Respiratory Protection - Advance Notice of Proposed Rulemaking
Docket Number H-049

Comments submitted on behalf of PPG Industries to the Occupational Safety and Health Administration, U.S. Department of Labor.

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The following comments are submitted on behalf of PPG Industries, Inc. in response to the Occupational Safety and Health Administration's (hereinafter referred to as OSHA) publication in the Federal Register of an Advance Notice of Proposed Rulemaking for Respiratory Protection (47FR20803, May 14, 1982).

I. Introduction

PPG Industries, Inc. (hereinafter referred to as PPG) produces flat glass, chemicals, coatings and resins, and fiberglass at 43 locations throughout the United States. With $3.4 billion in sales during 1981, PPG ranked 122nd in the Fortune 500 listing of the largest industrial companies. PPG has four operating divisions:

1) Glass, the nation's largest producer of flat glass,

2) Coatings and Resins, the largest domestic producer of industrial coatings, and a leader in trade paints and printing inks,

3) Chemical, the nation's second largest manufacturer of chlor-alkali chemicals,

4) Fiberglass, the nation's second largest manufacturer of continuous filament fiberglass.

Operations are diverse: PPG handles thousands of chemicals in a variety of processing operations ranging from small scale batch processing in the production of coatings to large continuous process units for chemical and glass manufacture.

To protect employees who handle chemicals and equipment in its production and research facilities, PPG has adopted an aggressive, comprehensive program of utilizing engineering controls, administrative controls, and personal protective equipment both to minimize employee exposures and to comply with pertinent government regulations. Necessarily, PPG safety and health professionals have gained considerable expertise in the subject of respiratory protection. Comments submitted herein represent a summary of data and a consensus on the issues collected from these professionals - including physicians, industrial hygienists, nurses, and safety engineers.

II. General Comments on Current Respirator Standard

PPG's policy has been to comply with the current respiratory protection standard, 29CFR1910.134. Much of this standard has proved adequate for the development and implementation of sound respirator programs for all four operating divisions. Several deficiencies have been noted, however, especially as new respirator technology has been developed and as increased knowledge about respirator use has become available. Our concern with five areas are briefly discussed below, followed by responses to agency questions contained in the Advance Notice of Proposed Rulemaking.

1. Exposure Determination

The respirator standard should include the concept of a protection factor in determining employee "exposures" for compliance purposes. OSHA has wisely adopted this concept in the Cotton Dust Standard (29CFR1910.1043).

2. Flexible Fit Test Strategy

Improved qualitative respirator fit test methods have become available since the issuance of ANSI Z88.2-1969, upon which the current respirator standard is based. The respirator standard should recognize these methods and should be written so as to encourage development of new respirator fit test methods.

3. Performance Approach to Stimulate Technology

The NIOSH/MSHA respirator approval process has not responded adequately to changes in respirator technology. OSHA should address this problem in the respirator standard by adopting a performance approach to respirator acceptance. This would permit the use of innovative approaches to respiratory protection when sound, scientific data demonstrate that they are effective.

4. Facial Hair

The respirator standard should directly address the issue of facial hair interfering with respirator facepiece seals or proper valve function. Quantitative respirator fit test data indicate that facial hair does interfere with respirator fit, reducing fit factors by orders of magnitude in the case of full beards. The respirator standard, therefore, should permit employers to prohibit the presence of facial hair or any other factors which interfere with respirator fit or function.

5. Uniformity of Approach

Additional OSHA regulations have complicated the administration of respirator programs by including substance - specific respiratory protection requirements which are in addition to, and sometimes in conflict with, the requirements of 29CFR1910.134. These regulations include those for lead, acrylonitrile, and vinyl chloride. OSHA should incorporate performance criteria for all aspects of respiratory protection programs into one standard.

6. Recognition

The use of respiratory protection has been categorically relegated to the last alternative as a protection strategy. This demeans respiratory protection to the level of a failure scheme. OSHA should recognize instead that respirators are a valid - and, in some cases, the best, - means of assuring worker protection.

The consensus of PPG's health and safety professionals is that OSHA must address the above issues in a revised respiratory protection standard.

III. Replies to OSHA's Questions on Respiratory Protection

Question (Q):

Q: 1. Should current standards be revised? What alternatives to regulation are available?

Reply (R):

R: 1. OSHA should adopt a performance standard which clearly establishes respiratory protection program goals which will ensure employee health and safety. Employers can then choose those specific measures which prove most effective for achieving these goals at each workplace.

There is no effective alternative to a well-reasoned, comprehensive, performance standard for respiratory protection.

Q: 2a. Should all or part of the new ANSI Z88.2-1980 standard be adopted as an OSHA standard?

b. If so, which parts and why?

c. Which, if any, advisory provisions of the ANSI standard should be made mandatory for OSHA purposes?

R: 2. The ANSI Z88.2-1980 standard should not be adopted as a regulation. Such a specification-oriented standard would act to freeze respiratory protection technology at the level of currently accepted practices. It would not provide, for example, the flexibility needed to encompass the development of respirator programs for facilities which have two respirator users handling three or four different chemicals, as well as for those facilities which have 200 respirator users handling 2,000 different chemicals. OSHA should consider the entire ANSI Standard ("shall" and "should" provisions) to be a non-mandatory reference document.

Q: 3.a. Should a protection factor of 100 for full facepiece respirators be made generally applicable in the regulations or should 50, as recommended by Los Alamos National Laboratories, be retained?

b. Should the protection factors (other than for full facepiece respirators) recommended by Los Alamos National Laboratories be made generally applicable in the regulations?

c. What other values, if any, should be specified for protection factors?

Q: 3d. In what manner, if any, should OSHA allow QNFT to be used by an employer to assign a higher protection factor to a respirator for an individual or a group?

e. In what way should a distinction be made between fit factors determined by QNFT and true protection factors, that include filter leakage?

f. What methods or protocols are available to determine the true protection factor an employee achieves while in the actual workplace?

R: 3. a. Additional protection factor data is necessary before higher protection factors can be assigned to full facepiece respirators. Until further data is available, the present protection factor of 50 for full facepiece respirators should be retained as a practical guideline.

b. Los Alamos National Laboratory (LANL) protection factors have served well as guidelines for respirator selection. Use of LANL factors should be continued until additional data is available to support changes in them.

c. Employers should have the option of developing their own workplace protection factor data for specific contaminants, as long as the protocol meets defined criteria. (See 3f.)

d. Quantitative fit test data alone cannot be used to assign a higher protection factor to a respirator. These data measure only fit, not protection. (See e.)

e. Fit factor is a measure of the effectiveness of the facial seal of a respirator for an individual. It is determined under controlled conditions in which the performance of respirator parts is checked and the maximum amount of test material which can enter the filter/cartridge is known so that leakage around the facial seal can be quantified. Protection factor is a measure of the overall protection provided by a respirator and includes facial seal leakage as well as breakthrough of contaminant through the air-purifying element. Actual workplace protection factors will vary with work being performed, with environmental conditions, with contaminant(s) present, and with duration of respirator use, as well as among individuals and among respirator models.

f. PPG has no special protocol or method for determining workplace protection factors. To be acceptable, such a protocol should include:

R: 3.f.

- A method for monitoring workplace contaminant exposure concentrations, including particle size for particulates,

- A method with a detection limit low enough to permit measurement of behind-the-mask contaminant concentrations for calculation of desirable workplace protection factors. (With a 1.0 ppm (v/v) airborne vapor contaminant concentration, a detection limit of 0.01 ppm would be necessary to measure a protection factor of 100.),

- Qualitative fit testing of employees participating in the study for selection of properly fitting respirators,

- Monitoring of data collection, including a check of respirator function before and after behind-the-mask sampling, and observation of work practices, including duration of respirator use, during exposures,

- Valid statistical evaluation of data to establish desirable confidence limits on determined protection factors.

Q: 4.a. Should there be a distinction in the regulations between disposable respirators and other half-mask respirators?

b. In particular, should the protection factors for the disposable respirators be the same as for other half-mask respirators?

R: 4. a. There need be no arbitrary distinction in the regulation between:

1) disposable half-mask respirators and other air-purifying half-mask respirators,
2) disposable mouthpiece respirators and non-disposable mouthpiece respirators
3) mouthpiece respirators and other half-mask air-purifying respirators.

A sound respiratory protection program would ensure that all respirators are selected correctly for the contaminants present, that they provide the desired degree of protection, and that they are used properly. Disposable respirator use may necessitate more care to ensure that masks are not abused or overly used. (To quote one PPG safety professional, "'Disposable' respirators should be either disposed of or renamed.") This problem should be handled under training and surveillance in a good respirator program or perhaps under changes in respirator approval schedules: it is insufficient to necessitate separate treatment in the regulation.

R: 4.a. The chlorine mouthpiece respirator is currently approved for escape from atmospheres containing up to 10 ppm of chlorine gas (OSHA-PEL = 1 ppm). This represents a protection factor of 10, the same as for half-mask air-purifying respirators with acid gas cartridges. A recent Chlorine Institute study showed that there is no statistical difference in fit, as determined by corn oil aerosol QNFT, between the mouthpiece respirator, and the half-mask air-purifying respirator. (Johnson, D.E., "Comparison of Fitting Efficiency of Half Mask Acid Gas Respirators and Mouthpiece Escape Acid Gas Respirators by Quantitative Fit Testing Methods," presented at the American Industrial Hygiene Conference, Cincinnati, June 10, 1982.) While NIOSH policy currently dictates use of this mask only for escape purposes, OSHA should not distinguish arbitrarily between these two types of mask in the revised regulation. This issue should be left open until workplace protection factor data is available for these mouthpiece respirators.

b. Until further protection factor data is available, those masks with a molded facepiece of elastomeric material (e.g., 3M 8712) should be allowed the same protection factor as other half-mask air-purifying respirators, while single-use dust masks (e.g., 3M 8710) should be allowed the protection factor of 5 currently allowed in the OSHA Industrial Hygiene Manual.

Q: 5.a. What protocol(s), if any, for qualitative fit testing (QLFT) should be specified in any new OSHA standards as acceptable testing method(s)?

b. Are there different protocols appropriate for different uses of QLFT such as selection and fitting, periodic fit checking, or checking the fit at each donning?

c. How often should QLFT be repeated?

d. What exercises should be performed by the test subject during QLFT?

e. Should it be allowable to use substances identified as potential carcinogens as fit test challenge agents? If so, what basis should be used to determine that the probable dose is acceptable or unacceptable?

f. What basis should OSHA use to determine the acceptability of suggested QLFT protocols?

g. With the use of non-irritating test agents, does test subject bias significantly affect the usefulness of qualitative testing, or affect the test results a significant amount of the time?

Q: 5 h. Should increased testing or more frequent testing be required for respirators with facepieces that need adjustment other than strap tension to fit properly?

i. Under what circumstances and using what testing protocol would QLFT be sufficient to ensure that an employee's respirator fits sufficiently well?

R: 5. a. Rather than specify certain currently available qualitative test protocols (QLFT), OSHA should define criteria for acceptable test methods. (See 5f.) Any methods which can then meet these criteria would be acceptable and could be added to the standard as non-mandatory appendices for the benefit of employers who do not have the resources to develop their own QLFT procedures. Such a provision will eliminate an unnecessary use of the regulatory process.

b. OSHA should recognize the difference between "fit checks" and "fit tests." The positive and negative pressure tests ("fit checks") are useful for checking respirator leakage each time the respirator is donned. They indicate gross leakage which may be due to a missing gasket, a loose cartridge, or a "sticking" valve, as well as to improper positioning of the mask on the face. These tests additionally serve as an equipment check.

Qualitative "fit tests" (such as those described in the National Paint and Coatings Association (NPCA) program, A Guide to Respirator Fit Testing) have been used in our facilities and found useful in helping each employee select a mask which fits properly, and in training each worker how to use a respirator correctly.

c. Positive and negative pressure fit checks can be performed each time a respirator is donned. (See 5b.) Qualitative fit tests should be performed at initial respirator selection and periodically thereafter at intervals determined to be necessary by a person knowledgeable with the work conditions, the employees, and the respirators used. An additional test may be requested by a health professional if a recent illness, accident, weight loss/gain, or other condition indicates a possible change in fit conditions for an employee.

d. The standard fit test "exercises" (normal breathing, deep breathing, side-to-side head motion, up and down head motion, and talking), recommended by NIOSH and NPCA, are adequate. They can be included in a non-mandatory appendix of currently acceptable QLFT procedures. (See 5a.)

R: 5. e. Whether or not exposure to a "potential carcinogen" as a fit test agent should be permitted must be determined for each individual agent. First, "potential carcinogen" must be better defined. Certainly a proven human carcinogen would not be the fit test agent of choice. An agent which is defined as a "potential carcinogen" on the basis of in vitro mutagenicity tests or on the basis of large doses administered in animal feeding studies may be acceptable, however, when the risk of the employee's exposure to a possible small inhalation dose during the fit test is compared to the risk of his/her more frequent exposure to workplace contaminants behind an ill-fitting respirator.

f. OSHA should accept any QLFT protocol which can be demonstrated effective in helping the employee choose a respirator which fits properly. Such a protocol would include:

1) employee selection of a respirator which provides a comfortable fit,

2) generation of a stable concentration of test agent,

3) determination of employee's ability to detect the test agent at a low enough level to establish a minimum test protection factor,

4) exposure of employee to the challenge concentration while wearing the respirator and performing appropriate movements to simulate workplace motion.

5) method validation, including confidence limits on challenge concentration and detectable concentration of test agent, lower confidence limit on protection factor.

g. PPG's Coatings and Resins Division has used the NPCA isoamyl acetate protocol for qualitative testing of respirator fit to aid employees in the selection of a properly fitting mask. It is followed by the irritant smoke test (performed as described in NIOSH Publication 76-189, A Guide to Industrial Respiratory Protection) to eliminate the possibility of bias. The only bias ever observed was with two or three individuals with facial hair (long sideburns, goatee) interfering

with the respirator seal. While "passing" the isoamyl acetate portion of the test, they "flunked" the irritant smoke portion and were given dramatic demonstration of the importance of a good respirator seal. Employers should have the option of using a challenge agent which while not hazardous to the health or safety of the employee, will elicit an involuntary response to eliminate the possibility of bias in mask selection.

R: 5. h. PPG has no information to indicate that increased testing is necessary.

i. Any protocol which meets the performance criteria established as in 5f should be adequate to insure that an employee's respirator fits sufficiently well to protect him/her in any circumstances for which a negative respirator is required.

Q: 6.a. What protocol(s), if any, for quantitative fit testing (QNFT) should be specified as acceptable testing method(s) in any new OSHA standards?

b. To be an adequate test, should QNFT be able to distinguish the respirator efficiency for each test exercise performed by the test subject?

c. To be an adequate test, should QNFT be able to demonstrate the variation of contaminant concentration behind the respirator during the breathing cycle?

d. What exercises should be performed by the test subject during QNFT, and for how long?

e. What test agents are suitable for QNFT, and what are the essential characteristics of an appropriate aerosol for solid and liquid agents?

f. What algorithm should be used to calculate the protection factor from QNFT?

g. What situations require QNFT?

h. What is an acceptable accuracy for a QNFT test?

i. Should it be allowable to use substances identified as suspect carcinogens as test agents? If so, what basis should be used to determine that the probable dose is acceptable or unacceptable?

j. Should increased testing (i.e., repetitions) be required for respirators with facepieces that need adjustment other than strap tension to fit properly?

Q: 6.k. For each required protection factor, how high a fit factor, determined by QNFT, should be required to ensure proper employee protection?

1. How will the fit factor determined vary with different testing equipment, challenge agents, procedures, and test conditions?

R: 6. a. No protocol(s) for QNFT should be specified. A performance standard should be adopted. Any method which can generate a fairly constant challenge contaminant concentration and can accurately compare behind-the-mask concentrations with the challenge concentration should be acceptable. Specifying a given protocol or protocols may stifle the development of more efficient equipment for conducting QNFT.

b. The determination of respirator efficiency for each test exercise is not necessary. Actual work activities will not be restricted to, nor will they duplicate, any particular exercises in a QNFT. The average efficiency over a series of exercises will provide as useful a number as the respirator efficiency for each exercise.

c. Demonstration of contaminant concentration variation during the breathing cycle is not necessary. Averaging of peak height or integration of contaminant concentration should both be acceptable methods for determining contaminant concentration.

d. The exercises recommended by NIOSH and contained in the NPCA program, A Guide to Respirator Fit Testing (normal breathing, deep breathing, side-to-side head motion, up and down head motion, and talking), are adequate. Based on PPG's experience performing QNFT, thirty seconds is an adequate duration for each exercise.

e. The only requirements for a test agent should be that a relatively constant concentration can be generated in a test chamber, that low concentrations behind the mask can be measured for comparison with challenge concentrations, and that the agent not be hazardous to the health or safety of the test subject under the test conditions. Any test agents which meet these criteria should be acceptable.

f. Any algorithm which quantitatively compares the contaminant concentration behind-the-mask with the challenge concentration should be acceptable for calculating QNFT fit factors. Two methods currently used, comparison of peak height averages (e.g., DOP aerosol QNFT using Dynatech FE250A with strip chart recorder) and comparison of integrated particle counts (e.g., 3M saccharin aerosol test), are both valid.

R: 6. f. PPG has no algorithms for calculation of protection factors from QNFT fit factors. (See 6k.)

g. There is no situation which would require QNFT. QNFT can be used as a research tool and to validate QLFT protocols. It is a valuable training aid, but should not be required for routine respirator selection because adequate fit testing and training can be achieved by QLFT (questions 5f,i) at a much lower cost. (See 34d,e.)

h. No comment.

i. This must be determined on an individual basis for each contaminant being considered. (See 5e.)

j. PPG has no data to indicate that this is necessary.

k. A fit factor determined by laboratory procedures should not be used to predict workplace protection factors at this time. Appropriate protection factors depend on the agent, its toxicity, its OSHA-PEL, its warning properties, the efficiency of the cartridge used, and other factors. (See 3e.) More reliable scientific data is needed before fit factors can be correlated with protection factors. Until such data is available, LANL protection factors can be used. (See 3b.)

l. PPG has insufficient data to determine in what manner fit factors vary with these parameters. However, if a test protocol meets performance criteria, the fit factors attained with that protocol should be as useful in respirator selection and in respirator research as those attained with any other acceptable protocol.

Q: 7. Which respirator related provisions, if any, of the more recent OSHA health standards (e.g., 29CFR1910.1018(h) - arsenic, 29CFR1910.1029(g) - coke oven emissions, 29CFR1910.1043(f) - cotton dust, etc.) should be made generally applicable by incorporation into 29CFR1910.134, Parts 1915-1918, or 29CFR1926.103?

R: 7. None. Respiratory protection requirements in individual health standards, above and beyond - or in conflict with (e.g., acrylonitrile) - the provisions of 29CFR1910.134, increase the difficulty of administering a respirator program. OSHA should develop a comprehensive, performance-based standard in 1910.134, then incorporate its provisions into other health standards by reference.

Q: 8.a. What type and level of training and retraining should be provided to all respirator users (c.f. 1910.134(b)(2), (e)(5), (e)(5)(i), 1915.82(a)(4), 1926.103(c)(1)?

b. In such training, what topics should be covered and how thoroughly?

c. In which cases should more specialized or comprehensive training be required?

d. How should required training and retraining be specified?

R: 8. a. Training provided to respirator users must be presented at a level which they can understand; the content should be adequate to ensure that they can use the equipment properly. The educational level of PPG employees varies widely from facility-to-facility, and even within each facility. Respirator users range from laborers who have not completed high school to doctoral level research scientists. No one specific training program can span this range, so a flexible approach to training, combining formal and informal methods, is used. Slide-tape presentations, videotapes, department safety meetings, equipment demonstrations, personal respirator fitting, practice sessions, pamphlets on respirator use, SOP's, and individual counseling all play a part in the training process, depending on the needs of the individuals and the operations. The frequency of retraining required will also depend upon the employees involved, the hazards faced, and the equipment used. To supplement formal respirator training at PPG, informal sessions covering specific aspects of respirator use are held with various groups or individuals as they are deemed appropriate by the safety/health professional at each facility.

b. Respirator training should include:

- explanation of why, and for which contaminants/ hazards, respirators are being used;
- explanation of how respirators work to protect employee health;
- selection of an appropriate respirator for the individual, including a qualitative determination of fit;
- discussion of proper respirator use, including equipment inspection and fit checks according to the manufacturer's instructions;
- information on program administration: respirator use policy; where respirators, parts, and supplies are kept; how these are distributed; who is responsible for various aspects of the program; to whom the employee can go with questions or problems.

R: 8. c. Those individuals who will be entering situations which are Immediately Dangerous to Life or Health (e.g., Fire Brigade Members, anyone who enters oxygen deficient atmospheres) should be given the opportunity to frequently practice use of the required respiratory protection. This is especially true when the individual may rarely encounter the hazardous situation, but when a mistake could be fatal, such as in firefighting. The intensity and frequency of this training would have to be judged by a professional who knows the individuals involved, the hazardous situations which they might encounter, and any other pertinent safety/health regulations.

d. The adequacy of training can only be judged by the result: the proper use of respiratory protection. The only requirement should be that training provided be of sufficient content and frequency to ensure that employees are knowledgeable enough to use respirators properly.

Q: 9. What specifications should be made concerning the content of standard operating procedures presently required in 29CFR1910.134(b)(1) and (e)(3)?

R: 9. Written Standard Operating Procedures (SOP's) should include all aspects of a respiratory protection program at each facility. It may be appropriate to develop more than one respirator SOP to cover different respirator uses. (Many PPG facilities, for example, have adopted the practice of developing separate SOP's; one for use of air-purifying and atmosphere- supplying respirators which are used for reduction of employee exposure to airborne contaminants and another for emergency use of atmosphere-supplying respirators by fire brigade members.)

Respirator SOP's vary from location-to-location, but typically they include:

1) The name of the person(s) responsible for administration of the respirator program (These are persons the employees can contact with questions or problems.),

2) Statement of requirement for employee's medical certification by the plant physician prior to entering the respiratory protection program,

3) Guidelines on when respirators are worn (i.e., for which activities, and for which contaminants),

R: 9.

4) A listing of respirators, filters/cartridges which are approved for use. (It may also be indicated in the SOP where such information is posted.),

5) A brief description/statement of qualitative fit test requirements for individual mask selection and for user training,

6) An outline of training provided to respirator users (This may be referenced to a formal program, such as a pamphlet or videotape.),

7) The location of respirators, parts, and supplies, and the issuing procedure,

8) A summary of respirator inspection procedures,

9) A summary of respirator maintenance, cleaning, and disposal procedures,

10) The work area surveillance program, including air contaminant or oxygen deficiency monitoring,

11) Statement of any procedures and policy(ies) relevant to the respirator program, including program review by management.

12) Reference to other relevant SOP's (especially if more than one respirator SOP is developed),

It is extremely important that employer and employee responsibilities be delineated clearly for each of the above, as these may differ with each respirator program. For example, at some PPG locations with few respirator users or infrequent respirator use, each wearer has been trained to clean his/her own respirator and is responsible for doing so, while at other plants with many employees using respirators, one person has been trained to clean masks and handles cleaning responsibilities for all users.

Based on PPG's experience with respirator programs, OSHA should not specify respirator SOP contents but should require instead that SOP's outline the administration and operation of the respirator program so that employees understand the appropriate procedures and their own, as well as their employer's, responsibilities.

Q: 10a. What medical screening, if any, or potential users of respirators should be required?

b. For those employees who use respirators, is it safe to require medical examinations only in those cases where there is some complaint by the employee or a problem is noticed by the fit testing technician?

c. Should the regulations limit an employer's choice of type, class, or specialty of health care provider in obtaining these medical examinations?

d. Could a questionnaire be used to select those few individuals who should be medically examined?

e. What medical conditions, if any, of an employee should preclude the wearing of a respirator? Explain.

f. What medical conditions, if any, could be aggravated by wearing a respirator?

g. Could the wearing of a respirator medically endanger an employee? If so, with what respirator, and as a result of what medical condition?

R: 10. a. Medical evaluation of potential respirator users should include a complete history (medical and occupational), with emphasis on respiratory and cardiac systems, and a physical examination, including pulmonary function screening. Chest X-ray would be performed if clinically indicated or needed for base line information.

b. No.

c. OSHA should not limit an employer's choice of health care provider. Properly trained and certified technicians should perform pulmonary function testing. X-rays are to be interpreted by a certified radiologist. Any "qualified" physician should be responsible for the final evaluation.

d. A medical questionnaire can be used to select individuals for a more detailed medical examination. It should not replace a medical examination for users of negative-pressure chemical cartridge/filter respirators or any other type of respirator that depends on facial fit. A medical questionnaire would include: past medical history, past occupational history, smoking history, pulmonary disease history (such as cough (productive vs. non-productive, timing,

type) colds, bronchitis, wheezing, tightness in chest), skin allergies.

e.f. Any medical condition that is clinically compromised by an increased workload on the pulmonary, circulatory, or cardiac systems may preclude the employee from wearing a respirator. This must be evaluated by a physician for each individual.

Medical conditions for which a physician should perform such an evaluation would include: emphysema, chronic obstructive pulmonary disease, bronchial asthma, pneumoconiosis, reduced pulmonary function, coronary artery disease, cerebral blood vessel disease, severe or progressive hypertension, epilepsy (grand mal or petit mal), pernicious anemia, primary hypoglycemia, punctured eardrum, pneumomediastinum gap, communication of sinus through upper jaw to oral cavity, bone deformities of nose (blocking the nasal passage), claustrophobia, cardiac arrythmia of organic heart disease origin, angina pectoris, congestive heart failure, uncontrolled paroxysmal tachycardia, facial dermatitis (particularly folliculitis), restrictive lung disease, sarcoidosis, tracheotomy, laryngectomy, severe thoracic bony cage deformities or vertebra curvatures, Addison's disease, leukemia, collagen diseases (such as Burger's disease, necrotizing arteritis).

Fractures
Eye correction
Hearing aids
?

Any listing of conditions for further medical evaluation (such as ANSI Z88.2-1980) cannot be all-inclusive and should only be considered for inclusion as a reference in a non-mandatory appendix to the standard.

g. Yes. A negative pressure respirator causing increased workload could endanger an individual with marginally compensated cardiac, pulmonary, or circulatory systems. A positive pressure respirator could endanger an asthmatic where the major impairment is exhalation, not inhalation.

Q: 11. The respirator testing criteria used by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA) (30 CFR Part 11)have been acknowledged by NIOSH to be in need of extensive revision.

a. Should OSHA independently address the adequacy and application of some or all types or models of respirators? If yes, specify in detail.

Q: 11. b. Should OSHA always accept the adequacy of MSHA/NIOSH approved respirators without additional requirements (e.g., higher performance requirements for use against certain substances)?

c. Under what circumstances, if any, should OSHA allow the use of respirators not approved by MSHA/NIOSH under 30 CFR Part 11?

d. Should OSHA automatically reject any modification to approved respirators?

e. Should OSHA allow the interchange of parts between different makes or types of respirators?

f. Should OSHA recognize other organizations' (other than NIOSH) testing and certification of respirators?

g. Are there changes in regulations or procedures that would encourage more rapid development and utilization of respirators to provide protection from chemicals for which there are no currently approved respirators?

h. Are there changes in regulations or procedures which would encourage more rapid development and utilization of respirators which would provide immediate warning of overexposure; improved communication capabilities; reduced skin irritation, breathing resistance or heat stress; or other improvements?

i. In order for negative pressure air purifying respirators to be permitted for protection from a gaseous chemical, should that chemical always present adequate warning properties?

j. How, if at all, should OSHA address physical aspects of respirator performance and suitability such as abrasion resistance, tear strength, withstanding temperature extremes, corrosion resistance, and field of vision?

R: 11. a. No. NIOSH/MSHA should establish performance criteria for respirators and for respirator testing protocols. Actual testing can then be performed by academic institutions, private industry, government agencies, or other interested parties.

b. NIOSH/MSHA should determine which performance/testing criteria are adequate and approve any respirator meeting those criteria.

c. OSHA should allow the use of any respirator which can be demonstrated to meet NIOSH/MSHA performance

criteria (see 11a) with test data developed by an employer "in-house," by a contract laboratory, or by academic research scientists. The NIOSH/MSHA approval process should be amended to permit rapid approval/disapproval of respirators based on performance data. Industry will not be encouraged to develop new respirators if OSHA will not allow their use until NIOSH or MSHA has had the time to test them.

R: 11. d. No. If test data show that the modifications are effective, they should be accepted. For example, facilities which currently use different brands of full facepiece respirators and self-contained breathing apparatus (SCBA's) are required to furnish different prescription eyeglass adapters for each brand of mask. This not only adds to expense, it also adds to confusion. (Carrying two or more adapters, the employee could try to fit the wrong one into a mask in an emergency situation.) While not currently approved, a universal prescription eyeglass adapter could eliminate the problem. The same mount could be placed in each respirator so the employee need carry only one prescription adapter which then would fit airline and SCBA respirators. If an employer can document that such a device does not affect respirator performance, OSHA should permit its use.

e. If testing results indicate that specific parts can be interchanged without decreasing the effectiveness of the respirator, then interchanging those parts should be permitted.

f. Certification of respirators should be governed by a single organization. However, testing should be permitted by other government, private, or academic organizations. If testing protocol and acceptable performance criteria are clearly defined, NIOSH should grant certification based on review of the testing done by these organizations. This certification format could expedite the development of better respirators.

g. Yes. If NIOSH/MSHA were to establish acceptable performance criteria, industry or academic institutions could conduct testing of previously unapproved respirator/ contaminant combinations. NIOSH/MSHA could then review test results and provide approval to respirators meeting the established performance criteria. (A similar situation has already occurred in the field of air sampling. NIOSH has established acceptable performance criteria for air sampling methods. As

a result, industry has developed, tested, and validated the effective use of passive dosimeters for monitoring workplace concentrations of many organic vapors. PPG, for instance, has documented the effectiveness of passive dosimeters for several chlorinated hydrocarbons. In July, 1982, NIOSH finally announced that it had devised a protocol that will allow independent laboratories to test the performance of passive air sampling monitors. The protocol evaluation will include testing of passive monitors for formaldehyde, sulfur dioxide, and ammonia.)

R: 11. h. Yes. See g.

i. Negative pressure air-purifying respirators should be permitted for protection against gaseous contaminants with poor warning properties if:

1) An effective respirator program is in effect, including qualitative fit testing for mask selection,
2) The contaminant exposure concentration is known, through personal or area air sampling, by use of a continuous monitor, or by monitoring of engineering controls,
3) The contaminant breakthrough pattern (concentration, time) is known for the cartridge(s) being used and for the conditions involved.

The above information would permit establishment of a cartridge change-out schedule to ensure employee protection. PPG, for example, has experience using air-purifying respirators which are not NIOSH/MSHA approved for elemental mercury vapors in mercury-chlorine cell facilities. Use is based on periodic personal and area monitoring of airborne mercury levels, cartridge breakthrough studies, an established cartridge change-out schedule, and qualitative respirator fit testing. The level of mercury in the urine of employees is monitored as part of the overall mercury health program: results indicate that respirators are effectively protecting employees from mercury exposures.

In workplace situations in which mixtures are present, employers should be allowed to document that a co-contaminant with good warning properties and with more rapid cartridge breakthrough than the poor-warning contaminant is effective as an "alarm" monitor, indicating the need for cartridge changeover.

R: 11.i. Engineering controls may provide adequate control of contaminants most of the time, but misuse or failure of engineering controls may occur, thus creating occasional high exposure concentrations. Use of respirators which have been demonstrated to be effective against the contaminants involved as "back-up" protection against this possibility should be permitted and encouraged - even for contaminants with poor warning properties. (These contaminants provide no early indication of engineering control failure, either.)

j. These topics should be addressed in the NIOSH/MSHA performance criteria. Any respirator which meets the test criteria will be adequate.

Q: 12. Should OSHA continue to accept as adequate all manufacturers' instructions for fit checking (29CFR1910.134 (e)(5)(i))?

R: 12. The consensus at PPG is that respirator manufacturers' instructions are adequate for fit checking (positive/ negative pressure tests) and that OSHA should continue to accept them.

Q: 13. When, if at all, should OSHA limit the amount of time in a single shift that employers may require their employees to wear respirators? (The lead standard (29CFR1910.1025(f)(1)(i)) imposes a limit of 4.4 hours in some cases.)

R: 13. OSHA should not limit single shift use time of respirators. The time for which a respirator may be required depends upon the job being performed, the nature of the contaminants present, and upon the protection required. Matters of employee comfort and convenience are best addressed at each facility through established channels for defining working conditions. Setting maximum use time would discourage use of respirators as secondary protection. (See 11i.)

Q: 14. In determining compliance with exposure standards for those employees wearing respirators, should OSHA assume that an employee's exposure has been reduced by a factor equal to the assigned protection factor of the respirator? Such an assumption is already part of the enforcement policy for the cotton dust standard. (See 46 FR85736, Dec. 30, 1980.) It allows an employee to wear a respirator for only part of the work shift when respirators are relied upon to achieve compliance with permissible exposure levels.

R: 14. Yes. For employers who have a sound respirator program, OSHA should assume, for purposes of compliance, that the employee's exposure has been reduced by a factor equal to the assigned protection factor of the respirator. The standard should permit use of currently recommended Los Alamos protection factors, but should be flexible enough to permit higher protection factors to be used as sound scientific data are available to support them. OSHA should not use protection factors to specify time limits for respirator usage.

Q: 15.a. What degree of surveillance of work area conditions and degree of employee exposure and stress are adequate to ensure safe use of respirators (29CFR 1910.134(b)(8))?

b. What costs are associated with this surveillance?

c. For situations that require the use of respirators for extended periods, what limitations should be placed on an employee's schedule of use of that respirator in order to make adequate allowance for:

Q: 15c. 1. Degree of exertion required by the work activity?
2. Physiological burden imposed by different respirator types?
3. Physiological burden imposed by the ambient temperature and humidity or by radiant heat?

R: 15. a. Workplace surveillance must be adequate to ensure that employee exposures have not changed significantly enough to affect the selection of respiratory protection. The type of monitoring and the frequency required for this will depend upon the operation, the facility, the reliability of engineering controls, the work practices of individual employees, and the nature of the contaminants present. Such monitoring could take several forms: personal hydrocarbon vapor and/or particulate exposure sampling, portable survey instrument measurements, a continuous monitor for a specific contaminant in a process stream, periodic measurement of ventilation system performance, static pressure gauges on spray booths to indicate performance, periodic observation of work practices, supervisory checks for proper respirator usage. Only safety and health professionals with knowledge of the workplace variables and of the proper use of respiratory protection can make decisions on what constitutes adequate monitoring at a facility at any given time.

b. The amount of activity in a surveillance program associated with a respirator program is dependent upon three main factors:

Q: 15. 1) The amount of intensive initial monitoring necessary to determine if respirators are necessary and, if so, which types are acceptable.
2) The amount of routine surveillance necessary to monitor the work environment to ensure that the respirators used continue to provide adequate employee protection.
3) Monitoring requirements specified by government regulation.

For example, PPG's Coatings and Resins Division has two compliance programs where workplace surveillance and respirator usage are regulated.

Each employee handling lead pigment wears a respirator even if exposures are less than the OSHA PEL of 50 ug/M^3, which is generally the case. On the average, each employee is monitored four times per year. The costs of monitoring, including time spent by the person conducting the monitoring, calibrating pumps, shipping filters to the Division's AIHA- accredited laboratory, sample analysis for total dust, lead, and chromium, and administrative costs in collating and reporting data. These costs are about $85 per sample or $350 per employee per year.

R: 15. b. Costs of laboratory analysis for acrylonitrile samples are less than those for the analysis of lead samples. Cost per sample is about $65 or $280 per employee per year.

Other work area surveillance costs would include costs associated with continuous monitors in a process stream, monitoring products for residual monomers (e.g., acrylonitrile), periodic evaluation of ventilation system performance, supervisors' observations of work practices, medical examinations and/or biological monitoring of employees.

c. Evaluation of any necessary limitations on respirator use can only be made by safety and health professionals who are familiar with the employees, the operation, and the work environment. PPG plants, for example, are located throughout the United States. Environmental conditions may range from 10 F to 100 F, with humidities ranging from 15% to 95%. While few jobs requiring respirators are performed outdoors, indoor climate does vary with these weather conditions. Determination of an employee's ability to perform a given task under a given set of conditions is made on-site at the time the work is to be performed. This is too complex a matter for regulation.

Q: 16.a. How frequently should the carbon monoxide concentration be measured from an air compressor without a carbon monoxide alarm?

b. Is there any reason not to require a carbon monoxide alarm on all oil-lubricated compressors used to provide breathing air?

R: 16. a. Monitoring of carbon monoxide concentrations in air from compressors should be adequate to ensure that the specifications for Grade D breathing air (Compressed Gas Association) are met. PPG has no data to support establishment of a specified frequency of monitoring.

b. No comment.

Q: 17. Should acceptable respirator breathing air continue to be specified as Grade D from Compressed Gas Association Commodity Specification G7.1-1966 (29CFR 1910.134(d)(1)) or should some alternate specification, such as grade E, be used?

R: 17. There have been no problems with the use of Grade D breathing air at PPG, nor is anyone aware of data indicating that such problems occur. Its use for breathing air should be recommended in a nonmandatory appendix to the standard.

Q: 18. It has been claimed that some powered air purifying respirators (PAPR's) have been shown to induce inward leakage.

a. In view of this, what protection factor is appropriate and how should proper fit be ascertained?

b. Should PAPR's have alarms to indicate low airflow?

c. Under what circumstances would PAPR's be made available to employees?

R: 18. a. More research is needed to ascertain which PAPR's and which use conditions are associated with these problems and to quantify the extent of the inward leakage for each.

b. A simple, reliable device to indicate low airflow should be adequate.

c. PPG currently has PAPR's available for employee use per the Lead standard (29CFR1910.125(f)(2)(ii)). To date, no employee has requested use of a PAPR. OSHA should not specify availability of PAPR's; this should be left to the respirator selection process.

Q: 19.a. What recordkeeping should be required to ensure an effective respirator program? Possible items for documentation include breathing air chemical analysis, fit testing, medical evaluations, respirator inspection, etc.?

b. What costs are associated with these items?

R: 19. a. Recordkeeping is primarily a management tool for assuring the effectiveness of a respirator program. To fulfill this function, respirator program records should include the following:

- a written copy of the program SOP
- medical certification of an employee's ability to wear a respirator (part of employee's medical record)
- exposure monitoring data on which decision to use respirators is based including any assigned or developed protection factors
- training of employees, including documentation of any fit testing performed,
- respirator inspection, maintenance, and cleaning procedures will be incorporated into a well-written respirator program SOP. Records need only include updated documentation of the most recent inspection for emergency use respirators. OSHA should not specify the exact content of these items, their maintenance, or their retention.

b. Costs of maintaining these records at PPG facilities vary from approximately $500 to $6,000 annually, depending on the extent of the respirator program at each facility. In some cases, recordkeeping may consist of only a few notebooks with training session attendance sheets, workplace monitoring results, types of respirators issued, and an inventory of replacement parts. In other cases, recordkeeping may be more comprehensive and include inspection schedules for emergency equipment, repair and maintenance documentation, QNFT data, periodic monitoring results of workplace air, medical screening results, engineering control inspection results, as well as training and inventory data. Administrative time to maintain and update these files and records is the most significant cost factor for an extensive respirator program.

Q: 20. What type and level of training and education should be considered the minimum required to permit a person to train others in respiratory protection?

R: 20. A person training others in respiratory protection should be knowledgeable in the use of respirators. This training can actually be obtained in many ways. At PPG, those with responsibilities for respiratory protection training of employees have received their own training in various ways: undergraduate and graduate level safety and health courses, in-house training provided by Division Industrial Hygiene Departments, training sessions provided by respirator manufacturers, on-the-job training from a superior with experience in respiratory protection, previous work experience requiring the use of respirators, fire department training in emergency use of respirators, PPG Corporate Fire School sessions, professional society-sponsored courses (American Industrial Hygiene Association (AIHA), American Society of Safety Engineers (ASSE)), the NIOSH course, "Occupational Respiratory Protection." All of these individuals are very knowledgeable in the proper use of respiratory protection and are competent in training others in that use.

Q: 21. Under what circumstances, if any, should men with beards be permitted to wear each type or style of respirator?

R: 21. Men with facial hair (beards, goatees, long sideburns, long moustaches) should not be permitted to wear a respirator if the hair interferes with the facepiece-to-skin seal of the mask or if it interferes with the function of the respirator valves.

In the case of negative pressure air-purifying respirators, a poor facial seal or improper valve function mean that airborne contaminants can leak into the mask resulting in increased employee exposure to them. It is also possible to "overbreathe" the airflow in airline respirators during heavy exertion, resulting in inward contaminant leakage. In the case of positive pressure atmosphere-supplying respirators with a limited air supply (such as SCBA's), outward leakage from a poorly fitted respirator shortens the duration of the air supply by an unknown amount. All are undesirable.

While PPG has not done quantitative fit testing for research purposes, some initial fit testing on individuals with beards was done to demonstrate to them the effect of facial hair on respirator seal (Table I). These individuals were successfully fitted with the same model of mask when clean-shaven, thus permitting comparison. A good respirator seal has not been found on anyone with more than one week's growth of facial hair. Experience in fit testing individuals with "stubble" showed fit to be unpredictable. Some

men with light beards can get a good facepiece seal with 2-3 days' growth, while other men experience leakage with overnight growth (Table II). (These data are provided only to reflect experience with facial hair and respirator fit gained during the performance of more than 400 quantitative fit tests in the Coatings and Resins Division; they are not meant to imply a statistically valid study of the variables involved.) Since performing a qualitative fit test on each individual with facial hair on a daily basis would be impractical, the administrative expedient adopted to ensure employee protection is that employees in jobs requiring the use of respirators cannot have facial hair interfering with the respirator facepiece seal or with proper valve function.

TABLE I

ARE BEARDS COMPATIBLE WITH RESPIRATORS?

INDIVIDUAL	BEARD GROWTH	MEASURED FIT FACTORS WITH BEARD	CLEAN-SHAVEN
1	Full beard	17	3,300
2	Full beard	687	>10,000
3	Full beard	92	>10,000
4	Full goatee	25	3,560
5	Full goatee	9	6,560
6	Full beard	26	9,700
7	Two weeks beard	1,960	>10,000
8	One week beard	1,200	>10,000
9	Long moustache	1,830	>10,000
10	Five days, plus goatee	1,360	9,400

ANSWER: NO

Quantitative respirator fit tests performed with Dynatech Frontier Model FE250A, Portable DOP Aerosol Quantitaive Respirator Fitting System, according to protocol outlined by NIOSH in HEW Publication No. 76-189, A Guide to Industrial Respiratory Protection. Each individual was tested with the same model of half-mask, air-purifying respirator, equipped with high-efficiency filters, before and after shaving. A fit factor of >3300 represents the highest measurable factor since the stated minimum efficiency of the filters for this size aerosol is 99.97%. Higher factors are often measured since filters often exceed this efficiency.

TABLE II

DOES "STUBBLE" INTERFERE WITH RESPIRATOR SEAL?

INDIVIDUAL	FACIAL HAIR GROWTH	MEASURED FIT FACTOR "STUBBLE"	CLEAN-SHAVEN
1	1 day	2,000	8,500
2	1 day	>10,000	>10,000
3	2 days	2,320	4,000
4	3 days	4,350	>10,000
5	2 days	2,580	7,750
6	1 day	4,330	>10,000
7	2 days	9,090	9,400
8	3 days	6,570	>10,000
9	3 days	7,820	>10,000
10	3 days	26	9,700
11	1 day	>10,000	9,860
12	2 days	>10,000	>10,000

ANSWER: SOMETIMES - It depends on the individual and the extent of growth.

Quantitative respirator fit tests performed with Dynatech Frontier Model FE250A, Portable DOP Aerosol Quantitaive Respirator Fitting System, according to protocol outlined by NIOSH in HEW Publication No. 76-189, A Guide to Industrial Respiratory Protection. Each individual was tested with the same model of half-mask, air-purifying respirator, equipped with high-efficiency filters, before and after shaving. A fit factor of >3300 represents the highest measurable factor since the stated minimum efficiency of the filters for this size aerosol is 99.97%. Higher factors are often measured since filters often exceed this efficiency.

Q: 22. To what extent, if any, should the OSHA/NIOSH Respirator Decision Logic be incorporated into revised OSHA standards?

R: 22. OSHA should not incorporate the Respirator Decision Logic (Joint NIOSH/MSHA Standards Completion Program, August 18, 1975) into the revised respirator standard. The logic does not permit the use of air-purifying negative pressure respirators for substances that have warning properties above the PEL (yet this is allowed in separate OSHA regulations, e.g., acrylonitrile), nor does it permit the use of half-facepiece or mouthpiece respirators for eye-irritating substances even when adequate eye protection is provided. OSHA should adopt a performance oriented approach to respirator selection, permitting employers to document the effectiveness of a given respirator for a given use situation.

Q: 23. What level(s) of oxygen deficiency should impose a restriction on the types of respirators that may be worn?

R: 23. Existing recommendations by NIOSH and ANSI are adequate - air purifying respirators should not be worn in atmospheres containing <19.5% oxygen at sea level.

Q: 24. How should "immediately dangerous to life or health" (IDLH) be defined with respect to limiting respirator use for oxygen deficiency or for the presence of toxic materials?

R: 24. OSHA should adopt the ANSI Z88.2-1980 definition of IDLH, "any atmosphere that poses an immediate hazard to life or produces immediate irreversible debilitating effects on health."

Technically, IDLH, with respect to oxygen levels, should be defined in terms of partial pressure of oxygen in the lungs. A definition of this sort would make measurements impractical and administration of a respirator program nearly impossible. OSHA should, therefore, use <19.5% atmospheric oxygen concentration (sea level) as a practical IDLH definition for limiting respirator use. (See Question 23.)

IDLH, with respect to toxic materials, must be defined for each contaminant and will depend on the nature of that contaminant as well as on the conditions of its use. OSHA should not attempt to establish an IDLH definition for each toxic substance; rather, it should be left to professionals familiar with a given substance to determine adequate IDLH levels for that substance and use situation.

Q: 25. How and to what extent should respirator regulations for the maritime and/or construction industries differ from those for general industry?

R: 25. No comment.

Q: 26. Should regulations be established for permissible shelf life for filters, cartridges, and canisters?

R: 26. No. NIOSH/MSHA should require manufacturers to determine the effective shelf life of filters, cartridges, and canisters, and to include the shelf life or expiration date on the label as part of the approval process, when such information is deemed important to the user determining the effectiveness of a respirator.

Q. 27. Using either sanitary, durability, or service life considerations, how long should "disposable" respirators be permitted to be used?

R. 27. No specific service life should be stated for disposable respirators. Their effective life depends on many variables. PPG has not set maximum service lives for these masks; they are determined at each facility based on first-hand knowledge of the respirators and the conditions under which they are used.

Q: 28. For work in atmospheres immediately dangerous to life or health, are there respiratory devices other than self-contained breathing apparatus that are suitable for use by standby persons? (See CFR1910.134(e)(3)(iii)).

R: 28. The standby person should be permitted to use a positive-pressure airline respirator (having a separate air source than that used by the person(s) working in the IDLH atmosphere) with an auxiliary SCBA.

Q: 29. Respirator filters and sorbents have a limited service life.

a. What limits, if any, should be placed on particulate filters?

b. In what manner should allowance be made for the degradation of some filters due to humidity?

c. What scheme should be used to specify service lives for organic vapor cartridges and canisters for various organic vapors. What use can be made in this regard of published breakthrough times for various organic vapors? (See, for example, Nelson and

Correia, American Industrial Hygiene Association Journal, September, 1976, p. 514; and others.)

Q: 29. d. Should sorbent cartridges be restricted to a single day's use on account of the desorption that may occur during overnight storage and exposure to humidity?

R: 29. a. Limitations of particulate filters should be determined by the manufacturer or should be made evident by the testing protocol. Filter penetration and degradation data would be useful to employers in determining the effectiveness of a respirator for a given use.

b. Information on the effects of humidity on efficiency or capacity of filters or adsorbent media, when known by the manufacturers, should be made available to respirator users. Professionals can then determine appropriate allowances depending on local environmental conditions. Mandatory regulations would be impractical.

c. For organic vapors with adequate warning properties, the sorbent media can be used until the odor of the vapor can be detected while wearing the respirator. Screening of individual olfactory responses is necessary if this method is to be relied on. For substances with poor warning properties, such as acrylonitrile, breakthrough data coupled with knowledge of workplace conditions can be used by employers to establish effective service lives for cartridges. OSHA should not attempt to specify cartridge or canister replacement frequencies.

d. Not for chemicals with adequate warning properties, such as many solvents. For certain contaminants desorption, migration through the sorbent bed, high toxicity, and/or poor warning properties may necessitate limiting sorbent media use to a single day. This must be determined for individual contaminants and workplace situations.

Q: 30.a. Should the respirator standards continue to address the relative priority of engineering controls and respirators? (See 29CFR1910.134(a)(1)).

b. Do feasible engineering controls always provide better protection or greater assurance of protection of employee health than the use of respirators?

R: 30. a. OSHA, rather than establish a hierarchy of controls, should recognize that a combination of engineering controls, administrative controls, and personal respiratory protection can often provide the best employee protection. The respirator standard should concentrate on the goals essential to providing good respiratory protection.

a. While engineering control of contaminants is highly desirable, to rely solely on engineering may provide neither the most cost effective nor the best protection for employees. Use of respirators as back-up protection against atypical, unexpected, high exposure concentrations is desirable and should be encouraged, especially for highly toxic materials with poor warning properties.

Employee exposures to lead-containing pigment dust in the PPG Coatings and Resins Division are well controlled, with lead exposures generally below the OSHA-PEL of 50 ug/M^3. Operating procedures require, however, that individuals handling leaded pigment wear respirators with particulate filters. This is to ensure that, in the event of an unexpected high exposure (lead concentration >50 ug/M^3), due to failure or improper use of local exhaust, leaking pigment bags, or careless handling procedures, the employee will still be protected. This has been judged by PPG health and safety professionals to be the best way to protect employee health during lead-handling operations.

b. Engineering controls, if properly designed, constructed, operated, and maintained, will generally, but not always, provide assurance of employee health protection. A malfunctioning engineering control for a highly-toxic material with poor warning properties can provide a false sense of protection for an employee and could result in a high exposure without warning. Use of area monitors, administrative controls, and respiratory protection in combination with engineering controls will often provide the best assurance of employee health protection.

Q: 31. Are there any other issues or problems relevant to respiratory protection programs in general industry, maritime, or construction which OSHA should address in revising current standards?

R: 31. No.

Q: 32.a. What would be the economic impact on affected industries and on small businesses and other small entities of the possible changes to OSHA regulations described above or suggested by you or other commentors?

b. Which, if any, of these changes would result in major increases or decreases in costs or prices for individual industries, small businesses, other small entities, or consumers?

c. Would these changes have a significant economic impact on a substantial number of small businesses or other small entities?

d. Would these changes, taken individually or as a whole, result in significant adverse or beneficial effects on domestic or foreign competition, investment, productivity, or innovation?

R: 32. OSHA can best answer these questions after it reviews respirator program cost data provided by all companies and organizations submitting comments.

Q: 33. There have been claims that the use of respirators results in productivity losses.

a. What factors may contribute to productivity losses?

b. What are the costs of each of these factors?

c. What is the aggregate cost, if any, of productivity losses induced by the use of respirators?

d. What provisions of current respirator standards affect productivity?

e. What effective alternatives are available that could reduce these productivity losses?

R: 33. Productivity losses associated with respirator use will differ with each type of operation. The use of respirators should be viewed no differently from any other necessary preparatory tasks. The prevention of productivity losses due to respirator usage is the responsibility of management. It can be aided by government regulation only if that regulation is flexible and performance-oriented, permitting the innovations necessary to adapt effective respirator programs to specific work operations.

Q: 34. Respirator program costs can vary widely depending on the conditions which necessitate respirator use.

Q: 34. a. How much time during a typical shift are respirators actually worn? Please be as specific as possible about type of industry and classification of employee concerned.

b. How many employees and what portion of the employer's workforce use respirators?

c. What are typical maintenance and replacement costs for each type of respirator used?

d. What are the total costs and per employee costs for a qualitative fit testing program? Where known, separately state the costs of program staff training, equipment purchase, equipment rental, consultant fees, employee time, program staff time, and the number of tests performed per employee.

e. What are the total costs and per employee costs for a quantitative fit testing program? Where known, separately state the costs of program staff training, equipment purchase, equipment rental, consultant fees, employee time, program staff time, and the number of tests performed per employee.

R: 34. a. Respirator usage varies a great deal at PPG. A Thinner (adjusts paint and coatings batches to final specifications after initial mixing) may wear a respirator once a month, or less, for a specific duty. A person responsible for emptying pigment bags may wear a respirator 4 hours or more everyday. Persons working in a chlorine manufacturing plant may be trained and supplied with mouthpiece respirators for escape purposes and may never use them.

b. The number of employees actually using respirators at PPG facilities ranges from a low of 3 persons, representing 0.25% of employees at one facility, to a high of 2700 persons supplied with mouthpiece escape respirators, representing 100% of the employees at another facility. A total of about 675 persons are included in all respirator programs in the Coatings and Resins Division - this represents about 12% of the total number of people in the division. A total of 3430 persons, 64% of the total number of employees, in the Chemical Division are included in respirator programs. Approximately 1-3% of the employees in the Glass Division wear respirators intermittently.

R: 34. c. Assuming 5 minutes are spent cleaning a respirator each day it is worn, labor costs are slightly over $1/day/employee, resulting in annual costs ranging from <$10 to >$100 per employee for air purifying respirators. Maintenance of disposable respirators, if disposed of after each use, is minimal. Treating the elastomeric "disposable" respirators as reusable will result in cleaning costs similar to those for air purifying respirators. These costs will be lower if cleaning consists of merely wiping the sealing surface with an alcohol wipe or washing with soap and water. They will be higher if cleaning consists of removing cartridges, gaskets, and valves and then thoroughly cleaning the respirator; which takes about 10 minutes per respirator for an experienced person.

Total costs in PPG's Chemical Division for maintenance repair and administration amounts to $253,600 per year or $74.00 per employee included in respirator programs.

Replacement costs and initial costs vary widely with the type of respirator.

Air-purifying respirator costs:
- Half-mask facepiece - from $10.50 to $13.80
- Full facepiece - from $31.00 to $96.00
- Disposable - about $1.00
- Disposable "reusable" elastomeric - about $5.95
- Powered air purifying - from $195 to $340
- Cartridges - from $2.15 to $3.95 each
- Canisters - from $13.00 to $18.00

Air-supplying respirators (including air supply, hose assembly) costs:
- for canister with air source - $160 to $400
- for SCBA - about $900

R: 34. d. Costs of QLFT vary greatly with the type of test. A QLFT consisting of only an irritant smoke test may take less than five minutes at a cost of less than $3.00/test. A more comprehensive test, such as an isoamyl acetate vapor or a saccharin mist test following the NPCA protocols, may take 30 minutes. Costs range from $17.00 to $25.00 per test. These costs represent the extremes of QLFT as reported by PPG plant safety professionals who conduct the tests.

R: 34. e. QNFT in PPG's Coatings and Resins Division is conducted by Divisional Industrial Hygienists with a Dynatech FE250A portable unit. A number of assumptions were made in order to determine the most accurate average cost/test for the division: testing twice/year at each plant requiring two qualified testers; test time of 30 minutes; transportation costs, including air and rental car were determined for each geographic location, totaled, and averaged on a per test basis; initial equipment cost was $13,000, assuming a 5-year straight line depreciation; annual costs are $2,600; daily expenses for testers were assumed to be $82.50; salary and benefits were included to determine the cost of testing time for both the workers and the testers. On this basis, the total cost per year is $29,790 for 211 employees on 422 tests/year or $70.60 per test.

As has been stated, there are many factors which determine the per employee cost of a respirator program. These include: the number of employees using respirators, the type(s) of respirator(s), frequency of use, type(s) of contaminant(s), training - including type of fit testing, recordkeeping, medical screening, administration, maintenance, etc.

Because of these factors, the annual cost of a respirator program per employee in the Coatings and Resins Division ranges from about $100/employee to about $400/employee as reported by plant safety professionals. These figures do NOT include the cost of QNFT for selected employees who, per the lead standard, must undergo this testing. Average annual cost per employee excluding QNFT amounts to about $264.

This is comparable with annual average costs in the Chemical Division. In addition to maintenance costs (see question 34c) annual equipment costs are $611,800 or $178 per employee for a total cost of about $252 per year per employee.

It must be noted that much of this cost is involved with respirator programs where respirators are used as supplemental protection to primary engineering controls. For example, a chlorine manufacturing plant has total respirator equipment costs of $271,000 per year. Of that, $145,000 or 54% is spent on mouthpiece respirators which provide employee protection in the event of an engineering failure, e.g, a leak. As previously mentioned (see 30a), the Coatings and

Resins Division uses respirators to supplement engineering controls for lead-handling operations, even when measured exposure levels are routinely below the OSHA-PEL.

This approach of utilizing feasible engineering controls, administrative controls, and respiratory protection programs established by health and safety professionals familiar with each operation is believed to provide the most effective employee health protection.