or Health (IDLH) concentration for the substance. Refer to Part III (E) of this Logic.

F. Any possibility of poor sorbent efficiency at IDLH concentration and below. Refer to Part III (C) of this Logic.

G. Any possibility of systemic injury or death resulting from absorbance of the substance (as a gas or vapor) through the skin. Refer to Part III (A) of this Logic.

H. Any possibility of severe skin irritation resulting from contact of the skin with corrosive gases, vapors, or particulates. Refer to Part III (A) of this Logic,

I. The vapor pressure of the stance (and equivalent ppm).

J. Any possibility of high heat of reaction with sorbent material in cartridge or canister.

K. Any possibility of shock sensitivity of substance sorbed on sorbent of cartridge canister.

Step 2 -- Determine Physical State of Substance. Determine the physical state(s) of the substance as it is likely to be encountered in the occupational environment. It will be either (a) gas or vapor, (b) particulate (dust, fume, or mist), or (c) combination of (a) and (b).

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Step 3 -- Assemble a Table of Permissible Respiratory Protection for Substance. This is done using the material from Step 1 and the appropriate Specific Decision Logic Chart from Part II of this Logic and the Respiratory Protection Factors in Appendix I.

Classes of respirators are only included where at least one device has been approved.

II. SPECIFIC DECISION LOGIC CHARTS

A. Specific Decision Logic Chart for Respiratory Protection Against Gases or Vapors

Condition	Selection Sequence
Routine use	1. Consider skin irritation and sorption of the material through the skin. See III (A). 2. Poor warning properties -- eliminate all air purifying respirators. See III (B). 3. Eye irritation -- eliminate or restrict use of half-mask respirators. See III (D). 4. IDLH or LFL -- above this concentration eliminate all but positive pressure self-contained breathing apparatus and combination positive pressure supplied air respirator with auxiliary positive pressure self-contained breathing apparatus. See III (E) and (F). 5. List all allowed respirators by condition of use and type.
Entry and escape from unknown concentrations	Use positive pressure self-contained breathing apparatus or combination positive pressure supplied air respirator with auxiliary positive pressure self-contained breathing apparatus.
Fire Fighting	Use positive pressure self-contained breathing apparatus.
Escape	Gas mask or escape self-contained breathing apparatus. See III (C).

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B. Specific Decision Logic Chart for Respiratory Protection Against Particulates

Condition	Selection Sequence
Routine use	1. Consider skin irritation or sorption of the material through skin. See III (A). 2. Eye irritation -- eliminate or restrict use of half-mask respirators. See III (D). 3. Systemic poison -- eliminate single-use respirators. 4. For permissible exposures less than 0.05 mg/cu.m. -- eliminate DFM respirators except with high efficiency particulate filter. 5. IDLH or LFL -- above this concentration eliminate all but positive pressure self-contained breathing apparatus and combination positive pressure supplied air respirator with auxiliary positive pressure self-contained breathing apparatus. See III (E). 6. List all allowed respirators by condition of use and type.
Entry and escape from unknown concentration	Use positive pressure self-contained breathing apparatus or combination positive pressure supplied air respirator with positive pressure self-contained breathing apparatus.
Fire Fighting	Use positive pressure self-contained breathing apparatus. See III (F).
Escape	Use any dust, fume, or mist respirator, except single-use, or any escape self-contained breathing apparatus

C. Specific Decision Logic Chart for Respiratory Protection Against Combination of Gas or Vapor and Particulates

Condition	Selection Sequence
Routine use	1. Consider skin irritation or sorption of the material through the skin. See III (A).

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2. Poor warning properties or inadequate sorbent efficiency -- eliminate all air purifying respirators. See III (B) and (C).

3. Eliminate all respirators except with combination sorbent/particulate filter.

4. Eye irritation -- eliminate or restrict use of half-mask respirator. See III (D).

5. For permissible exposures less than 0.05 mg/cu.m. -- eliminate all respirators except with sorbent/high efficiency particulate filter.

6. IDLH or LFL -- above this concentration eliminate all but positive pressure self-contained breathing apparatus and combination positive pressure supplied air respirator with auxiliary positive pressure self-contained breathing apparatus. See III (E).

7. List all allowed respirators by condition of use and type.

Entry and escape from unknown concentration	Use positive pressure self-contained breathing apparatus or combination positive pressure supplied air respirator with auxiliary positive pressure self-contained breathing apparatus.
Fire Fighting	Use positive pressure self-contained breathing apparatus. See III (F).
Escape	Gas mask or escape self-contained breathing apparatus. See III (C).

III. DECISION LOGIC CRITERIA

A. Skin Absorption and Irritation

Personal protection requirements for protection against exposure to substances which may cause injury by absorption through the skin from materials splashed or spilled on the skin are covered in Section (f) of each substance standard. Respirator selection criteria are based primarily on the inhalation hazard of the substance. A supplied air suit may provide skin protection for extremely toxic substances which may be absorbed through the skin, or for substances which may cause severe skin injury.

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Supplied air suits are not covered in 30 CFR 11. Data are not available upon which to make recommendations for supplied air suits for all types of exposures.

Where information is available indicating systemic injury or death resulting from absorbance of a gas or vapor through the skin, or where severe skin irritation or injury may occur from exposure to a gas, corrosive vapor, or particulate, the following statement is included as a footnote to the respirator tables and both the employee and employer are cautioned in the appendices concerning their use:

> Use of supplied air suit may be necessary to prevent skin contact and respiratory exposure for airborne concentrations of (specific substance). Supplied air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied air suits. Where supplied air suits are used above a concentration which may be immediately dangerous to life and health, an auxiliary positive pressure self-contained breathing apparatus must also be worn.

The supplied air suit statement is an advisory footnote. The decision whether or not to include the footnote is made by the NIOSH/OSHA Review Committees based on available information. Since most information concerning skin irritation is not quantitative but, rather, presented in commonly used descriptive terms, such as "a strong skin irritant, highly irritating to the skin, corrosive to the skin," etc., the decision made by the committees concerning skin irritation is a judgmental decision often based on nonquantitative information. As a guideline for inclusion of the supplied air suit statement for substances which are absorbed through the skin, a single skin penetration LD_{50} of 2 grams/kilogram for any species used.

The footnote is advisory in nature and its inclusion does not make the use of supplied air suits mandatory. Further, employers may use supplied air suits in situation where they provide adequate protection, whether there is an advisory footnote in the respirator table or not. To assure the health and safety of persons using supplied air suits, it is imperative that they be used under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied air suits.

B. Poor Warning Properties

It is important to realize that 30 CFR 11 NIOSH/MESA approvals for air purifying (organic vapor) devices prohibit against organic vapors with poor warning properties. Specifically, 30 CFR 11.90(b) (Note 4) covers gas masks (canister respirators) and 30 CFR 11.150 (Note 7) covers chemical cartridge respirators. Thus, these approvals are only for those organic vapors with adequate warning properties and not all organic vapors.

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Warning properties include odor, eye irritation, and respiratory irritation. Warning properties relying upon human senses are not foolproof. However, they provide some indication to the employee of possible sorbent exhaustion or of poor facepiece fit or other respiratory malfunction.

Adequate warning properties can be assumed when the substance odor, taste, or irritation effects are detectable and persistent at concentrations "at" or "below" the permissible exposure limit.

It is expected that environmental concentrations will vary considerably and, therefore, warning of a respirator failure would soon be perceived at contaminant concentrations somewhat above the permissible exposure limit.

If the odor or limitation threshold of a substance is more than three times greater than the permissible exposure limit, this substance should be considered to have poor warning properties. If the substance odor or irritation threshold is somewhat above the permissible exposure limit (not in excess of three times the limit) and there is no ceiling limit, consideration is given as to whether or not undetected exposure in this concentration range could cause serious or irreversible health effects. If not, the substance is considered to have adequate warning properties. Some substances have extremely low thresholds of odor and irritation in relation to the permissible exposure limit. Because of this, these substances can be detected by a worker within the facepiece of the respirator, even when the respirator is functioning properly. These substances are, therefore, considered to have poor warning properties.

C. Sorbents

Where supporting evidence exists or immediate (less than three minutes) breakthrough time at the IDLH concentration and below for a cartridge or canister sorbent, air purifying devices shall not be allowed for any use, escape or otherwise.

Where there is reason to suspect that commonly used sorbents (e.g. activated charcoal) do not provide adequate sorption efficiency against a specific contaminant, use of such sorbents shall not be allowed. However, where another sorbent material has been demonstrated to be effective against a specific contaminant, approved respirators utilizing the effective sorbent material shall be allowed. The statement in the respirator table shall read: "Any chemical cartridge respirator providing protection against (specific substance)," and "any gas mask providing protection against (specific substance)."

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Where there is reason to suspect that a sorbent has a high heat of reaction with a substance, use of that sorbent is not allowed. In such cases, only sorbents providing safe protection against (specific substance) may be used. For such substances, a footnote is added to the respirator table which reads as follows: "(Specific substance) is a strong oxidizer and should be kept away from oxidizable material. Some cartridges and canisters may contain activated charcoal and shall not be used to provide protection against (specific substance). Only non-oxidizable sorbents are allowed." Where the oxidizable material may be an oxidizable filter, the footnote reads: "(Specific substance) is a strong oxidizer and should be kept away from ozidizable substances. Only air purifying respirators with non-oxidizable filters are allowed."

Where there is reason to suspect that a substance sorbed on a sorbent of a cartridge or canister is shock sensitive, use of air-purifying respirators is disallowed.

D. Eye Irritation

For routine work operations, any perceptible eye irritation is considered unacceptable. Therefore, only full facepiece respirators are permissible in contaminant concentrations which produce eye irritation. Note that 30 CFR 11.90(b) (Note 6) specifies that eye protection may be required in certain concentrations of gases and vapors. For escape, some eye irritation would not inhibit escape and such irritation is reversible.

Where quantitative eye irritation data cannot be found in literature references, and theoretical considerations indicate the substance should not be an eye irritant, half-facepiece respirators are allowed.

Where review of the literature indicates a substance causes eye irritation but no eye irritation threshold is specified, the data will be evaluated to determine whether quarter or half-facepiece respirators are to be included in the respirator tables. When a table is developed for such substances, the respirators with a quarter and half facepieces shall be footnoted as follows: "When an employee informs his employer that he is experiencing eye irritation from (name) while wearing a respirator allowed in Table 2, the employer shall provide and ensure that the employee use an equivalent respirator with a full-facepiece, helmet, or hood."

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E. IDLH

The definition of IDLH provided in 30 CFR 11.3(t) is as follows: "Immediately dangerous to life or health" means conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health.

In establishing the IDLH concentration, the following factors are considered:

1. Escape without loss of life or irreversible health effects. Thirty minutes is considered the maximum exposure time for escape.

2. Severe eye or respiratory irritation or other reactions which would prevent escape without injury.

IDLH should be determined from the following sources:

1. Specific IDLH provided in the literature such as the American Industrial Hygiene Association Hygienic Guides.

2. Human exposure data.

3. Acute animal exposure data.

4. Where such data are lacking, acute toxicologic data from analogous substances may be considered.

The following guidelines should be used to interpret toxicologic data reported in the literature for animal species:

1. Where acute exposure animal data are available (30 minutes to four-hour exposures), the lowest exposure concentration causing death or irreversible health effects in any species is determined to be the IDLH concentration.

2. Chronic exposure data may have no relevance to the acute effects and should be used in determining the IDLH concentration only upon competent toxicologic judgment.

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3. Where there is no toxicologic evidence of an IDLH concentration, 500 times the permissible exposure limit shall determine the upper limit above which only highly reliable breathing apparatus providing maximum worker protection is used.

F. Lower Flammable Limit and Fire Fighting

Contaminant concentrations in excess of the LFL are considered to be immediately dangerous to life or health. At or above the LFL, the use of respirators is limited to those devices which provide the maximum protection, i.e., positive pressure SCBA, and the combination positive pressure supplied air respirators with auxiliary positive pressure SCBA.

Fire fighting is defined by ANSI Z88.5-1971 as being immediately dangerous to life. For fire fighting, the only device providing adequate protection is the positive pressure self-contained breathing apparatus.

G. Protection Factors

Protection factors are a measure of the overall effectiveness of a respirator. Filtering efficiency is a part of the protection factor and becomes a significant consideration for less efficient air purifying respirators.

The protection factors used in the preparation of the standards are based on quantitative fit tests performed at Los Alamos Scientific Laboratory (Reference 43) and elsewhere, and in some instances, on professional judgment. In Appendix I, the protection factors for each class of respirators listed in the checklists are shown. The entries in each list are for an entire class of respirators.

H. Variations with 30 CFR 11

1. The type of supplied air respirator is allowed in 30 CFR 11 for use in immediately dangerous to life or health atmospheres. However, the air flow requirement of 50 L/min is insufficient to maintain a positive pressure in the facepiece under all working conditions. Therefore, this

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device should have the same protection factor as applied to other air purifying and atmosphere-supplying respirators having a negative pressure in the facepiece (See Appendix I). 30 CFR 11 will require a revision to eliminate approval of Type A supplied-air respirators for IDLH atmospheres.

2. 30 CFR 11 does not contain protection factor requirements. Protection factors are used in the decision logic. An amendment to 30 CFR 11 is planned to include protection factor requirements for DFM respirators. Future amendments are contemplated for other types of respirators.

3. 30 CFR 11 does not permit the use of an escape gas mask against acid gases or organic vapors with poor warning properties. A change to 30 CFR 11 is necessary to permit the use of an escape gas mask against substances with poor warning properties.

I. Escape

Where escape respirators are provided, they shall be selected from the escape category in Table 2. The employer shall provide and ensure employees carry an escape respirator where exposure may occur to extremely toxic substances. (An extremely toxic substance is defined as a gas or vapor having a rate LC_{50} of less than 10 ppm.)

The following statement is added to the introduction to the respirator table for these substances:

> "Employers shall provide each employee working in areas where (name) may be released into the workplace air with an approved escape respirator as specified in Table 2. The employer shall ensure that each employee carry the escape respirator in the area where (name) may be released into the workplace.

J. "Entry tanks or closed vessels; or..."

Item (d)(4)(iv) is a variable provision in the introductory statements to the respirator tables which lists the specific operations where a respirator is considered to be an acceptable means of control. Examples of where this may occur are for operations which require occasional entry into tanks or other closed vessels.

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RESPIRATOR PROTECTION FACTORS[a]

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in Immediately-Dangerous-to-Life-or-Health Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Particulate-filter, quarter-mask or half-mask facepiece[b,c]	No	No	10	As measured on each person with maximum of 100.
Vapor- or gas-removing, quarter-mask or half-mask facepiece[c]	No	No	10, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 100, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.
Combination particulate-filter and vapor- or gas-removing, quarter-mask or half-mask facepiece[b,c]	No	No	10, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 100, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.
Particulate-filter, full facepiece[b]	No	No	100	As measured on each person with maximum of 100 if dust, fume, or mist filter is used, or maximum of 1000 if high-efficiency filter is used.
Vapor- or gas-removing, full facepiece	No	No	100, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 1000, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.
Combination particulate-filter and vapor- or gas-removing, full facepiece[b]	No	No	100, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 100 if dust, fume, or mist filter is used and maximum of 1000 if high-efficiency filter is used, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.
Powered particulate-filter, any respiratory-inlet covering[b,c,d]	No	No (yes, if escape provisions are provided[d])	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 100 if dust, fume, or mist filter is used and 3000 if high-efficiency filter is used.	
Powered vapor- or gas-removing, any respiratory-inlet covering[c,d]	No	No (yes, if escape provisions are provided[d])	N/A	N/A
			No tests are required due to positive pressure operation of respirator. The maximum protection factor is 3000, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.	
Powered combination particulate-filter and vapor- or gas-removing, any respiratory-inlet covering[b,c,d]	No	No (yes, if escape provisions are provided[d])	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 100 if dust, fume, or mist filter is used and 3000 if high-efficiency filter is used, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.	

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RESPIRATOR PROTECTION FACTORS[a]

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in Immediately-Dangerous-to-Life-or-Health Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Air-line, demand, quarter-mask or half-mask facepiece, with or without escape provisions[c,e]	Yes[f]	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the *immediately-dangerous-to-life-or-health* (IDLH) values.
Air-line, demand, full facepiece, with or without escape provisions[c]	Yes[f]	No	100	As measured on each *person, but limited* to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Air-line, continuous-flow or pressure-demand type, any facepiece, without escape provisions[c]	Yes[f]	No	N/A	N/A No tests are required due to positive-pressure operation of respirator. The protection factor provided by the respirator is limited to use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Air-line, continuous-flow or *pressure-demand* type, any facepiece, with escape provisions[c,e]	Yes[g]	Yes	N/A	N/A No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10 000 plus.[h]
Air-line, continuous flow, helmet, hood, or suit, without escape provisions	Yes[f]	No	N/A	N/A No tests are required due to positive-pressure operation of respirator. The protection factor provided by the respirator is limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Air-line, continuous-flow, helmet, hood, or suit, with escape provisions[e]	Yes[g]	Yes	N/A	N/A No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10 000 plus.[h]
Hose mask, with or without blower, full facepiece	Yes[f]	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Self-contained breathing apparatus, demand-type open-circuit or negative-pressure-type closed-circuit, quarter-mask or half-mask facepiece[c]	Yes[f]	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Self-contained breathing apparatus, demand-type open-circuit or negative-pressure-type closed-circuit, full facepiece or mouthpiece/nose clamp[c]	Yes[f] (Yes[g], if respirator is used for mine rescue and mine recovery operations.)	No (yes, if respirator is used for mine rescue and *mine recovery operations.*)	100	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values, except when the respirator is used for mine rescue and mine recovery operations.

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RESPIRATOR PROTECTION FACTORS[a]

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in Immediately-Dangerous-to-Life-or-Health Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Self-contained breathing apparatus, pressure-demand-type open-circuit or positive-pressure-type closed-circuit, quarter-mask or half-mask facepiece, full facepiece, or mouthpiece/nose clamp[c]	Yes[g]	Yes	N/A No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10 000 plus.[h]	N/A
Combination respirators not listed.	The type and mode of operation having the lowest respirator protection factor shall be applied to the combination respirator.			

N/A means not applicable since a respirator-fitting test is not carried out.

[a]A respirator protection factor is a measure of the degree of protection provided by a respirator to a respirator wearer. Multiplying the permissible time-weighted average concentration or the permissible ceiling concentration, whichever is applicable, for a toxic substance, or the maximum permissible airborne concentration for a radionuclide, by a protection factor assigned to a respirator gives the maximum concentration of the hazardous substance for which the respirator can be used. Limitations of filters, cartridges, and canisters used in air-purifying respirators shall be considered in determining protection factors.

[b]When the respirator is used for protection against airborne particulate matter having a permissible time-weighted average concentration less than 0.05 milligram particulate matter per cubic meter of air or less than 2 million particles per cubic foot of air, or for protection against airborne radionuclide particulate matter, the respirator shall be equipped with a high-efficiency filter(s).

[c]If the air contaminant causes eye irritation, the wearer of a respirator equipped with a quarter-mask or half-mask facepiece or mouthpiece and nose clamp shall be permitted to use a protective goggle or to use a respirator equipped with a full facepiece.

[d]If the powered air-purifying respirator is equipped with a facepiece, the escape provision means that the wearer is able to breathe through the filter, cartridge, or canister and through the pump. If the powered air-purifying respirator is equipped with a helmet, hood, or suit, the escape provision shall be an auxiliary self-contained supply of respirable air.

[e]The escape provision shall be an auxiliary self-contained supply of respirable air.

[f]For definition of "oxygen deficiency – not immediately dangerous to life or health" see Section 2.

[g]For definition of "oxygen deficiency – immediately dangerous to life or health" see Section 2 and A10.

[h]The protection factor measurement exceeds the limit of sensitivity of the test apparatus. Therefore, the respirator has been classified for use in atmospheres having unknown concentrations of contaminants.

[i]The service life of a vapor- or gas-removing cartridge or canister depends on the specific vapor or gas, the concentration of the vapor or gas in air, the temperature and humidity of the air, the type and quantity of the sorbent in the cartridge or canister, and the activity of the respirator wearer. Cartridges and canisters may provide only very short service lives for certain vapors and gases. Vapor/gas service life testing is recommended to ensure that cartridges and canisters provide adequate service lives. Reference should be made to published reports which give vapor/gas life data for cartridges and canisters.

[j]Vapor- and gas-removing respirators are not approved for contaminants that lack adequate warning properties of odor, irritation, or taste at concentrations in air at or above the permissible exposure limits.

NOTE: Respirator protection factors for air-purifying-type respirators equipped with a mouthpiece/nose clamp form of respiratory-inlet covering are not given, since such respirators are approved only for escape purposes.

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RESPIRATORY PROTECTION TRAINING PROGRAM

APPENDIX II

QUALITATIVE FIT TESTING

Isoamyl Acetate Vapor

Irritant Smoke

Sugar Solution

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SUGAR SOLUTION FIT TEST

(3M Brand Respirators)

- Wearer puts on respirator, adjusts and fits it, per the manufacturer's instructions.

- Instruct the wearer to close his eyes and breathe through the mouth, at a normal rate (breathing through the mouth is essential, because a leak will be detected by taste, rather than smell).

- Remove the large rubber stopper and, holding the nebulizer 3 to 4 inches away from the subject, direct aerosol toward the sealing edge of the respirator. Move around the circumference of the respirator, pausing in each area for at least one breath, to check for leaks at all points.

- If the wearer detects the very sweet taste of the sugar solution, have him readjust the respirator, and repeat the test.

- If the wearer does not detect the sugar solution, move on to the series of exercises.

- Have the wearer perform the various exercises (normal breathing, deep breathing, side to side movement of head, up and down movement of head, and talking), while directing the aerosol spray around the entire circumference of the respirator.

- If the wearer detects the sugar solution, have him readjust the respirator, and repeat the fit test, beginning with the exercises.

- If the wearer does not detect the sugar solution, the fit is considered acceptable.

ADVANTAGES: Easy, quick; requires no expensive equipment nor highly trained tester.

DISADVANTAGES: Relies upon the attitude of the employee, is subjective, does not use contaminant in question, and detects only relatively large leaks.

ISOAMYL ACETATE VAPOR FIT TEST

- Wearer puts on respirator and adjusts straps and facepiece to obtain normal fit. If the respirator is air-purifying type, it must be equipped with organic vapor cartridges to remove the banana oil.

- Move the isoamyl acetate swab or wand around the respirator facepiece to face seal, approximately 2-3 inches from the face.

- If the wearer detects the odor of isoamyl acetate, have him readjust the fit of the respirator, and retest, starting at this point.

- If the wearer does not smell the isoamyl acetate, move on to the series of exercises.

- Have the wearer perform the various exercises (normal breathing, deep breathing, side to side movement of head, up and down movement of head, and talking), while moving the isoamyl acetate wand around the facepiece to face seal, approximately 2-3 inches from the face.

- If the wearer detects isoamyl acetate, have him readjust the fit of the respirator, and repeat the test, starting at this point.

- If the wearer indicates that he does not detect the isoamyl acetate, then break the seal to make sure he can recognize the odor of banana oil. If he does, then the fit is considered to be acceptable.

- If the wearer cannot adjust the respirator in such manner that he passes all the tests, then the fit is considered unacceptable.

ADVANTAGES: Easy, quick; requires no expensive equipment nor highly trained tester. Test is fairly realistic.

DISADVANTAGES: Relies upon attitude of employee, is subjective, does not use contaminant in question, detects only large leaks, especially if the wearer is someone insensitive to the odor of isoamyl acetate.

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IRRITANT SMOKE FIT TEST

- Wearer puts on respirator and adjusts straps and facepiece to obtain normal fit. If the respirator is air-purifying type, it must be equipped with a high efficiency filter (99.97%) to remove the irritant smoke.

- Hold the ventilation smoke tube (MSA Part #458480) approximately 2 feet from the wearer. Instruct the wearer to close his eyes, and lightly puff the smoke over the respirator. At this time, keep the amount of smoke minimal and pause between puffs to note the wearer's reaction.

- If the wearer detects leakage (irritation, involuntary cough, etc.) have him readjust the fit, and repeat the test.

- If the wearer does not detect a leakage, increase the amount of smoke and move progressively closer to the subject, always remaining alert to the wearer's reactions.

- When the smoke tube is about 6 inches from the respirator, with no leakage detected, begin to direct the smoke at specific potential sources of leakage - around the facepiece to face seal, exhalation valve, and bridge of the nose.

- If a leak is detected, have the wearer readjust the fit, and retest.

- If no leakage is detected, the wearer should be instructed to slowly begin the same series of exercises as performed with the isoamyl acetate.

- If the leakage is detected at any time, the test should be stopped and the respirator readjusted; then start the test again at this point.

- If the wearer cannot adjust the respirator in such a manner that he passes all the tests, then the fit is considered unacceptable.

ADVANTAGES: Quick, easy; requires no expensive equipment or highly trained tester. Test is fairly realistic.

DISADVANTAGES: Smoke is extremely irritating and test must be performed with considerable care and safeguards; does not use the contaminant in question, and is somewhat subjective, unless leakage is quite large.

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ANNUAL RESPIRATOR REPORTING FORM

Facility_____ Date_____

ROUTINE USE RESPIRATORS

AREA(S) USED	TYPE(S) RESPIRATOR USED	CONTAMINANT(S) ENCOUNTERED	APPROX. NO. OF WORKERS

NON-ROUTINE OR EMERGENCY USE RESPIRATORS

AREA(S) USED	TYPE(S) RESPIRATOR USED	CONTAMINANT(S) ENCOUNTERED

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QUALITATIVE FIT TESTING RECORD

EMPLOYEE & JOB TITLE	DATE	TYPE FACIAL HAIR	RESPIRATOR TESTED	TEST UTILIZED	PASS OR FAIL	ASSIGNED PROTECTION FACTOR	TESTER

Notes:

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APPENDIX B

Jobs/Tasks Requiring Mandatory Respiratory Protection and Type of Respirator

AREA	TASK/JOB	CONTAMINANT EXPOSURE	DESIGNATED RESPIRATOR
Potrooms			
All employees working in potroom (pot tenders, anode workers, tappers)*	All jobs/tasks	Coal Tar Pitch Volatiles Particulate Dust	3M9906 MSA Dustfoe 88 MSA Comfo II, Type F
Carbon Plant			Dustfoe 88 MSA Comfo II, Type F or H
All employees in the carbon plant*	Mixing, batching, sampling, unloading coke & pitch; sheeting pots; dumping anode paste	Coal Tar Pitch Volatiles Particulate Dust	3M9906 MSA Dustfoe 88 MSA Comfo II, Type F or H
Pot Service			
All employees in pot relining	Dumping, spreading, cathode levelling, ramming cathode paste	Coal Tar Pitch Volatiles Particulate Dust	MSA Comfo II [redacted] Cartridge GMA-H
Vent, duct and fan cleaners	Cleaning air control systems	Coal Tar Pitch Volatiles Particulate Dust	3M9906 MSA Dustfoe 88 *Willson GAFW - air supplied
Sweeper Operator	Sweeping Potroom	Coal Tar Pitch Volatiles Particulate Dust	3M9906 MSA Dustfoe 88 *Willson GAFW - air supplied
Material Handlers	Distribution of bath, carbon & dross	Coal Tar Pitch Volatiles	3M9906 MSA Dustfoe 88 *Willson GAFW - air supplied
Pot Control			
All Employees	Taking Pot temperature, metal & bath samples	Coal Tar Pitch Volatiles Particulate Dust	3M9906 Dustfoe 88 MSA Comfo II, Type F or H
Miscellaneous			
Visitors	Plant tours, inspections, etc.	Coal Tar Pitch Volatiles Particulate Dust	3M9906
Outside Contractors	Special contract jobs	Coal Tar Pitch Volatiles Particulate Dust	3M9906

* Now Willson 1810 1920 Type C continuous flow; or 1850/1860

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