NIOSH Comments to DOL

COMMENTS OF THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH ON THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION'S PROPOSED RULE ON HEALTH STANDARDS; METHODS OF COMPLIANCE

29 CFR Part 1910
Docket No. H-160

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

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A. NIOSH STRATEGY FOR METHODS OF COMPLIANCE

In June 1983, the National Institute for Occupational Safety and Health (NIOSH) submitted comments to an Occupational Safety and Health Administration (OSHA) advance notice of proposed rulemaking (ANPR) on methods of compliance. In these comments, we stated our approach for the implementation of effective hazard control strategies (NIOSH 1983). This strategy was expressed then, and is reiterated now, as an ordered hierarchy of elements in the prevention of worker exposure to hazardous substances.

"The three elements of this effectiveness hierarchy of control solutions, in order of preference, are:

1. First, prevent or contain hazardous workplace emissions at their source;

2. Next, remove the emissions from the pathway between the source and the worker;

3. Last, control the exposure of the worker with barriers between the worker and the hazardous work environment."

NIOSH further stated that the:

"Essential characteristics of specific control solutions are:

- The levels of protection afforded workers must be reliable, consistent, and adequate.

- The efficacy of the protection for each individual worker must be determinable during use throughout the lifespan of the system.

- The solution must minimize dependence on human intervention for its efficacy so as to increase its reliability.

- The solution must consider all routes of entry into workers' bodies and should not exacerbate existing health or safety problems or create additional problems of its own."

NIOSH continues to strongly and unequivocably support the use of engineering controls over the use of respirators for preventing worker exposure to hazardous substances. NIOSH recognizes that engineering controls may include substitution for a less hazardous substance, containment of the process, isolation of the worker, ventilation for

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16. Abstract (Limit: 200 words) This testimony concerns the views of NIOSH with regard to effective hazard control strategies. The three elements of effectiveness in designing control systems include preventing or containing hazardous workplace emissions at their source; removing the emissions from the pathway between the source and the worker; and controlling the exposure of the worker with barriers between the worker and the hazardous work environment. Levels of protection afforded the workers must be reliable, consistent, and adequate. The efficacy of the protection for each individual worker must be determinable during use throughout the lifespan of the system. The solution must minimize dependence on human intervention for its efficacy so as to increase its reliability. The solution must consider all routes of entry into workers' bodies and should not exacerbate existing health or safety problems or create additional problems of its own. Documentation in support of the views of NIOSH is cited.

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removing the hazardous substance, and the associated administrative and work practice controls necessary for initiating and maintaining the engineering controls.

B. DOCUMENTATION FOR NIOSH STRATEGY

The central issue in the OSHA proposed rule involves the efficacy of engineering controls vs. respirators for reducing worker exposure to toxic substances [54 FR 23991]. In these comments, NIOSH will present data and references to support the assertion that engineering controls are the preferred method of control.

1. NIOSH Health Hazard Evaluation and Technical Assistance (HETA) reports have shown that the implementation of engineering controls can effectively reduce airborne lead exposure. The following examples are provided:

   - A NIOSH investigation, involving workers producing lead medallions, found airborne lead exposures during grinding and buffing to be in excess of 1300 $\mu g/m^3$. A follow-up sampling after the installation of local exhaust controls indicated that airborne lead levels had been reduced to below the limit of detection (< 6 $\mu g/m^3$) (NIOSH 1987a).

   - A NIOSH investigation of a facility producing leaded glass crystal art objects indicated that 5 out of 6 air samples exceeded 50 $\mu g/m^3$ of lead. The average worker blood lead level was 29.1 $\mu g/dl$ (NIOSH 1984). A follow-up visit was conducted after improvements were made in the local ventilation. At the time of the follow-up, only 3 out of 16 air samples exceeded 50 $\mu g/ml$ of lead and the average blood lead level was 13.4 $\mu g/dl$. The engineering controls had been effective but additional improvements were needed (NIOSH 1986).

2. A recent study has shown excess exposure to lead among construction workers who use oxyacetylene torches to cut lead-painted metal. These workers were exposed to high concentrations of airborne lead (from 600 to 4,000 $\mu g/m^3$) for only a few weeks while wearing positive-pressure airline respirators and still showed evidence of lead poisoning (blood lead levels ranged from 48 to 120 $\mu g/dl$) (Marino et al. 1989).

   This study indicates that under these circumstances, the use of positive-pressure airline respirators did not provide adequate protection for the workers. The authors hypothesized that this inadequate protection may have resulted from the inappropriate selection, use, and maintenance of the respirators. They further hypothesized that the point of air intake for the compressors to the airline respirator may have been contaminated. Furthermore, workers without respirators who were performing other tasks in the same area may have been exposed.

Had engineering controls such as isolation or local ventilation been used, NIOSH suggests that these excess exposures would have been reduced. NIOSH studies have shown that using engineering controls at the source of emission reduces exposures not only at the source, but also to workers in the immediate vicinity of the operation (NIOSH 1981). Obviously, this reduction of exposure in adjacent areas would not occur with the use of respirators alone. In fact, if respirators are used to control exposures, then more workers in the boundary or marginal work areas will need to wear respirators to assure their protection.

3. A NIOSH walk-through survey of a brass foundry, and review of environmental and medical data after the initiation of both engineering controls and a respirator program, indicated significant improvements in potentially dangerous levels of exposure to lead. It is impossible to know which components of the lead control program resulted in the greatest proportion of the decline in blood lead levels. Undoubtedly, changes in respiratory protection and ventilation both had significant impacts (NIOSH 1988).

4. NIOSH agrees with OSHA that when respirators are worn, a respirator program must be implemented that incorporates training in the proper selection, use, maintenance, cleaning, and storage of respirators, as well as medical evaluation of the respirator wearer (NIOSH 1987b; NIOSH 1987c).

   The NIOSH HETA program has identified several incidents where respirators were not being properly worn, where an inappropriate respirator was being worn, or where other aspects of a proper respirator program were not implemented. Exhibit 1 lists these HETA studies and the principal problems with respirator protection programs.

5. NIOSH has recognized that respirator programs are not inexpensive. Exhibit 2 details some of the costs for the purchase and use of various types of air-purifying and air-supplied respirators.

   It should be noted, however, that this cost analysis does not include the following cost factors:

   - Personnel and paperwork associated with the purchase of respirator supplies and equipment

   - Personnel required to manage and maintain the respirator program

   - The costs required to clean, maintain, and store respirators

   - Medical evaluation of employees required to wear respirators

- Training of employees

- Fit-testing of respirators

- Sampling and analysis of the work environment to determine whether the proper respiratory protection system is being used based on the protection factor recommended for the equipment in use

6. In the preamble to its proposed rule, OSHA cites numerous statements which indicate that significant progress has been made in respirator technology and application to permit their use on a wider scale. Although there has been progress in respirator technology, none of the progress has decreased the need for responsible human performance regarding their use. For example, Exhibit 3 shows that the best performing respirator may not give adequate protection if it is not worn properly <u>all</u> of the time.

   Furthermore, NIOSH laboratory and field studies on the performance of respirators indicate there is still significant uncertainty about the actual in-use performance of respirators (Myers et al. 1983; Myers et al. 1984a; Liu et al. 1984; Myers et al. 1984b; Myers et al. 1986; Myers et al. 1988a; Myers et al. 1988b; Lenhart et al. 1984).

Exhibit 4 from the NIOSH <u>Respirator Decision Logic</u> (NIOSH 1987b) lists six cautionary statements regarding the use of respirators. Also, in its recently updated <u>Guide to Industrial Respiratory Protection</u> (NIOSH 1987c), NIOSH has stated that other problems with the use of respirators still exist. These following problems are described.

<u>Air-Purifying Respirators</u>

Some of the problems with the use of air-purifying respirators are:

- They cannot be used in atmospheres containing less than 19.5 percent oxygen.

- They cannot be used in atmospheres immediately dangerous to life and health.

- They should not be used for protection against gases and vapors with inadequate warning properties.

- The cartridges and canisters have a limited capacity to remove gases and vapors and, therefore, have a limited useful service time necessitating frequent replacement (daily or after each use). This creates an added expense due to the relatively high cost of the cartridges and canisters (Exhibit 1).

Air-Supplying Respirators

The use of air-supplying respirators presents problems of a different nature.

A. **Airline respirators**

- The air supply is dependent on an outside source such as a compressor or bottles of compressed air. Loss of the air supply can be caused by cutting, burning, kinking, or crushing the supply air hose, compressor failure, or depletion of the air in a storage tank.

- The trailing air supply hose severely restricts the user's mobility.

B. **Self-Contained Breathing Apparatus (SCBA)**

- This equipment allows the user to carry the air supply with him/her, but the bulk and weight of the equipment make them unsuitable for strenuous work or use in a constricted space. The limited service life makes them unsuitable for routine use or for long continuous periods.

7. A NIOSH study (James et al. 1984) indicates the effects of wearing different types of respirators under different combinations of heat and workload conditions. Based on laboratory tests, wearing full- and half-facepiece cartridge-type, air-purifying respirators caused increased physiological strain (measured by changes in heart rate, oxygen consumption, energy expenditure, and oral temperature) which approached the upper limit of tolerance under the heat/workload conditions employed. As expected, the full-facepiece respirator caused greater strain than a comparable half-mask type. Findings indicate that workers' tolerance to moderate or higher workloads under hot conditions is reduced by wearing a respirator, especially a full-face type.

Several additional NIOSH studies (White et al. 1984; White et al. 1987; White et al. 1988; White et al. 1989) evaluate the physiological effects and subjective responses to the wearing of various combinations of respirators and protective clothing. The results of these studies generally show significantly increased physiological effects (minute ventilation, heart rate, skin temperature, rectal temperature, and sweat rate) and decreased work tolerance (time to subjective or objective sign of maximal stress) while wearing protective equipment ensembles. One study (White et al. 1987) determined that, "It is concluded that wearing protective clothing and respirators causes significant stress to the cardiorespiratory and thermoregulatory systems, even at low work intensities in a neutral environment."

8. Hopkins et al. (1986a) have investigated the use of behavioral approaches for reducing occupational exposures to styrene. The intent of this pilot study was to show the utility of behavioral methods for reducing worker exposures to styrene. Nine behaviors were identified as affecting exposures to styrene in the manufacturing processes at one plastics plant. These behaviors were addressed by a training program aimed at reducing styrene exposure by modifying these behavior patterns. The use of organic vapor respirators was one of the behavior patterns addressed. Pre- and post-training performance was compared and results demonstrated little positive change in the wearing of respirators. The authors note that one worker commented during training that he would not wear a respirator.

   Problematic use of respirators in this pilot effort was the basis for considering it only an optional practice in the main study which followed (Hopkins et al. 1986b). The main study concentrated on those behaviors that best exploited the engineering control systems that were in place (e.g., engaging exhaust ventilation, placing work to take maximal advantage of exhaust airflow, etc.). The enclosed paper by Hopkins et al. 1986b describes the main study.

9. A NIOSH study (NIOSH 1982) on behavioral approaches for promoting personal protective equipment usage determined that the likelihood of a worker wearing a personal protective device is a combined function of (a) the immediacy of the hazard and its consequences, (b) the encumbrance/discomfort imposed in wearing the device, and (c) its perceived effectiveness to the wearer. Examples are given which offer empirical support to this proposition. Respirator use is judged to be least likely used in light of these various considerations.

C. CONCLUSION

NIOSH is pleased that OSHA has publicly reaffirmed its policy on the hierarchy of controls. In response to a question from the American Federation of State, County, and Municipal Employees (AFSCME) at the OSHA hearings on bloodborne diseases, Mr. Charles Adkins stated, "We have not changed our position on the hierarchy of controls. There is no change in OSHA's theory that methods of compliance should be engineering controls first, then administrative and protective equipment" (BNA 1989). This policy is certainly consistent with the hierarchy of control that is endorsed by NIOSH and the consensus of the public health community. Furthermore, this hierarchy of control is consistent with NIOSH's philosophy on limiting the use of respirators only to those circumstances where engineering controls are not technologically feasible.

The OSHA proposed rule specifies five circumstances under which respirators may be used in lieu of engineering controls for reducing worker exposure to hazardous substances. They are:

1. During the time necessary to install feasible engineering controls;

2. Where feasible engineering controls result in only a negligible reduction in exposure;

3. During emergencies, life saving, recovery operations, repair, shutdowns, and field situations where there is a lack of utilities for implementing engineering controls;

4. Operations requiring added protection where there is a failure of normal controls; and

5. Entries into unknown atmospheres.

NIOSH is particularly concerned that circumstance number 2, "Where feasible engineering controls result in only a negligible reduction in exposure," is nebulous and the term "negligible reduction" is subjective and open to broad interpretation. If circumstance number 2 is to be retained, NIOSH recommends that OSHA quantitatively define "negligible reduction" and require the employer to document that feasible engineering controls result in only "negligible reduction." The evaluation of this documentation would help to assure the best protection for workers and minimize the inappropriate use of respirators as a primary form of hazard control.

These five circumstances seem reasonable and, on occasion, NIOSH has recommended the use of respirators for circumstances corresponding to numbers 1, 3, 4, and 5. However, NIOSH is concerned that unsafe workplace conditions may result if the routine use of respirators rather than engineering controls is permitted by default any time one of these five conditions exist. For example, during the installation or retrofitting of new engineering controls (circumstance #1), it might be feasible to install temporary controls such as portable ventilation or to isolate the the worker, rather than to use respirators for controlling exposures until the new engineering controls are in place. Respirators for this circumstance might not be as protective as the temporary engineering controls. For all five circumstances, NIOSH recommends that OSHA establish criteria by which the employer can document that engineering controls are not feasible or that they are less effective than respirators. These criteria would help to minimize the inappropriate use of respirators as a primary form of hazard control. If requested by OSHA, NIOSH would assist in developing the criteria for evaluating the hierarchy of control.

Enclosures and/or attachments that are not included are available free of charge from the NIOSH Docket Office [513/533-8450].

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