Respiratory Protection

Is your program effective?

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RESPIRATORS PROTECT WORKERS against various airborne contaminants that may cause adverse health effects. In circumstances where ventilation or substitution of a less-toxic chemical is not possible, respiratory protection may be the only protection available to workers. However, to effectively protect respirator users, an adequate written respiratory protection program must be established.

Respirator-related issues continue to be among those most frequently cited by OSHA inspectors. From September 2006 to October 2007, of all standards cited within general industry, federal OSHA citations for respirator-related issues were the third highest in number (OSHA, 2008). In 2001, NIOSH and the Bureau of Labor Statistics (BLS) surveyed 40,002 randomly selected U.S. private industry establishments (BLS, 2003). U.S. private industry establishments employed 110 million workers in 2001 (BLS, 2001).

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Respirator Use in Industry

In 2001, approximately 4.5% (an estimated 281,776) of establishments and 3.1% (3,303,414) of workers in all private industry used respirators for required purposes (BLS, 2003). Of these, an estimated 30,148 larger establishments (250 or more employees) and 251,627 smaller establishments (fewer than 250 employees) used respirators for required purposes.

As part of a study to evaluate respirator usage practices and how these practices compare with OSHA (1998) regulations and NIOSH (2004) recommendations, a survey questionnaire was mailed to the selected establishments during August 2001 through February 2002. It was designed to collect information on the types of respiratory protection used by workers at an establishment; assessment of medical fitness to wear respirators; types of respirator fit tests performed; and presence of substances that prompted the decision to use respiratory protection (BLS, 2003). This article discusses the elements of an effective respiratory protection program and underscores the need for a company self-assessment.

Respiratory Protection Program Quality Indicators

Each listed question [developed on the basis of OSHA (1998) requirements and NIOSH (2004) recommendations] examines the key components of an effective respirator program. The percentages of respirator-using establishments with indication of a potentially inadequate respiratory protection program are listed as are suggestions to improve respirator programs.

1) Is there a written change-out schedule for air-purifying gas/vapor filters?

Survey results. Of respirator-using establishments using gas/vapor filters, 78.1% did not have a written change-out schedule.

Suggestions. Many substances have poor warning properties (e.g., isocyanates in paint), so a change-out schedule to replace spent cartridges is needed. Filtering elements must be changed often enough to prevent saturation with chemicals or clogging with dust. Cartridge change-out schedules are available from OSHA (www.osha.gov/SLTC/etools/respiratory/change_schedule.html) and from NIOSH (www.cdc.gov/niosh/npptl/multivapor/multivapor.html).

2) Does the program require use of the manufacturer instructions or NIOSH certification labels to adjust the airflow for air-line respirators?

Survey results. Of air-line respirator-using establishments, 77.2% did not require use of instructions or labels or did not know how airflow was adjusted.

Suggestions. Airflow must be properly adjusted for the air-line respirator to ensure adequate flow to the user and prevent infiltration of dusts and chemicals (OSHA, 1998). In addition, the length of air

hoses is limited by NIOSH certification to ensure sufficient airflow (NIOSH, 2004).

3) Has management adopted a written respirator program that determines how respirators are used?

Survey results. Of the respirator-using establishments surveyed, 65.5% had not adopted a written program.

Suggestions. OSHA requires a written program with worksite-specific procedures for selecting and using respirators; evaluating the respirator program; fit testing; maintaining and storing respirators; medically evaluating workers; training workers about respiratory hazards and respirator use, limitations and maintenance; and ensuring adequate quality, quantity, and flow of air for air-supplying respirators (OSHA, 1998).

4) Do written procedures include regularly scheduled evaluations of the effectiveness of respirators used at the establishment?

Survey results. Of respirator-using establishments surveyed, 64.3% did not include such an evaluation or were unaware of whether evaluations had been conducted.

Suggestions. The employer should conduct evaluations to determine whether the proper respirators are being used for changing conditions. Worker feedback should also be obtained to learn whether respirators are interfering with work performance.

5) Are employees assessed for medical fitness to wear respirators?

Survey results. Of respirator-using establishments, 51.2% did not provide the assessment or did not know whether such an assessment was conducted.

Suggestions. Adverse health effects associated with respirator use are greater among individuals with underlying health conditions. Medical assessment will help identify workers who cannot safely and effectively use respirators before placing them in hazardous situations (Syamlal, Doney, Bang, et al., 2007). The employer must obtain a written determination from a physician or other licensed healthcare provider regarding the worker's ability to use a respirator. The determination may be based on responses to the OSHA screening questionnaire and, if necessary, a medical examination (OSHA, 1998).

6) Does the program include written procedures for maintaining respirators?

Survey results. Of respirator-using establishments, 49.9% did not include such procedures or did not know whether any procedures were included.

Suggestions. Respirators must be cleaned after each day's use and stored properly to prevent skin rashes. Respirators must be periodically inspected for degradation of straps, face pieces and valves, with repairs or replacements made as needed. Respirators used in routine situations must be inspected before each use and during cleaning; respirators maintained for emergency situations must be inspected at least monthly and checked for proper function before and after each use; and emergency escape-only respirators must be inspected before being carried into the workplace for use (OSHA, 1998).

7) Are wearers of tight-fitting respirators fit tested?

Survey results. Of those establishments whose employees use tight-fitting respirators, 43.3% did not provide fit testing or did not know whether fit testing was conducted.

Suggestions. A fit test (as described by OSHA) such as those using banana oil, saccharine or Bitrex, or quantitative techniques should be conducted to determine whether a selected respirator fits and can be adjusted to prevent leaks (OSHA, 1998). Duling, Lawrence, Slaven, et al. (2007) have reported that fit testing improves the simulated workplace protection factor for filtering face-piece respirators. The survey indicates that filtering face-piece respirators are the most commonly used type of respirator.

8) Is the respirator program administered by a trained person?

Survey results. Of the respirator-using establishments surveyed, 41.9% did not have a trained program administrator.

Suggestions. A trained respirator program administrator should oversee the program for that company or site. The amount and type of training depends on the complexity of the respirators used and hazards encountered.

9) Does the program provide training regarding the need, use, capabilities and limitations of respirators?

Survey results. Of respirator-using establishments, 41.4% did not provide such training.

Suggestions. Workers must be trained to wear respirators properly, use the right type of respirator for the job, know the respirator's limitations, and understand the health effects of dusts and chemicals.

Table 1

Distribution of Indicators of an Inadequate Respirator Program by Establishment Size

Employment size groups[a]	0 to 2 negative indicators[b]	3 to 6 negative indicators[b]	≥ 7 negative indicators[b]
1-10 (n = 122,620)	22,128 (18)	46,859 (38)	53,633 (44)
11-49 (n = 83,716)	20,726 (25)	39,564 (47)	23,427 (28)
50-249 (n = 45,291)	19,576 (43)	16,765 (37)	8,950 (20)
250-999 (n = 21,742)	12,313 (57)	8,683 (40)	727 (3)
≥ 1,000 (n = 8,406)	6,537 (78)	1,766 (21)	26 (<1)
Total (n = 281,776)	81,279 (29)	113,691 (40)	86,804 (31)

Note. *Estimates of the total number of U.S. establishments using respirators are based on BLS/NIOSH Survey of Respirator Use and Practices of 40,002 establishments. Percentages may not total to 100% due to rounding, nonresponse to indicator questions or results not meeting BLS publication criteria.*

[a]n = *total number of establishments using respirators.* [b]*Number (%).*

Abstract: *This article examines key factors that can be used to assess the quality of a company's respiratory protection program. Based on results of a survey of respirator-using firms, the authors provide suggestions for improving these programs.*

Table 2

Distribution of Indicators of an Inadequate Respirator Program by Industry

Major industry division[a]	0 to 2 negative indicators[b]	3 to 6 negative indicators[b]	≥ 7 negative indicators[b]
Agriculture, forestry and fishing (*n* = 13,186)	1,476 (11)	8,138 (62)	3,296 (25)
Mining (*n* = 3,493)	1,400 (40)	1,849 (53)	225 (6)
Construction (*n* = 64,172)	13,515 (21)	26,939 (42)	23,717 (37)
Manufacturing (*n* = 48,556)	18,992 (39)	17,510 (36)	12,053 (25)
Transportation (*n* = 10,351)	4,881 (47)	4,688 (45)	772 (7)
Wholesale trade (*n* = 31,238)	14,968 (48)	11,332 (36)	4,839 (15)
Retail trade (*n* = 16,948)	3,292 (19)	4,510 (27)	9,147 (54)
Finance, insurance and real estate (*n* = 4,202)	584 (14)	2,947 (70)	350 (8)
Services (n = 89,629)	22,074 (25)	35,557 (40)	31,999 (36)
All private industry (*n* = 281,776)	81,279 (29)	113,691 (40)	86,804 (31)

Note. *Estimates of the total number of U.S. establishments using respirators are based on BLS/NIOSH Survey of Respirator Use and Practices of 40,002 establishments. Numbers and percentages by industry or indicator category may not equal total* n *or total to 100% due to rounding, nonresponse to indicator questions or not meeting BLS publication criteria.*

*[a]*n *= total number of establishments using respirators. [b]Number (%).*

Respirator-related issues are among those most frequently cited by OSHA inspectors. From September 2006 to October 2007, federal OSHA citations for respirator-related issues were the third highest in number.

10) Are dust masks (filtering-face piece respirators) used to protect against dusts only, not against gases or vapors?

Survey results. Of the dust-mask-using establishments surveyed, 25.3% did not use these masks only against dust.

Suggestions. Dust masks should be used only for dusts. If gas or vapor hazards are present, respirators with chemical filtering cartridges or air-supplied respirators may be needed. Air-line respirators are required when gas or vapor airborne concentrations exceed the respective OSHA permissible exposure limits or when the concentration of gases or vapors are unknown in confined space situations. An air-supplied respirator can provide adequate respiratory protection for gases or vapors, but a dust mask cannot.

11) Are air-line respirator couplings incompatible with other gas systems at the establishment?

Survey results. Of air-line-respirator-using establishments, 23.7% did not verify compatibility.

Suggestions. Respirator hose couplings should not be connected to a source that may contain nitrogen, argon or another asphyxiant because a fatality could result (OSHA, 1998).

12) Is someone responsible for directing or overseeing the use of respirators at the site?

Survey results. Among respirator-using establishments, 13.7% did not have a person responsible for the respirator program.

Suggestions. A trained respirator program administrator is needed to oversee the program for a company or site. The amount and type of training needed depends on the complexity of the respirators used and hazards encountered.

Three other indicators are related to a lack of knowledge about methods used and responsibility for medical fitness or fit testing (12.1% of establishments lack that knowledge); air sampling to select respirator type (4.6%); and familiarity of respirator terms used in at least two questions (0.8%).

Discussion

Overall, among the respirator-using establishments, 71.1%, or an estimated 200,343 establishments, had any three or more of the previously described 15 indicators of a potentially inadequate respiratory protection program. Table 1 (p. 33) provides details regarding respirator program inadequacies by size of establishment. As establishment size decreased, the percentage of establishments with indicators of an inadequate program increased. The percentage of establishments with three or more negative indicators ranged from 21% (establishments with 1,000 or more employees) to 82% (establishments with 1 to 10 employees). The extent of respirator program inadequacies varied by industry and ranged from 52% of establishments with three or more indicators in wholesale trade up to 87% in agriculture, forestry and fishing (Table 2).

In assessing respiratory protection programs, employers need exposure data for the specific substances that prompt respirator use in their workplaces to ensure proper changeout schedules (in the case of gasses and vapors) and to ensure that the proper respirator is being used. Figure 1 shows the percentages of respirator-using establishments that reported respirator use by the 10 most frequently indicated substances. Dust/mist, paint vapors, solvents, silica dust and welding fumes were the substances for which respirators were most frequently used.

Certain hazardous airborne chemicals can be present in the workplace during specific activities and can cause adverse health effects (e.g., metal fumes from welding and thermal cutting; silica dust from abrasive blasting; solvent vapors from metal cleaning; solvent and isocyanate vapors from painting and coating metals and metalworking fluid mists) (Stellman, 1998). For example, exposure to welding fumes can cause metal fume fever or lead intoxication (Stellman); exposure to silica dust can cause silicosis (CDC, 2005; NIOSH, 2003); exposure to isocyanate vapors can cause asthma (NIOSH, 2003; Liu, Stowe, Bello, et al., 2006); and exposure to metalworking fluid mists can cause hypersensitivity pneumonitis and other lung diseases (NIOSH, 1998; NIOSH, 2008a).

Despite the existence of legally enforceable limits for respirable crystalline silica dust, data suggest that exposure to high concentrations of crystalline silica still occurs. OSHA compliance inspection data for the

manufacturing major industry division for 1993 to 2003 (5,074 samples) also suggest potential overexposure of workers to respirable silica in this industry. The percentage of samples exceeding NIOSH recommended exposure limit (REL) varied by year and was lowest in 1996 (26.0%) and highest in 1999 (54.7%) (NIOSH, 2008b). These data suggest a continuing need for attention to compliance with respiratory protection program criteria.

Study Limitations

The survey findings are subject to some limitations. Public-sector, self-employed and agriculture establishments with fewer than 11 workers were not included in the survey. Although the instructions stated that the person most familiar with respiratory protection should complete the questionnaire, this may not have always occurred. Despite the cognitive and field testing of the survey at small, medium and large establishments before its distribution, recipients may have misinterpreted the written questions.

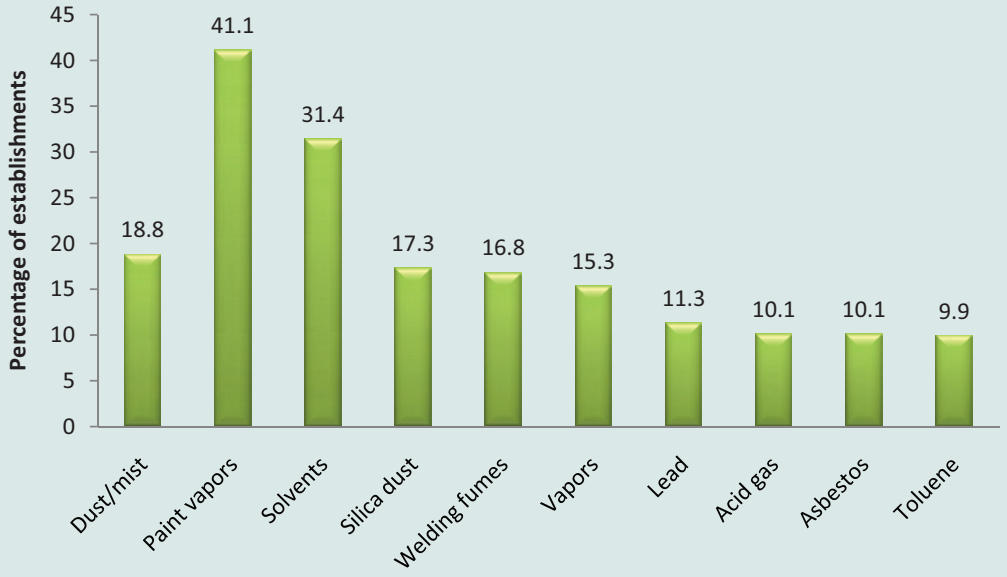
Conclusions & Recommendations

Respirators are used extensively to protect against a wide variety of dusts and chemicals that pose potential health hazards. However, data indicate that respiratory protection programs at many sites have inadequacies and workers may be at risk for developing respiratory diseases.

Employers who suspect their respiratory protection program is in need of improvement should consider contacting OSHA's free confidential consultation service available for small businesses in every state. The agency also has a *Small Entity Compliance Guide for the Revised Respiratory Protection Standard* (available at www.osha.gov/Publications/secgrev-current.pdf. ■

Figure 1

Percentage of Establishments Using Respirators to Protect Against the 10 Most Frequently Indicated Subtances



Note. *Adapted from* Respirator Usage in Private Sector Firms, 2001, *by Bureau of Labor Statistics, 2003, Washington, DC: U.S. Department of Labor, Author.*

Respirators are used extensively to protect against a wide variety of hazards. Data indicate that respiratory protection programs at many sites have inadequacies.

PHOTOS COURTESY MSA

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