FEATURE

Respirator use in the chemicals and allied products manufacturing industry

The Bureau of Labor Statistics (BLS) has determined that the chemicals and allied products manufacturing industry (CAP) had 3.5 cases of respiratory conditions per 10,000 full-time workers in 2002, as compared to 2.5 cases for all of private industry. CAP establishments appear to rely on respirators to protect their workers to a greater extent than many other industries. A 2001–2002 survey conducted by the National Institute for Occupational Safety and Health (NIOSH) and the BLS indicated that the CAP had one of the highest rates of required respirator use (36.9% of all CAP establishments used respirators), as compared to other industries (4.5% of all private industry establishments used respirators). The survey found that the most common indicators of potentially inadequate programs within the CAP were lack of written respirator program elements, not performing an assessment of medical fitness to wear respirators, poor respirator training for the respirator program administrators, and inadequate respirator training for employees. Establishments seeking to improve their respirator programs are encouraged to make use of OSHA compliance assistance programs or private consultants.

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BACKGROUND AND METHODS

Inhalation hazards within the chemicals and allied products manufacturing industry (CAP) are made evident by morbidity data reported by the Bureau of Labor Statistics (BLS) for 2002.[1] The BLS data indicate that CAP had an incidence of 3.5 cases of respiratory conditions for every 10,000 full-time workers in 2002, as compared to 2.5 cases for all private industry. For all other illnesses (which include inhalation-related cases), CAP had an incidence of 33.2 cases per 10,000 full-time workers, as compared to 25.2 cases per 10,000 full-time workers for all private industry.

Given the hazards present, CAP employers have appropriately undertaken a number of measures to protect workers, including the use of respirators. In fact, CAP had one of the highest rates of respirator use, according to a survey of private U.S. establishments conducted in 2001–2002 by the NIOSH and the BLS. The survey methods, questionnaire, and findings have been published in printed and electronic formats.[2] The survey report may be obtained by calling 1-800-35NIOSH or online from www.cdc.gov/niosh/docs/respsurv/.

NIOSH and BLS each have long-standing interests related to the survey. The National Personal Protective Technology Laboratory of NIOSH has responsibility for the certification of industrial respirators used in the United States.[3] BLS periodically surveys U.S. employers regarding occupational health, safety, employment, wage, and other statistics.

The BLS/NIOSH respirator survey was conducted by mailing a questionnaire to a representative sample of 40,002 private sector establishments. The survey sample was stratified by Standard Industrial Classification (SIC) and establishment size category (as measured by the number of employees). The CAP is a two-digit SIC (28) within the larger manufacturing division.[4]

Survey questionnaires were mailed in August 2001, and the last survey questionnaires were returned in February 2002. The overall response rate for return of questionnaires was 75.5%. Most of the questions addressed aspects of required respirator use in the 12 months prior to each establishment's completion of the questionnaire. The questionnaire asked respondents about the types of respirators used as well as the manner in which the respirators are used.

Respirator Use — As Required by OSHA

OSHA regulations define the required manner of respirator use.[5] NIOSH certification requirements for respirator design and performance assume that respirators will be used as specified by OSHA regulations.

OSHA requirements for respirator use include the following, among others:

- Provide a written respiratory protection program with worksite specific procedures and elements for required respirator use such as cleaning respirators and evaluating the effectiveness of respirator use.
- Designate a single program administrator to administer or oversee the respiratory protection program and evaluate the program's effectiveness.

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- Assure that the program administrator is qualified by appropriate training or experience.
- Use a method of respirator selection that includes identification and evaluation of airborne hazards in the workplace.
- Provide effective training to employees who are required to use respirators so they understand the need, use, limitations, and capabilities of the respirators they wear.
- Provide a medical evaluation to determine the employee's fitness to use a respirator in the conditions for which they are required, before the employee is fit tested or required to use the respirator in the workplace.
- Provide for fit testing of positive- and negative-pressure tight-fitting respirators on employees who will wear them.
- Ensure that airline respirator hose couplings are *not* compatible with any other gas line couplings used in a given establishment.

FINDINGS

The survey found that CAP had one of the highest rates of respirator use when compared to all other two-digit SICs. Among CAP establishments, 36.9% required respirator use during the 12 months prior to the survey, with 16.6% of CAP employees being required to use respirators. Only the metal mining SIC, at 39.2%, exceeded CAP establishment rate of respirator use. The high rate of respirator use found within the CAP industry is consistent with the nature of the industry, wherein a multiplicity of chemicals presents a potential for workers' exposure. Thus, the survey findings serve to confirm what would otherwise be a "gut" expectation.

For all of private industry, 4.5% of establishments had required respirator use during the 12 months prior to completion of the survey form. That

Table 1. Percent of respirator-using establishments reporting selected indicators of a potentially inadequate respiratory protection program

	Percentage Rates of Indicator Occurrence Among Respirator-Using Establishments (Lower is Better)		
Definition of Indicator	All Industries (Includes Manufacturing)	Manufacturing (Includes CAP[a])	CAP[a,b]
No written change-out schedule for establishments reporting use of air purifying gas/vapor filters	78.1	72.5	52.6
Improper method of setting airflow on airline respirators, or don't know which method is used	77.2	75.5	–
No written procedure for deciding how respirators are used	65.5	51.4	30.9
No written procedures to periodically evaluate the effectives of respirator use, or don't know if such procedures exist	64.3	53.6	38.2
No assessment of the medical fitness of respirator-wearing employees, or don't know if an assessment is done	51.2	40.7	22.0
No written procedures and schedule for maintaining respirators, or don't know if such procedures exist	49.9	42.2	20.7
No fit-testing for wearers of tight-fitting respirators, or don't know if fit-testing is done	43.3	38.1	–
No trained respirator program administrator	41.9	39.4	15.3
No training for employees regarding respirator need, use, limitations, and capabilities	41.4	33.8	11.6
Used dust masks (disposable) to protect against gases or vapors	25.3	20.5	–
Airline respirator couplings are compatible with other gas systems, or don't know about compatibility	23.7	22.6	–
No one assigned to be responsible for directing and overseeing the use of respirators	13.7	9.0	5.1
Didn't know which method, or who was responsible for assessing employees' medical fitness, or didn't know what method was used to fit-test employees	12.1	10.8	2.6
Didn't know if air sampling was conducted for substances for which employees were required to use either air-purifying or air-supplied respirators	4.6	7.6	4.2
Not familiar with traditional respirator terms/language used in at least two of nine questions regarding respirator selection, types of respirators/hazards, and fit-test methods	0.8	0.4	–

[a] CAP: Chemicals and Allied Products Manufacturing Industry. [b] Data denoted by "–" specific to CAP are not available because they do not meet BLS publication guidelines (industry estimates based on reports from fewer than three companies, relative standard error for an estimate exceeded a specified limit, or publication might disclose confidential information).

use involved 3.1% of all private industry employees.

The manufacturing industry division as a whole had more respirator use than most other industry divisions, with 12.8% of manufacturing establishments requiring respirator use during the 12 months prior to the completion of the survey form, and 4.8% of the employees being required to use the respirators.

The most commonly used type of respirator by CAP was the air-purifying respirator, found in 34.8% of all CAP establishments. The percentage of CAP employees using air-purifying respirators (14.8%) was fourth highest among all two-digit SICs. CAP had one of the highest rates of establishments that reported using air-supplied respirators (15.2%), only second to the metal mining industry (16.7%).

As shown in Table 1, the questionnaire responses provided by the establishments often contain indicators of potentially inadequate programs. CAP establishments show lower rates of these indicators than other manufacturing industry establishments and private establishments as a whole. The most common indicators of potentially inadequate programs within CAP were lack of written respirator program elements, not performing an assessment of medical fitness to wear respirators, poor training for the respirator program administrators, and inadequate respirator training for employees.

DISCUSSION

As required by the OSHA regulations,[5] written plans and procedures and respirator training are important to the quality of respirator programs. Properly written programs help assure continuity in respirator decision-making. Likewise, well-trained administrators help assure that respirator programs are operated with good day-to-day decision-making. The provision for medical screening of workers who may be required to use respirators is important because some workers may not be able to accommodate the greater level of exertion required when wearing some respirators.[6]

The relatively high rate of use of air-supplied respirators might prompt some CAP establishments to examine their use of airline respirators. As indicated in Table 1, 22.6% of all manufacturing industry establishments that use airline respirators allowed the use of hose couplings that were compatible with other air and other plant gases or don't know if their airline respirator hose couplings are compatible with other air and other plant gases. This compatibility can lead to an inadvertent connection of the respirator air line to an asphyxiating or poisonous gas such as nitrogen or argon or non-respirable plant air, with potentially fatal results.[7] Airline respirator couplings should *not* be compatible with any other gas line couplings in use in a given establishment.[5]

The relatively high rates of indicators of potential inadequacies (Table 1) suggest widespread systematic defects with respiratory protection programs in the CAP industry as well as other industries. While there is always some potential for occasional misinterpretation of questions, it is unlikely that misinterpretations alone would be so widespread as to result in the rates shown in Table 1. Prior to mailing the questionnaires, the draft questionnaires were cognitively tested by BLS with representatives of establishments ranging in employment levels from small to large. The resulting final questionnaire should be understood by persons moderately familiar with respiratory protection.

The manufacturing industry, to which CAP belongs, had the highest percentage of establishments with respirator use (12.8%) and yet had generally lower percentages of indicators of potentially inadequate respiratory protection programs than all private industry (see Table 1). The CAP industry generally had even lower percentages of indicators than all of Manufacturing. While the prevalence of Table 1 indicators within the CAP industry gives concern, the reasons for these differences between the CAP and the other industries were not determined by the NIOSH-BLS survey. One might speculate, however, that the CAP industry presents a higher potential for worker exposure, thus stimulating more thorough attention to respiratory protection. Clearly, however, there is room for improvement of the respiratory protection within the CAP industry. Establishments seeking to improve their respirator programs can contact any of several sources. The OSHA-funded on-site consultation programs can offer guidance.[8] OSHA also offers small business assistance.[9] And private consultants can provide guidance for program improvement.

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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