

Medical Surveillance Practices of Blue Collar and White Collar Hazardous Waste Workers

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Given the occupational risks of hazardous waste workers, this study was conducted to explore possible differences in medical surveillance practices among blue and white collar workers. Demographic and medical surveillance data were collected from 636 white collar and 206 blue collar trainees, enrolled in health and safety training courses. Overall, 4.5% of the trainees reported being ill or injured because of hazardous substances. Significant differences ($P < .0001$) were noted between groups; blue collar trainees were more likely to have been ill or injured. Differences also existed for medical surveillance enrollment; 32% of the white collar trainees report enrollment compared to 19% of the blue collar trainees ($P = .004$). This study indicates that blue collar trainees are more likely to be injured and less likely to be enrolled in medical surveillance programs. Issues of illness and injury, as well as medical surveillance enrollment, must be addressed; ensuring that all workers receive medical surveillance needed to prevent occupational illness in the hazardous waste field.

Incidents such as the explosions at Union Carbide in Bhopal, India, and the Chemical Control Corporation in Elizabeth, New Jersey, have increased apprehension and awareness over the potential health effects of hazardous waste work. There are an estimated 75,000 hazardous waste dumps and sites in the United States, with 32,000 considered for Superfund designation, yet little is known about actual occupational exposure.¹ Potential health problems are associated with hazardous waste work.² According to the National Institute for Occupational Safety and Health (NIOSH), hazards at sites are a "function of the nature of the site as well as a consequence of the work being performed."³ These hazards may include chemical exposure, fires, oxygen deficiency, and heat stress.³ Of particular concern is the significant risk of heat stress during hazardous waste work.⁴ Given these potential hazards, protecting the worker has become an occupational health concern.

The protection of workers falls under the Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910.120, which requires that workers in hazardous waste removal, containment, or emergency response receive health and safety training.⁵ The health and safety training prescribed covers hazard identification, use of personal protective equipment, safe work practices, as well as medical surveillance. The New Jersey/New York Hazardous Materials Worker Training Center (the Center) was established in 1987 through support from

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The New Jersey/New York Hazardous Materials Worker Training Center members include: the University of Medicine and Dentistry of New Jersey—Robert Wood Johnson Medical School, Hunter College, New Jersey Department of Labor, New Jersey State Police Office of Emergency Management, New Jersey Department of Personnel, New Jersey Department of Health, New York Committee on Occupational Safety and Health, and the State University of New York at Buffalo.

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the National Institute of Environmental Health Sciences (NIEHS) to respond to regional needs under 1910.120 to provide comprehensive health and safety training. Worker health and safety training is typically composed of didactic lectures with a major emphasis on hands-on training. Recently some health and safety programs, including NIEHS hazardous waste programs, have included the concept of empowerment in their training.^{6,7} The Center has taken an empowering approach to its training, educating trainees in health and safety practices as well as raising their awareness of employers' responsibility to maintain a safe work environment. This approach includes educating trainees about the regulations that protect workers, as well as the responsibilities of the employer, such as the provision of a medical surveillance program.

OSHA standard 1910.120, paragraph F, states that all workers who are potentially exposed to hazardous materials are required to be enrolled in medical surveillance programs.⁵ According to Favata et al, hazardous waste workers have a "unique exposure problem"; they are potentially exposed to multiple chemicals, thereby limiting the use of traditional preventive strategies.⁸ As a result, medical surveillance of the hazardous waste worker has become a key preventive strategy.⁹ Another unique aspect of hazardous waste workers is their diversity in the industry.¹⁰ This diversity crosses many demographic characteristics, such as job duty (ie, feasibility studies versus waste transportation), gender, and social class, thereby increasing the complexity of the task of protecting the worker. This study examines possible differences in medical surveillance program compliance among two different groups of trainees, those defined as white collar and blue collar hazardous waste workers.

Methodology

All trainees receiving hazardous materials health and safety training

from the Center complete a scanable registration form. The registration form enables the collection of demographic data as well as specific information pertaining to previous health and safety training and medical surveillance program enrollment. The data analyzed for this study encompass training given from September 1989 through September 1991.

For the purpose of this study, we examined data from two training groups: site workers and site investigators. The New Jersey Department of Labor, the agency responsible for training site workers, targets blue collar laborers needed for the clean-up of hazardous waste sites and provides a 40-hour course. Similarly, site investigators, described as white collar workers, receive 40 hours of training from the University of Medicine and Dentistry of New Jersey and Hunter College specific to the duties of a site investigator, which include feasibility studies and site assessments. The demographic characteristics of the two groups were compared to ensure the terms "blue collar" and "white collar" accurately describe each of the two groups. Additionally, the characteristics were examined to gain a better understanding of the trainees and to effectively target health and safety training toward subgroups within the population.

Employment status was controlled for because medical surveillance is or should be provided by the employer; therefore, trainees who reported being unemployed were excluded from the study. This resulted in a sample size of 206 site workers and 636 site investigators.

Trainees were asked to respond to a series of questions pertaining to medical surveillance on the registration form. All trainees were asked two questions: "Have you ever been ill or injured due to a hazardous substance?" and "Are you enrolled in medical surveillance?" Those who responded yes to enrollment were asked to respond to three additional

items: "Have you had a baseline exam?"; "Were the results of the exam explained to you?"; and "Are you examined annually?"

Statistical analysis was conducted with SPSSPC software.¹¹ The χ^2 statistic was used to identify differences within the nominal variables. Statistical significance is noted with a two-tailed *P* value of $<.05$. The independent variable consisted of the training groups, blue collar and white collar, and the dependent variables were composed of five medical surveillance questions. The groups were also compared by gender, age, ethnicity, education, and job duty.

Results

The demographic variables assessed were gender, age, ethnicity/race, educational level, and job duty; frequency distributions can be found in Table 1. With respect to gender, significant differences existed among the two groups ($P = .003$); 13% of white collar trainees were females, compared to 5% of blue collar trainees. Overall, for both the white and blue collar trainees, the modal age group was 26 to 35 years of age. However, blue collar trainees were significantly younger than white collar trainees ($P = .046$). Seventy-three percent of blue collar trainees were 35 years of age or younger, compared to 64% for white collar trainees (Table 1). The majority of both white and blue collar trainees identified themselves as Caucasian (84% and 76%, respectively). However, blue collar trainees had a larger minority representation, with 17% identifying themselves as African-American or Hispanic, compared to 7% of the white collar trainees ($P = .0004$). Significant differences were also noted in the educational level of the two groups, with 63% of the white collar trainees reporting having a college education or higher, compared to 37% of the blue collar trainees ($P < .0001$).

The majority of the blue collar trainees (48%) identified "waste site

TABLE 1

Demographic Profile of Site Workers and Site Investigators

	Site Worker		Site Investigator		P
	n	(%)	n	(%)	
Gender					
Male	196	(95)	554	(87)	.003
Female	10	(5)	80	(13)	
Age group					
18-25	57	(28)	130	(21)	.046
26-35	90	(45)	266	(43)	
36-45	39	(19)	144	(23)	
46-55	12	(6)	66	(11)	
56+	3	(2)	3	(2)	
Ethnicity					
African American	19	(10)	25	(4)	.0004
Hispanic	15	(7)	17	(3)	
Asian	6	(3)	37	(6)	
Caucasian	154	(76)	505	(84)	
Other	8	(4)	16	(3)	
Education					
Less than high school	26	(13)	18	(3)	<.0001
High school graduate	71	(35)	117	(19)	
Some college/technical	31	(15)	94	(15)	
College graduate	50	(25)	198	(32)	
Some graduate school	7	(4)	74	(12)	
Graduate degree	17	(8)	122	(19)	
Job Duty					
Hazardous waste clean-up	95	(48)	113	(19)	<.0001
Transportation	16	(8)	28	(5)	
Treatment, storage, and disposal	7	(4)	33	(5)	
Site investigation	44	(22)	271	(45)	
Other	36	(18)	152	(26)	

P values were obtained from χ^2 test results.

clean-up" as their primary job duty, and 45% of the white collar worker trainees identified "site investigation" as their primary job duty. Other job duties selected by both groups were waste transportation, RCRA-TSD, and "other" (Table 1).

Table 2 details the results of the five medical surveillance questions. Overall, 4.5% of the trainees reported that they "had been ill or injured due to hazardous substances." A significant relationship ($P < .0001$) was detected between training groups and trainee illness and injury. Two percent of the white collar trainees report illness or injury compared to 15% of the blue collar workers.

Interestingly, given the regulations, only 30% of the sample reported current enrollment in a medical surveillance program. Significant

differences exist among the two groups, with 32% of white collar trainees reporting enrollment in a medical surveillance program compared to 19% of the blue collar trainees ($P = .004$).

The 217 trainees who reported that they were enrolled in medical surveillance answered three additional questions regarding their experience with a medical surveillance program. Eighty-five percent of those enrolled in medical surveillance reported that they had received a baseline exam. Statistical differences ($P = .047$) were found, with white collar trainees more likely to have received a baseline exam (87%) than blue collar trainees (68%).

Eighty-two percent of the trainees reported that the results of the exam were explained to them. Blue collar

trainees were less likely (75%) to report having results explained to them than white collar trainees (83%). Similarly, white collar trainees were more likely to have been examined annually (92%) than blue collar trainees (87%). These results, however, were found not to be statistically significant.

Conclusion

Overall, blue collar trainees in this study were more likely to be younger, less educated, male members of minority ethnic groups and hold laborer-oriented jobs compared to white collar trainees. These demographic differences (see Table 1) are consistent with findings reported by Gochfeld et al on the demography of the hazardous waste industry.¹⁰ The findings of this study indicate that the hazardous waste industry has diverse work groups, with different classes of workers, specifically professionals (ie, white collar) and blue collar.

The results of this study indicate that differences exist for blue and white collar employees regarding medical surveillance practices. Blue collar trainees have a significantly higher frequency of illness or injury due to hazardous substances than white collar trainees, which is understandable given the nature of their work, (ie, coming into direct contact with hazards). However, it is also noted that blue collar trainees are less likely to be protected and monitored through medical surveillance. White collar trainees are significantly more likely to be enrolled in medical surveillance programs than blue collar trainees. These findings raise additional questions as to possible factors influencing the lower blue collar enrollment. Variables such as the effects of turnover and lower literacy rates must receive further inquiry.

Turnover rate may be one explanation for the low rate of medical

TABLE 2

Responses to Medical Surveillance Questions for Site Workers and Site Investigators

	Site Worker		Site Investigator		P
	n	(%)	n	(%)	
Ever ill/injured due to hazardous substance?					
Yes	19	(15)	15	(2)	<.0001
No	111	(85)	603	(98)	
Enrolled in medical surveillance?					
Yes	23	(19)	194	(32)	.004
No	100	(81)	404	(68)	
Have you had a baseline exam?					
Yes	15	(68)	164	(87)	.047
No	7	(32)	25	(13)	
Were the results explained to you?					
Yes	15	(75)	140	(83)	NS
No	5	(25)	29	(17)	
Are you examined annually?					
Yes	20	(87)	157	(92)	NS
No	3	(13)	13	(8)	

P values were obtained from χ^2 test results.

NS, not significant.

surveillance enrollment among blue collar trainees, in that the group is more transient than white collar trainees. The hazardous waste industry, due in part to its growth, has a high turnover in personnel, especially among blue collar workers.¹⁰ Preliminary Center studies indicated that aging trends may exist, with blue collar cohorts remaining young over time, while other cohorts are aging. This may in fact mean that blue collar workers are not staying on the job long enough to become enrolled in medical surveillance programs. Additionally, companies may be discouraged from enrolling their employees in programs because of lost revenue due to high turnover.

In fact, economically, businesses may be "encouraged" to hire short-term employees. Short-term employees may exempt businesses from the responsibility of providing medical surveillance under OSHA's standard 30-day trigger, which requires 30 days of exposure each year for inclusion in a program.¹² Gochfeld et al point out that high turnover has significant consequences for medical surveillance programs. A blue collar worker is less likely to be employed

by the same employer for two consecutive medical examinations, which results in incomplete medical records and thereby undermines the medical surveillance concept of longitudinal monitoring.¹⁰

The results of this study also raise the concern of possible literacy bias. The effects of low literacy rates may effect the outcomes of questions asked about illness, injury, and medical surveillance. Currently trainees are asked about these issues upon registration prior to the initial 40-hour training and in fact may not understand the terms used (such as "medical surveillance"). This concern was raised by Wallerstein when she noted that 20% of the U.S. workforce faces some degree of illiteracy. It is estimated that 23 million read below a fourth-grade level and 40 million read between a fourth and eighth grade level.¹³ One possible intervention strategy to collect more accurate information about medical surveillance enrollment would be to pose the questions after training. This would enable the trainees to understand the terminology. Additional questions should be adapted to inquire if trainees understand the questions.

Other questions should be asked of trainees, such as: "How long have you been employed at this job?" and "How long have you worked in this field?" This information would allow for more in-depth analysis of the turnover rate of blue collar workers and its effect on enrollment. As noted above, if the turnover rate of workers is a significant issue, and the data in this study indicate that the trend may exist, then perhaps a hazardous waste worker tracking system could be initiated. Gochfeld and Favata note the high turnover rate of workers in hazardous waste and suggest that a national database be maintained by NIOSH in order to track workers.¹⁴

Training must reemphasize assertiveness for inquiring about as well as acquiring medical surveillance. "Empowerment" and "assertiveness," terms used quite frequently in the 1960s and 1970s and less in the 1980s, are reemerging. These terms are important in the training of hazardous waste workers. It is especially important to develop educational techniques specific to blue collar trainees since they are reporting a higher incidence of illness and injury and are potentially exposed more often. Specific training must be developed to enhance their understanding of protective requirements covered under the law. In accordance with training, the identification and importance of being seen by occupational medical professionals must be reinforced. Trainees should be provided with resource information to lead them to professionals within occupational medicine.

In conclusion: the results of this study indicate that blue collar trainees are more likely to be injured and less likely to be monitored by medical surveillance programs. This finding raises important implications. A difference exists between two different groups of trainees within the same industry, and this gap must be addressed by training centers, indus-

try and regulatory agencies. Training centers must develop better methods of educating workers in medical surveillance procedures, such as asking additional questions at more appropriate times to ensure worker understanding of the concepts and terminology of medical surveillance and occupational health. The hazardous waste industry must be accountable for its role in protecting the worker through medical surveillance. Regulatory agencies' responsibilities must include a reemphasis on enforcement of health and safety practices of the hazardous waste industry, as well as the initiation of a national database to track these workers, possibly through mandated refresher training. Additionally, such recommendations are consistent with approaches outlined by Pollack et al for the prevention of occupational illness and injury, which include: education, data collection, and regulation and enforcement.¹⁵ This three-pronged approach could provide the foundation for ensuring that workers, especially blue collar workers, receive the medical surveillance needed to prevent occupational illness in the hazardous waste field.

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The Armonica

Among the several Ben Franklin inventions displayed in the underground museum at Franklin Court [in Philadelphia] is a strange looking contraption called an Armonica.

Ben Franklin . . . decided to improve upon the popular 18th-century pastime of playing liquid-filled, stemmed glasses. In 1762 he invented the Armonica by replacing the stemmed glasses with 37 blown lead-glass hemispheres, ranging from 9 to 3 inches in diameter and strung on their sides along an iron spindle. A foot treadle attached to the spindle was used to revolve the bowls of the three-octave instrument. The Armonica was played with moistened fingertips. With a slight touch of the finger, the tones were swelled or softened.

While working on the Armonica, Franklin kept the instrument concealed from his wife until it was ready to play. He surprised her by playing it one night while she was asleep. Awakened and somewhat startled, she thought it the music of angels.

The Armonica became extremely popular during the late 18th century—Beethoven and Mozart wrote music for it—but it went out of vogue by 1800. This may have been due to the belief that players could become crazed from too much stimulation of their fingertips.

From the Staff of Independence National Historical Park, in the *Philadelphia Inquirer* Magazine, March 20, 1994, p 8.