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THE MOUND LABORATORY RESPIRATORY PROTECTION PROGRAM

Eugene M. Wright
Monsanto Research Corporation
Mound Laboratory*
Miamisburg, Ohio

ABSTRACT

The Mound Laboratory Respiratory Protection Program provides 1) quality assurance to ensure that equipment is approved (U. S. Bureau of Mines) and adequate, 2) orientation and training, 3) respirator fitting, 4) maintenance of equipment, and 5) records.

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DISCLAIMER

INTRODUCTION

Mound Laboratory has had a Respiratory Protection Program since operations were begun in 1948. The objective of the Mound Respiratory Protection Program is to comply with the Laboratory Safety Policy which is to: "Provide a safe working environment. To provide adequate respiratory protective devices. To establish a training program and train employes in safe operating practices, and to monitor equipment and procedures to enforce these obligations." This program is under the responsibility of the Health Physics Operations Manager and is administered in close liaison with the Medical and Environmental Control sections.

Each of these groups specializes in unique fields, all of which are necessary to meet the Laboratory requirements. Health Physics Operations specializes in radiation safety and is responsible for all respirator fittings and training and for providing and maintaining appropriate respiratory equipment. The Medical section monitors employes to ensure they are physically able to wear respiratory protective equipment. Environmental Control provides guidance concerning toxic materials which are nonradioactive.

Concisely, the Mound Respiratory Protection Program consists of:

I. Quality Assurance (to ensure equipment is approved* and adequate)

II. Orientation and Training (to ensure proper use)

III. Respirator Fitting

   A. Qualitative (to determine proper fit)

   B. Quantitative (to determine type of respirator)

IV. Maintenance (to restore equipment for reuse)

V. Records (to maintain historical file of personnel fitting data)

QUALITY ASSURANCE

Quality assurance begins when respiratory equipment is received from the supplier. When the equipment is received, it is inspected to ensure it is approved and that there are no apparent defects. The respirators and accessories are stored at the warehouse until ready to be placed in service. As a control to prevent unapproved respiratory equipment being purchased and put into use, only certain Health Physics specialists are authorized to withdraw the equipment from the warehouse.

*Approved by the Department of Interior, Bureau of Mines.

When the respiratory equipment is to be put into service it is sent to the decontamination laboratory where the respirators are washed, disinfected, and sanitized. The respirators are washed in a Hobart commercial dishwasher which has been modified to regulate the water temperature. The disinfecting and sanitizing agents are added to the wash cycle. Upon completion of the washing, the respirators are once again inspected for defective parts which may malfunction.

The filters, after being inspected for apparent damage, are placed in an Air Techniques Penetrometer (more commonly known as a DOP tester) where they are tested for leaks according to the following procedure. The filter cartridge is placed in the specially designed chuck. The chuck is then closed and a monodispersed dioctyl phthlate test atmosphere is injected. (Dioctyl phthlate is more commonly known as DOP). It is generated in a thermal generator which produces a 0.3 μm aerosol. Any DOP that penetrates the filter passes into a forward-light-scatter chamber where light bouncing off the particles is reflected into a photomultiplier tube. Here it is amplified and converted to electrical energy that activates a readout device which is calibrated in percent of leakage. The filters must be 99.97% efficient to be acceptable. Any filter which has a DOP penetration greater than 0.03% is above the maximum allowed and it is discarded.

At the same time the filter cartridge is being tested for leaks, the instrument also checks the pressure drop across the filter to determine whether it is "loading up." This pressure drop is read out on the Magnehelic gauge mounted above the unit. The maximum allowable pressure drop is 1.4 in. of water. The pressure drop is based on past experience at Mound Laboratory.

After these tests are completed, the respirators are assembled, sealed in plastic bags, sent to the distribution center, and stored until they are used.

ORIENTATION AND TRAINING

Respiratory protection devices come in many types, shapes, and sizes. Those that are used at Mound Laboratory have been carefully selected to provide maximum protection to a maximum number of the plant population. These respiratory devices include:

Many models of air-purifying half-face respirators

Air-purifying full-face respirators

Supplied air respirators

Self-contained breathing apparatus

The two-piece bubble suit that was developed at Mound

For safe use of this equipment, the training program at Mound provides both supervisors and employes with instructions in proper selection, use, and maintenance. The foundation for the success of the Respiratory Protection Program is this training program.

The training program includes:

1) Instruction in the nature of the material being worked with and an honest appraisal of what may happen if the respirator is not used.

2) Explanation of why more positive controls are not immediately feasible. This includes recognition that every reasonable effort is being made to reduce or eliminate the need for respirators.

3) A discussion of why this is the proper type of respirator for the particular purpose.

4) A discussion of the respirator's capabilities and limitations.

5) Instruction and training in actual use of the respirator.

6) Classroom and field training to recognize and cope with emergency situations.

7) Other special training as needed for special use.

This training provides employes with an opportunity to handle the respirator, have it fitted properly, test its facepiece-to-face seal, wear it in normal air for a familiarity period, and finally, wear it in a test atmosphere.

RESPIRATOR FITTINGS

There are thin faces, plump faces, narrow faces, wide faces, square chins, and double chins; faces with scars, dimples, five o'clock shadow, large bone structure, and small bone structure. The list goes on endlessly. Each manufacturer of respirators makes his product in a unique style and usually in only one or two sizes. In most cases, one size is all that is available. Obviously, it would be difficult for an individual to select just any respirator and obtain a proper fit, and equally obvious, a respirator that does not fit properly will provide little or no protection and would even promote a false sense of security. Therefore, the proper fitting of respirators is an essential part of any respiratory protection program.

The first methods used for fitting respirators and checking the facepiece-to-face seal were the positive and negative pressure tests. In the positive pressure test, the exhalation valve of the respirator was closed and the employe being fitted would exhale gently into the

facepiece. The fit was considered satisfactory if slight positive pressure was built up in the facepiece without any evidence of outward leakage of air at the seal.

For the negative pressure test, the inlet openings of the filters were closed by covering them with the palms of the hands, then the employe would inhale gently so that the facepiece collapsed slightly, and hold his breath for a few seconds. If the facepiece remained in its slightly collapsed condition and no inward leakage of air occurred, the respirator was considered to have a proper fit.

As the state of the art grew in fitting respirators, we improved our methods at Mound in order to obtain more positive results. The first big change occurred 9 yr ago when we implemented the use of an irritant smoke as a method to determine the effectiveness of the facepiece-to-face seal. With the installation of our DOP man-test chamber in 1974, we now use what is considered by experts in the field of respiratory protection the ultimate methods for fitting respirators and checking their facepiece-to-face seal.

When we started using irritant smoke as a method for checking the facepiece-to-face seal of the respirators, we were fitting about 300 users per year. Today, there are approximately 800 employes who are fitted annually.

The respirator fitting program at Mound provides demonstrations on how to wear respiratory protection devices, how to adjust them properly, and how to determine a proper fit. Two of the visual aids used in these demonstrations include:

A mannequin dressed in protective clothing and wearing an air purifying full-face respirator properly.

A mannequin properly dressed in the Mound two-piece bubble suit.

Two techniques are used for fitting respirators. The simplest, called Qualitative Fitting, is used at Mound to determine whether the respirator is fitting properly. Qualitative fitting is performed in the field each time the respirator is put on for use in a contaminated atmosphere by the employe or by a coworker.

The primary contaminant of concern at Mound is a particulate. Therefore, an irritant smoke tube is used. This is a glass tube filled with stannic chloride-impregnated pumice. The smoke tube produces a very irritating smoke when air is blown through it. The person wearing the mask stands in or near the opening of a well-ventilated fume hood. The smoke is directed at the facepiece-to-face seal and leakage is indicated by irritation of the throat and lungs. When half-mask facepieces are tested, care must be taken not to direct the smoke into the eyes and that the eyes are closed during the test.

The other technique used at Mound for fitting respirators is called Quantitative Fitting. Quantitative fitting is used to determine the

type of respirator an individual wears and what degree of protection he can expect with the particular respirator. Quantitative fittings are conducted for new employes, after they have been examined by the Medical Department and have been deemed physically able to wear respiratory equipment. They are refitted annually after medical examinations. The techniques for quantitative fitting is much more sophisticated than the techniques used for qualitative fitting.

Step 1

The employe is given an orientation or reorientation on the proper way to put the respirator on to obtain the best facepiece-to-face seal. The orientation also includes an explanation of how the test system works and how the fittings are performed using this system.

Step 2

The tests take place in a DOP man-test chamber. The employe puts on the test respirator which has a flexible probe connected to it. He steps into the chamber and connects the probe into a quick-disconnect fitting that is fastened to a test line that connects to the forward-light-scatter chamber in the Air Techniques Penetrometer. The door of the chamber is closed and the chamber is flooded to 100% saturation (100,000 ppm) with a polydispersed dioctyl phthlate (DOP).

Step 3

The testing must be performed by a qualified person who can operate the equipment and interpret the results. The employe is put through a series of exercises which simulate actual conditions in which the respirator would be worn in the field. The penetrometer operates as the one described earlier for leak checking filter cartridges, except this one prints out a chart graph. Any penetration of DOP into the respirator registers as a peak on the graph. Each employe who is fitted is fitted for two types of half-face and full-face respirators.

Step 4

Upon completion of the fitting, a reference card is given to the employe. On one side the types of respirators the employe was best fitted with are recorded. On the other side names and telephone numbers are given for contacting if any question arises concerning respiratory equipment. The employe uses this card as a reference at the distribution center where he obtains a respirator.

RECORDS

An historical file is kept on all quantitative respirator fittings. This file includes the chart graph and a Rolldex card. The card identifies the employe, his control number, department, and supervisor. The types of respirators the employe was fitted for are noted, as well as the average and high penetrations. Also the protection factor the employe can expect when using the equipment is recorded. (The protection factor is based upon the highest penetration for that particular respirator.)

MAINTENANCE

After each use the respirators are returned to the Decontamination Laboratory where they are monitored for radioactive contaminants. If they are found free of radioactive contaminants they are then handled as previously described in the section on quality assurance. The respirators are disassembled, washed, disinfected, and sanitized. Then they are carefully inspected, and worn or defective parts are replaced. The filter cartridges are monitored for radioactive contaminants and checked for leaks and pressure drop. The respirators are then reassembled, bagged, and sent to the distribution centers for reuse. Radioactive contaminated respirators require special handling to remove the radioactive contaminants before they are sent through the process.

SETTING UP A RESPIRATORY PROTECTION PROGRAM

The Occupational Safety and Health Standards, Section 1910.134 (Appendix A), provide the minimum requirements for conducting a respiratory protection program. In running a respiratory protection program which meets the required criteria, some points that must be considered are:

1. The employer must provide respirators which are applicable and suitable for the purpose intended whenever such equipment is necessary to protect the health of the employe.

2. Approved or accepted respirators must be used when they are available.

3. The employe must be instructed and trained in the proper use of respirators and in their limitations.

4. There must be regular inspection and evaluation to determine the continued effectiveness of the program.

5. The respiratory protection program should be supervised by a qualified individual.

The type of program you'll want to develop should be considered carefully. If your operations are small and you have only a few employes who will wear respirators, a qualitative fitting program will probably be sufficient. If the operations are large and there are many users, you probably should consider quantitative fitting to determine the type of respirator an individual wears and qualitative fitting to determine proper fit.

Let's review the requirements for these two types of programs.

A) Qualitative Program

i) Test Atmosphere
ii) Fumehood
iii) Training

B) Quantitative Program

i) DOP walk-in man-test chamber
ii) Appropriate instrumentation
iii) Qualified technician
iv) Training

C) Quality Assurance and Maintenance

D) Records

Mound Laboratory has developed considerable expertise in the area of respiratory protection and I would like to extend this invitation to assist you in any way we can in setting up your program.

APPENDIX A

OCCUPATIONAL SAFETY AND HEALTH STANDARDS
SUBPART I – PERSONAL PROTECTIVE EQUIPMENT

(Code of Federal Regulations, Title 29, Chapter XVII, Part 1910)

Subpart I—Personal Protective Equipment

§ 1910.132 General requirements.

(a) *Application.* Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

(b) *Employee-owned equipment.* Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

(c) *Design.* All personal protective equipment shall be of safe design and construction of the work to be performed.

§ 1910.133 Eye and face protection.

(a) *General.* (1) Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. In such cases, employers shall make conveniently available a type of protector suitable for the work to be performed, and employees shall use such protectors. No unprotected person shall knowingly be subjected to a hazardous environmental condition. Suitable eye protectors shall be provided where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation, or a combination of these hazards.

(2) Protectors shall meet the following minimum requirements:

(i) They shall provide adequate protection against the particular hazards for which they are designed.

(ii) They shall be reasonably comfortable when worn under the designated conditions.

(iii) They shall fit snugly and shall not unduly interfere with the movements of the wearer.

(iv) They shall be durable.

(v) They shall be capable of being disinfected.

(vi) They shall be easily cleanable.

(vii) Protectors should be kept clean and in good repair.

(3) Persons whose vision requires the use of corrective lenses in spectacles, and who are required by this standard to wear eye protection, shall wear goggles or spectacles of one of the following types:

(i) Spectacles whose protective lenses provide optical correction.

(ii) Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles.

(iii) Goggles that incorporate corrective lenses mounted behind the protective lenses.

(4) Every protector shall be distinctly marked to facilitate identification only of the manufacturer.

(5) When limitations or precautions are indicated by the manufacturer, they shall be transmitted to the user and care taken to see that such limitations and precautions are strictly observed.

(6) Design, construction, testing, and use of devices for eye and face protection shall be in accordance with American National Standard for Occupational and Educational Eye and Face Protection, Z87, 1-1968.

§ 1910.134 Respiratory protection.

(a) *Permissible practice.* (1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to the following requirements.

(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protective program which shall include the requirements outlined in paragraph (b) of this section.

(3) The employee shall use the provided respiratory protection in accordance with instructions and training received.

(b) *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.

(c) *Selection of respirators.* Proper selection of respirators shall be made according to the guidance of American National Standard Practices for Respiratory Protection Z88.2–1969.

(d) *Air quality.* (1) Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Commodity Specification G–7.1–1966. Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air. Oxygen must never be used with air line respirators.

(2) Breathing air may be supplied to respirators from cylinders or air compressors.

(i) Cylinders shall be tested and maintained in as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 178).

(ii) The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air-type compressor shall be used. Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications in subparagraph (1) of this paragraph.

(3) Air line couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air line respirators with nonrespirable gases or oxygen.

(4) Breathing gas containers shall be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, Z48.1–1954; Federal Specification BB–A–1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG–B–00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

(e) *Use of respirators.* (1) Standard procedures shall be developed for respirator use. These should include all information and guidance necessary for their proper selection, use, and care. Possible emergency and routine uses of respirators should be anticipated and planned for.

(2) The correct respirator shall be specified for each job. The respirator type is usually specified in the work procedures by a qualified individual supervising the respiratory protective program. The individual issuing them shall be adequately instructed to insure that the correct respirator is issued. Each respirator permanently assigned to an individual should be durably marked to indicate to whom it was assigned. This mark shall not affect the respirator performance in any way. The date of issuance should be recorded.

(3) Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

(i) In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

(ii) When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby men must be present with suitable rescue equipment.

(iii) Persons using air line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby man or men with suitable self-contained breathing apparatus shall be at the nearest fresh air base for emergency rescue.

(4) Respiratory protection is no better than the respirator in use, even though it is worn conscientiously. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

(5) For safe use of any respirator, it is essential that the user be properly instructed in its selection, use, and maintenance. Both supervisors and workers shall be so instructed by competent persons. Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere.

(i) Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. The worker's diligence in observing these factors shall be evaluated by periodic check. To assure proper protection, the facepiece fit shall be checked by the wearer each time he puts on the respirator. This may be done by following the manufacturer's facepiece fitting instructions.

(ii) Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, glasses with short temple bars or without temple bars may be taped to the wearer's head. Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed. Systems have been developed for mounting corrective lenses inside full facepieces. When a workman must wear corrective lenses as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal.

(iii) If corrective spectacles or goggles are required, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimize or avoid this problem.

(f) *Maintenance and care of respirators.* (1) A program for maintenance and care of respirators shall be adjusted to the type of plant, working conditions, and hazards involved, and shall include the following basic services:

(i) Inspection for defects (including a leak check),

(ii) Cleaning and disinfecting,

(iii) Repair, and

(iv) Storage

Equipment shall be properly maintained to retain its original effectiveness.

(2) (i) All respirators shall be inspected routinely before and after each use. A respirator that is not routinely used but is kept ready for emergency use shall be inspected after each use and at least monthly to assure that it is in satisfactory working condition.

(ii) Self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be fully charged according to the manufacturer's instructions. It shall be determined that the regulator and warning devices function properly.

(iii) Respirator inspection shall include a check of the tightness of connections and the condition of the facepiece, headbands, valves, connecting tube, and canisters. 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 them from taking a set during storage.

(iv) A record shall be kept of inspection dates and findings for respirators maintained for emergency use.

(3) Routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Each worker should be briefed on the cleaning procedure and be assured that he will always receive a clean and disinfected respirator. Such assurances

are of greatest significance when respirators are not individually assigned to workers. Respirators maintained for emergency use shall be cleaned and disinfected after each use.

(4) Replacement or repairs shall be done only by experienced persons with parts designed for the respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair.

(5) (i) After inspection, cleaning, and necessary repair, respirators shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators placed at stations and work areas for emergency use should be quickly accessible at all times and should be stored in compartments built for the purpose. The compartments should be clearly marked. Routinely used respirators, such as dust respirators, may be placed in plastic bags. Respirators should not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

(ii) Respirators should be packed or stored 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.

(iii) Instructions for proper storage of emergency respirators, such as gas masks and self-contained breathing apparatus, are found in "use and care" instructions usually mounted inside the carrying case lid.

(g) *Identification of gas mask canisters.* (1) The primary means of identifying a gas mask canister shall be by means of properly worded labels. The secondary means of identifying a gas mask canister shall be by a color code.

(2) All who issue or use gas masks falling within the scope of this section shall see that all gas mask canisters purchased or used by them are properly labeled and colored in accordance with these requirements before they are placed in service and that the labels and colors are properly maintained at all times thereafter until the canisters have completely served their purpose.

(3) On each canister shall appear in bold letters the following:

(i)—

Canister for _____
(Name for atmospheric contaminant)
or
Type N Gas Mask Canister

(ii) In addition, essentially the following wording shall appear beneath the appropriate phrase on the canister label: "For respiratory protection in atmospheres containing not more than ------ percent by volume of_____
_____."

(Name of atmospheric contaminant)

(iii) All of the markings specified above should be placed on the most conspicuous surface or surfaces of the canister.

(4) Canisters having a special high-efficiency filter for protection against radionuclides and other highly toxic particulates shall be labeled with a statement of the type and degree of protection afforded by the filter. The label shall be affixed to the neck end of, or to the gray stripe which is around and near the top of, the canister. The degree of protection shall be marked as the percent of penetration of the canister by a 0.3-micron-diameter dioctyl phthalate (DOP) smoke at a flow rate of 85 liters per minute.

(5) Each canister shall have a label warning that gas masks should be used only in atmospheres containing sufficient oxygen to support life (at least 16 percent by volume), since gas mask canisters are only designed to neutralize or remove contaminants from the air.

(6) Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table I-1. All colors used shall be such that they are clearly identifiable by the user and clearly distinguishable from one another. The color coating used shall offer a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use. Appropriately colored pressure sensitive tape may be used for the stripes.

TABLE I-1

Atmospheric contaminants to be protected against	*Colors assigned**
Acid gases	White.
Hydrocyanic acid gas	White with ½-inch green stripe completely around the canister near the bottom.
Chlorine gas	White with ½-inch yellow stripe completely around the canister near the bottom.
Organic vapors	Black.
Ammonia gas	Green.
Acid gases and ammonia gas	Green with ½-inch white stripe completely around the canister near the bottom.
Carbon monoxide	Blue.
Acid gases and organic vapors	Yellow.
Hydrocyanic acid gas and chloropicrin vapor	Yellow with ½-inch blue stripe completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases.	Brown.
Radioactive materials, excepting tritium and noble gases.	Purple (Magenta).
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors.	Canister color for contaminant, as designated above, with ½-inch gray stripe completely around the canister near the top.
All of the above atmospheric contaminants	Red with ½-inch gray stripe completely around the canister near the top.

*Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

NOTE: Orange shall be used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.

§ 1910.135 Occupational head protection.

Helmets for the protection of heads of occupational workers from impact and penetration from falling and flying objects and from limited electric shock and burn shall meet the requirements and specifications established in American National Standard Safety Requirements for Industrial Head Protection, Z89.1–1969.

§ 1910.136 Occupational foot protection.

Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1–1967.

§ 1910.137 Electrical protective devices.

Rubber protective equipment for electrical workers shall conform to the requirements established in the American National Standards Institute Standards as specified in the following list:

Item	*Standard*
Rubber insulating gloves.	J6.6–1967.
Rubber matting for use around electric apparatus	J6.7–1935 (R1962).
Rubber insulating blankets.	J6.4–1970.
Rubber insulating hoods.	J6.2–1950 (R1962).
Rubber insulating line hose.	J6.1–1950 (R1965).
Rubber insulating sleeves.	J6.5–1962.

§ 1910.138 Effective dates.

(a) The provisions of this Subpart I shall become effective on August 27, 1971, except that:

(1) Any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation; and

(2) If any standard in 41 CFR Part 50–204, other than a national consensus standard incorporated by reference in

§ 50–204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart I which is derived from 41 CFR Part 50–204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

§ 1910.139 Sources of standards.

Sec.	*Source*
1910.132	41 CFR 50–204.7.
1910.133(a)	ANSI Z87.1–1968, Eye and Face Protection.
1910.134	ANSI Z88.2–1969, Standard Practice for Respiratory Protection.
1910.134 Table I–I.	ANSI K13.1–1967, Indentification of Gas Mask Canister.
1910.135	ASNI Z89.1–1969, Safety Requirements for Industrial Head Protection.
1910.136	ANSI Z41.1–1967, Men's Safety-Toe Footwear.
1910.137	ANSI Z9.4–1968, Ventilation and Safe Practices of Abrasive Blasting Operations.

§ 1910.140 Standards organizations.

Specific standards of the following organization have been referenced in this part. Copies of the referenced materials may be obtained from the issuing organization.

American National Standards Institute, 1430 Broadway, New York, NY 10018.