U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

October 1976

REGULATORY GUIDE 8.15

ACCEPTABLE PROGRAMS FOR RESPIRATORY PROTECTION

A. INTRODUCTION

Section 20.103, "Exposure of individuals to concentrations of radioactive materials in air in restricted areas," of 10 CFR Part 20, "Standards for Protection Against Radiation," permits licensees to make allowance for the use of respiratory protective equipment in estimating exposures of individuals to airborne radioactive materials provided the protective equipment is used as stipulated in this guide, which describes the elements of respiratory protection programs acceptable to the NRC staff.

B. DISCUSSION

This guide specifies elements of acceptable respiratory protection programs. More detailed advice, including technical needs and background information, may be found in NUREG-0041, "Manual of Respiratory Protection Against Airborne Radioactive Materials,"[a] sections of which are referenced and keyed to appropriate portions of this guide.

The NRC staff will use information in NUREG-0041 in assessing the adequacy of respiratory protection programs pursuant to the guidance provided herein (NUREG-0041, Section 3).

C. REGULATORY POSITION

Pursuant to §20.103 of 10 CFR Part 20, a licensee may make allowance for the use of respiratory protective equipment in estimating exposures of individuals to airborne radioactive materials if the equipment is used according to the following guidance:

1. A written policy statement on respirator usage is to be issued from a high management level. Strong management backing is considered essential to an adequate respiratory protection program. Techniques are to be provided and measures taken to ensure that management policy is carried out. Subjects to be covered by the policy statement include the use of practicable engineering controls instead of respirators; routine, nonroutine, and emergency situations; and periods of respirator use and relief from respirator use (NUREG-0041, Sections 2, 3.2, 12.1).

2. Respiratory protective equipment is to be selected to provide a protection factor greater than the multiple by which peak concentrations of radioactive materials are expected to exceed the values specified in Table I, Column 1 of Appendix B to 10 CFR Part 20. The equipment selected is to be used so that the average concentration of radioactive material in the air that is inhaled during any period of uninterrupted use in an airborne radioactivity area, on any day, by any individual using the equipment, will not exceed the values specified in Table I, Column 1 of Appendix B to 10 CFR Part 20. For the purposes of this guide, the concentration of radioactive material in the air that is inhaled when respirators are worn may be initially estimated by dividing the ambient concentration in air by the protection factor specified in Table 1. If a respirator user's intake of radioactive materials is later determined by other measurements to have been greater than that expected from initial estimates of radioactive materials in the air the user inhales, the greater quantity is to be used in evaluating exposures; if it is less than that initially estimated, the lesser quantity may be used in evaluating exposures (NUREG-0041, Sections 5, 6).

3. The licensee is to advise each respirator user that he may leave the area at any time for relief from respirator use in the event of equipment malfunction, physical or psychological distress, procedural or communication failure, significant deterioration of operating conditions, or any other condition that might require such relief (NUREG-0041, Section 2.2).

[a] NUREG-0041 is available from the National Technical Information Service, Springfield, Virginia 22161.

4. The licensee is to maintain and implement a respiratory protection program that includes, as a minimum, the following items (NUREG-0041, Section 3.1.5):

a. Air sampling and other surveys sufficient to identify the hazard, to evaluate individual exposures, and to permit proper selection of respiratory protective equipment (NUREG-0041, Sections 4, 5, 11).

b. Written procedures to ensure proper selection, supervision, and training of personnel using such protective equipment (NUREG-0041, Sections 8, 12).

c. Written procedures to ensure the adequate individual fitting of respirators, as well as such procedures to ensure the testing of respiratory protective equipment for operability immediately prior to each use (NUREG-0041, Sections 7, 8, 12).

d. Written procedures for maintenance to ensure full effectiveness of respiratory protective equipment, including procedures for cleaning and disinfection, decontamination, inspection, repair, and storage (NUREG-0041, Sections 9, 10).

e. Written operational and administrative procedures for control, issuance, proper use, and return of respiratory protective equipment, including provisions for planned limitations on duration of respirator use for any individual as necessitated by operational conditions (NUREG-0041, Sections 2, 9, 10, 12).

f. Bioassays and other surveys, as appropriate, to evaluate individual exposures and to assess protection actually provided (NUREG-0041, Sections 4, 11).

g. Records sufficient to permit periodic evaluation of the adequacy of the respiratory protection program (NUREG-0041, Section 12).

h. Determination prior to assignment of any individual to tasks requiring the use of respirators that such an individual is physically able to perform the work and use the respiratory protective equipment. A physician is to determine what health and physical conditions are pertinent. The medical status of each respirator user is to be reviewed at least annually (NUREG-0041, Section 7.4).

5. The licensee is to use equipment approved under appropriate Approval Schedules in 30 CFR Part 11 of the U.S. Bureau of Mines/National Institute for Occupational Safety and Health and as set forth in Table 1.

5. Where no equipment of a particular type has been approved under the schedules in 30 CFR Part 11 or where there is no existing schedule for approval of certain equipment, such equipment is not to be used without specific authorization by the Commission. An application for such authorization is expected to include a demonstration by testing or on the basis of reliable test information that the material and performance characteristics of the equipment are capable of providing an acceptable degree of protection under anticipated conditions of use.

7. Unless otherwise authorized by the Commission, the licensee is not to assign protection factors in excess of those specified in Table 1 in selecting and using respiratory protective equipment.[a] The Commission may authorize a licensee to use higher protection factors on receipt of an application (a) describing the situation for which a need exists for higher protection factors and (b) demonstrating that the respiratory protective equipment will provide such higher protection factors under the proposed conditions of use.

8. As a minimum, the following additional technical items are to be observed:

a. Respirable air of approved quality and quantity is to be provided and oxygen deficiency is to be avoided (NUREG-0041, Sections 4.1.1, 5.1.2, 5.1.3, 5.2.4.1, 5.2.4.1.1, 5.2.4.1.4, 9.8).

b. There is to be a standby rescue person equipped with self-contained breathing apparatus and communications equipment when supplied-air suits are used (NUREG-0041, Section 5.1.3).

c. No credit is to be taken for use of sorbents against radioactive materials (NUREG-0041, Sections 5.2.2, 5.2.2.2, 5.2.3.5, 5.6.6).

d. Filter media in air-purifying respirators are to be of the high-efficiency type (NUREG-0041, Sections 5.2.2.1, 5.2.2.3, 5.2.3.2, 5.6.1).

e. Air-purifying respirators are not to be used in oxygen-deficient atmospheres (NUREG-0041, Sections 4.1.1, 4.2.3, 5.2.3.1).

f. Adequate skin protection is to be provided (NUREG-0041, Sections 1.2, 5.2.3.2).

g. Air-purifying respirators are not to be used in atmospheres immediately hazardous to life or health (NUREG-0041, Section 5.2.3.4).

[a]The factors listed are intended as guides for selection and use of respirators in protection against radioactive materials. Additional precautions must be taken as necessary to protect against concurrent hazards other than radiation.

h. Canisters and cartridges are not to be used beyond service-life limitations (NUREG-0041, Section 5.2.3.5).

i. Facelets are not to be used (NUREG-0041, Section 5.2.3.6).

j. Oxygen and breathing air are not to be used in the same apparatus (NUREG-0041, Sections 5.2.4.1, 5.2.4.1.4, 5.2.4.2).

k. Proper fittings are to be used with supplied-air equipment (NUREG-0041, Sections 5.2.4.1.1, 5.2.4.1.2, 5.2.4.1.3).

l. Equipment is to be used within limitations for type and mode of use (NUREG-0041, Sections 5.2.3, 5.2.4).

m. Only specified equipment is to be used as emergency devices (NUREG-0041, Sections 5.2.4.1.4, 5.2.4.2.1, 5.2.4.2.4, 5.5).

n. Appropriate equipment with proper visual, communication, and other special capabilities is to be provided (NUREG-0041, Sections 7.1, 13).

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

This guide reflects current NRC staff practice. Therefore, except in those cases in which the licensee or applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the methods described herein are being and will continue to be used in the evaluation of the respiratory protection programs of licensees who are subject to the requirements of §20.103 of 10 CFR Part 20 until this guide is revised as a result of suggestions from the public or additional staff review.

TABLE 1
PROTECTION FACTORS FOR RESPIRATORS[a]

DESCRIPTION[b]	MODES[c]	PROTECTION FACTORS[d]: PARTICULATES ONLY	PROTECTION FACTORS[d]: PARTICULATES, GASES & VAPORS[e]	SELECTION OF TESTED & CERTIFIED EQUIPMENT: BUREAU OF MINES/NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH APPROVALS
I. AIR-PURIFYING RESPIRATORS				
Facepiece, half-mask[f]	NP	10		30 CFR Part 11 Subpart K
Facepiece, full	NP	50		
Facepiece, half-mask, full, or hood	PP	1000		
II. ATMOSPHERE-SUPPLYING RESPIRATORS				
1 Air-line respirator				
Facepiece, half-mask	CF		1000	30 CFR Part 11 Subpart J
Facepiece, half-mask	D		10	
Facepiece, full	CF		2000	
Facepiece, full	D		50	
Facepiece, full	PD		2000	
Hood	CF		2000[g]	
Suit	CF		h	i
2. Self-contained breathing apparatus (SCBA)				
Facepiece, full	D		50	30 CFR Part 11 Subpart H
Facepiece, full	PD		10,000[j]	
Facepiece, full	R		50	
III. COMBINATION RESPIRATOR				
Any combination of air-purifying and atmosphere-supplying respirators		Protection factor for type and mode of operation as listed abo		30 CFR Part 11 § 11.63(b)

[a]For use in the selection of respiratory protective devices to be used where the contaminant has been identified and the concentration (or possible concentration) is known.

[b]Only for shaven faces and where nothing interferes with the seal of tight-fitting facepieces against the skin. (Hoods and suits are excepted.)

[c]The mode symbols are defined as follows:

CF = continuous flow
D = demand
NP = negative pressure (i.e., negative phase during inhalation)
PD = pressure demand (i.e., always positive pressure)
PP = positive pressure
R = demand, recirculating (closed circuit)

[d]1. The protection factor is a measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of airborne radioactive material outside the respiratory protective equipment to that inside the equipment (usually inside the facepiece) under conditions of use. It is applied to the ambient airborne concentration to estimate the concentration inhaled by the wearer according to the following formula:

$$\text{Concentration Inhaled} = \frac{\text{Ambient Airborne Concentration}}{\text{Protection Factor}}$$

2. The protection factors apply:

(a) Only for trained individuals wearing properly fitted respirators used and maintained under supervision in a well-planned respiratory protective program.

(b) For air-purifying respirators only when high efficiency particulate filters [above 99.97% removal efficiency by thermally generated 0.3 μm dioctyl phthalate (DOP) test] are used in atmospheres not deficient in oxygen and not containing radioactive gas or vapor respiratory hazards.

(c) For atmosphere-supplying respirators only when supplied with adequate respirable air.

[e]Excluding radioactive contaminants that present an absorption or submersion hazard. For tritium oxide, approximately one half of the intake occurs by absorption through the skin so that an overall protection factor of less than 2 is appropriate when atmosphere-supplying respirators are used to protect against tritium oxide; for example:

If the protection factor for a device is:	PF overall for tritium oxide is:
10	1.82
100	1.98
1,000	1.99

(Continued)

(Continued)

Air-purifying respirators are not suitable for protection against tritium oxide. See also footnote g concerning supplied-air suits.

[f]Under-chin type only. This type of respirator is not satisfactory for use where it might be possible (e.g., if an accident or emergency were to occur) for the ambient airborne concentration to reach instantaneous values greater than 10 times the pertinent values in Table 1, Column 1 of Appendix B to 10 CFR Part 20, "Standards for Protection Against Radiation." This type of respirator is not suitable for protection against plutonium or other high-toxicity materials. The mask is to be tested for fit with irritant smoke, prior to use, each time it is donned.

[g]The design of the supplied-air hood or helmet (with a minimum flow of 6 cfm of air) may determine its overall efficiency and the protection it provides. For example, some hoods aspirate contaminated air into the breathing zone when the wearer works with hands-over-head. Such aspiration may be overcome if a short cape-like extention to the hood is worn under a coat or coveralls. Other limitations specified by the approval agency must be considered before using a hood in certain types of atmospheres (see footnote h). Manufacturers' recommended pressure settings for the air supply cannot always be relied on to ensure a minimum 6 cfm air flow. Equipment must be operated in a manner that ensures proper flow rates are maintained.

[h]Appropriate protection factors must be determined, taking into account the design of the suit and its permeability to the contaminant under conditions of use.

[i]No approval schedules are currently available for this equipment. Equipment is to be evaluated by testing or on the basis of reliable test information.

[j]This type of respirator may provide greater protection and be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure such as skin absorption must be taken into account in such circumstances.

Note 1: Protection factors for respirators, as may be approved by the U.S. Bureau of Mines/National Institute for Occupational Safety and Health (NIOSH) according to applicable approvals for respirators to protect against airborne radionuclides, may be used to the extent that they do not exceed the protection factors listed in this table. The protection factors listed in this table may not be appropriate to circumstances where chemical or other respiratory hazards exist in addition to radioactive hazards. The selection and use of respirators for such circumstances should take into account applicable approvals of the U.S. Bureau of Mines/NIOSH.

Note 2: Radioactive contaminants for which the concentration values in Table I of Appendix B to 10 CFR Part 20 are based on internal dose due to inhalation may, in addition, present external exposure hazards at higher concentrations. Under such circumstances, limitations on occupancy may have to be governed by external dose limits.