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NIOSH INVESTIGATORS:
Teresa M. Buchta, M.S.
Steve Short, D.O.

I. Summary

In October 1991, an authorized representative of the Retail, Wholesale, and Department Store Union requested a health hazard evaluation (HHE) at Fairmont General Hospital in Fairmont, West Virginia. The National Institute for Occupational Safety and Health (NIOSH) was asked to evaluate the chemical exposures in the dietary and housekeeping departments because of worker complaints of dermatitis, allergic reactions, and respiratory problems.

Between February and December 1992, NIOSH investigators made eight visits to the facility to conduct environmental and/or medical evaluations. The medical evaluation included confidential interviews with workers who had experienced skin and/or respiratory complaints, written questionnaires, medical record reviews, dermatological examinations, spirometry, and peak flow monitoring. The industrial hygiene assessment included a review of the material safety data sheets (MSDSs) and hazard communication program, walk-through inspection, and collection of bulk samples of frequently used cleaning supplies for laboratory analysis.

Interviews and questionnaires indicated that the workers associated respiratory and skin problems with the worksite. Based on the results from the spirometry testing, two individuals had cross-shift decreases in forced expiratory volume in one second (FEV1), which suggested a work-related effect. Upon further evaluation, the abnormal findings in each participant were attributed to either underlying abnormal lung function (chronic obstructive pulmonary disease), or asthma. The results from the dermatological examination indicated that two employees had a history of chronic urticaria (hives), four others had irritant dermatitis, and five had contact dermatitis. One of these individuals had contact dermatitis of the eye-lids, whereas the other four had contact dermatitis which was related to the use of latex gloves.

During the environmental investigation, a number of safety hazards including inappropriate personal protective equipment and apparent failure to meet the Occupational Safety and Health Administration (OSHA) hazard communication requirements were noted. The analysis of the bulk samples indicate that the composition of the solutions were consistent with their respective MSDS, except in one case. The results of this sample revealed that the cleaning solution contained one or more iodine compounds that were not listed on the MSDS.

Data collected during this investigation indicate that a health hazard did exist. Workers were being exposed to the Servicemaster® cleaning supplies through the use of inappropriate personal protective clothing and work practices. Recommendations were made to improve health and safety conditions by establishing a committee with the responsibility and authority to develop and implement a written health and safety program, including a comprehensive hazard communication program. This and other recommendations are discussed in Section VII of this report.

KEYWORDS: SIC 8062 (General Medical and Surgical Hospitals), dermatitis, respiratory problems, spirometry, belt spirometer, cleaning supplies, gloves.

II. Introduction

On October 2, 1991, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from an authorized representative from the Retail, Wholesale, and Department Store Union (RWDSU) at Fairmont General Hospital (FGH) in Fairmont, West Virginia. The union representative requested an evaluation of exposures to chemicals in the Servicemaster® cleaning supplies used by the dietary and housekeeping staff because of worker complaints of dermatitis, allergic reactions, and respiratory distress thought to be associated with exposures to these materials. On February 3, 1992, NIOSH investigators conducted a walk-through survey of the facility; additional follow-up visits were made (March 19, April 24 and 27, September 22, October 2, and December 14 and 21, 1992) to perform environmental and/or medical evaluations. Interim reports were distributed to FGH on March 5, and September 4, 1992 describing the evaluation techniques, initial results of the first phase of the medical testing, and preliminary recommendations. Workers who participated in the NIOSH medical testing were notified of the individual results by letter in January 1993.

III. Facility Description and Background

FGH is a 268-bed facility built in 1972. There are a total of 822 hospital employees working over three shifts. Of these 822 employees, 97 are union members working in either housekeeping or dietary.

Since 1983, the hospital contracted with The Servicemaster® Company to provide the cleaning supplies used by the housekeeping and dietary staff. As part of this service contract, The Servicemaster® Company controlled which products were brought into the hospital and also provided a supervisory staff to oversee the use of these products.

The majority of Servicemaster® cleaning chemicals were stored on either the fifth floor or basement. Although there were a number of different cleaning chemicals used at this facility, the most frequently used cleaning solutions contained small quantities of quaternary ammonium chloride, ethanolamine, iodine, nonylphenoxy(ethyleneoxy)ethanol, and phosphoric acid. One specific housekeeper was responsible for the dilution of the cleaning chemicals. This worker added concentrated cleaning product to water until the desired color was achieved. After dilution, the cleaning solutions were poured into small spray bottles, which the housekeeping staff used throughout the shift. Surgical latex gloves were the only personal protective clothing worn during the dilution and application of these cleaning compounds.

In the dietary section, most of the kitchen equipment and utensils were cleaned in dishwashing machines, although large kitchen items were manually washed. At the time of the initial survey, the food disposal and the metering devices for the detergent and sanitizing agents on the sinks were not operating. Therefore, the worker was required to pour an unmeasured amount of detergent or sanitizer into a sink filled with water. Despite the fact that the nature of the work required immersion of hands and forearms into a sink filled with the chemical solution, wrist length latex gloves were the only protective clothing worn. On July 1, 1992, the cleaning supply contract was awarded to another company.

IV. Evaluation Criteria and Literature Review

Occupational Dermatitis

Despite numerous protective mechanisms, the skin is particularly vulnerable to environmental injuries and diseases. Over the last decade, skin diseases have accounted for a disproportionately large percentage of all occupational illnesses, ranging from 24% to 37%.[1] The service industry, which includes such occupations as food service and hospital workers, has the highest number of identified cases of dermatological conditions.[2]

Dermatological conditions other than injuries are usually the result from more sustained or cumulative exposures and usually involve long intervals between exposure and occurrence of disease. These conditions include contact dermatitis, infection, acne, and skin cancer. Contact dermatitis makes up the vast majority (93.8%) of all occupational skin disease (OSD), occurring most often (88%) on the hands.[3] Occupational dermatoses may be produced either by irritant or by allergic contact sensitivity reactions. Irritants alter the chemistry of the skin. This alteration may cause itching, redness, inflammation, discomfort due to dryness, and pain related to fissures and ulcers. Quaternary ammonium salts, ethanol, ethanolamine, phosphoric acid, and iodine are all skin irritants.[4] Certain irritants may also act as sensitizers. Initial skin contact with the substance may not produce irritation, but after repeated or extended exposure some people may develop an allergic reaction termed allergic contact dermatitis.[5] Approximately 80% of occupational contact dermatitis cases are due to nonimmunologic irritant contact dermatitis, whereas 20% are attributable to allergic etiologies.[3] In one study of hospital workers, hand dermatitis was most common in housekeepers and kitchen workers. Nurses reporting hand dermatitis were largely found among those who worked in the operating room.[6] Frequent causes of work-related irritant contact dermatitis are water, soaps, and detergents, emphasizing the fact that "wet work" (dishwashing and cleaning), can be extremely irritating. Also, occlusion of a substance against the skin, such as a chemical trapped beneath a glove, combined with frictional forces can accelerate cutaneous absorption of a compound.[7]

Rubber glove reactions are becoming more common as health care workers try to institute precautions against infectious disease. Although non-specific irritant reactions from sweat entrapment and friction occur most frequently, hospital personnel may experience rubber glove allergy. This allergy may present as patches of dermatitis on the back of the hand, with a sharp cutoff at the wrist. Irritation of other body parts may also occur if contact is made once a glove is removed.[8]

Occupational Asthma

Asthma is a disease characterized by intermittent respiratory symptoms (shortness of breath, chest tightness, wheezing, and cough) and reversible or variable airflow obstruction.[9] Occupational asthma is characterized by variable airflow obstruction, related to exposure in the workplace environment to airborne dusts, gases, vapors, and fumes.[10] Affected persons are frequently asymptomatic for prolonged periods, except when exposed to a specific sensitizing agent. Variable airflow obstruction can be documented by cross-shift or periodic pulmonary function testing.

Spirometric indices are determined through the use of the forced expiratory maneuver. During this maneuver, a person inhales maximally to total lung capacity and subsequently exhales as rapidly and forcefully as possible. The volume of air exhaled is the forced vital capacity (FVC), and the volume of air exhaled in the first second is the forced expiratory volume (FEV1).

Cross-shift spirometry is performed prior to and after a work-shift to determine variability in airflow, which may suggest an immediate asthmatic reaction as a result of a workplace exposure. Cross-shift spirometry may detect early changes of pulmonary function in individual workers, thereby identifying possible cases of occupationally related airways disease. A decrease in cross-shift spirometry of 10% or more represents a degree of variability which would suggest an asthmatic reaction. Some exposures do not cause an immediate cross-shift response, but instead cause a delayed response in airflow, occurring after the worker is away from the worksite.

Peak Flow Determination

Peak expiratory flow has been used to identify and monitor workers who have developed airway variability in the workplace.[11] Workers who experience airway variability in their pulmonary function have decreased ability to exhale a maximum breath after exposure to an irritating or sensitizing environmental exposure. The utility of peak flow lies in its use as a portable measurement device allowing self-monitoring of pulmonary function both at work and away from the worksite. This allows the identification of acute, as well as delayed changes in airflow. The most important limitation in its use is that it is a highly effort-dependent maneuver, and depends on the tested person's cooperation and adequate effort to obtain a valid maneuver. Effort relatedness can be determined by looking at the tracing of a flow-volume curve. If inadequate effort is provided, the flow-volume tracing will not show a sharp initial peak, which is characteristic of a good tracing.

V. Evaluation Procedures

In order to evaluate reported health problems and potential occupational hazards, a series of medical and environmental investigations were performed. The medical component included interviews, written questionnaires, medical record reviews, dermatological examinations, spirometry, and portable peak flow monitoring. The environmental assessment included a review of the material safety data sheet (MSDS) and hazard communication program and collection and analysis of bulk samples. The procedures used are described in detail in the following sections.

A. Medical Investigation

Interviews

During the initial survey, NIOSH investigators interviewed nine employees working in housekeeping and dietary who had complaints of skin and/or respiratory problems. The union representative selected the employees who were interviewed. The employees reported that the onset of the complaints occurred in July or August 1991.

Based on these interviews, a decision was made to perform further medical evaluations of the workers. On April 24 and April 27, 1992, questionnaires were administered and/or spirometry was performed on 78 employees who worked in the housekeeping and dietary areas. Twenty-five of the 78 (32%) employees who participated in the study indicated that these days corresponded to the "last" and "first" working day of the work week.

Questionnaire

A standardized respiratory questionnaire (attached) was administered by a NIOSH employee. Demographic information, job title, work area, and smoking status were obtained. Additional questions were asked as to the occupational exposures that causes respiratory and dermatological irritation.

Spirometry

At least one spirometry session was completed by 76 participants. FEV1 and FVC were measured with an Ohio Medical Model 822 dry rolling seal spirometer attached to a Spirotech 200B dedicated computer. Equipment and test procedures conformed to the American Thoracic Society (ATS) standards for screening spirometry.[12] Predicted values for FEV1 and FVC were calculated using the equations of Knudson; these values were multiplied by 0.85 to obtain the predicted values for blacks.[13,14]

A total of at least five spirometry maneuvers for each participant was performed following the ATS guidelines for reproducibility and quality control. The largest FEV1 and FVC from all the trials for that session were used to calculate the individual's airflow characteristics.

Test results were compared to the 95th percentile lower limit of normal (LLN), for each spirometric parameter (five percent of the population will have a value that falls below the LLN, while 95% will have results above the lower limit).

For purposes of categorizing individual results, the following definitions were used:

Obstruction: observed ratio of FEV1/FVC% below the LLN

Restriction: observed FVC below the LLN, with FEV1/FVC% above the LLN

If both the FEV1/FVC% and FVC% were below the LLN, then a combined restrictive and obstructive process was identified. The following criteria was used to determine the level of severity for obstruction and restriction as assessed by spirometry:

Interpretation	Obstruction (FEV1/FVC*100)	Restriction (% Predicted FVC)
Normal	≥ 70	≥ 80
Mild	60 to 69	65 to 79
Moderate	45 to 59	50 to 64
Severe	< 45	< 49

Peak Flow Monitoring

Periodic peak flow monitoring was performed using a portable belt spirometer which workers used both at the worksite and at home. This device measured the peak flow, as well as the total spirometry maneuver (FEV1, FVC, FEV1/FVC, and flow-volume curve) throughout the day. The participants provided three forced vital capacity maneuvers every two hours while awake for an 8-day period including two days away from work. All participants kept logs of symptoms and activities both at work and at home throughout the testing period.

Dermatological Exam

Workers experiencing skin conditions were examined by a contract physician specializing in dermatology. A written report of the findings was provided to NIOSH detailing the different dermatologic conditions identified and the possible relationship of these findings to occupational exposures.

B. Environmental Investigation

The environmental evaluation focused primarily on a review of the MSDSs and hazard communication, assessment of the industrial hygiene and safety conditions, and collection and analysis of the bulk samples.

Bulk Samples

Since the union representative was concerned with the accuracy of the contents listed on the MSDSs, seven bulk samples of the most frequently used Servicemaster® cleaning supplies were collected by transferring 100 milliliters of solution into a clean plastic or glass vial and were submitted for qualitative analysis to verify the presence of the volatile organic compounds listed in the MSDSs. A portion of each of the samples was extracted with methylene chloride and analyzed by gas chromatography-mass spectrometry (GC-MS).

VI. Results and Discussion

A. Medical

Interviews

Eight of the nine employees initially interviewed were female. Five dietary workers reported having at least one of the following conditions: rash, redness of skin, itching, dryness of skin, a welt, or "hives." Of these five workers, one person had consulted a number of physicians. One dietary employee reported both itching and a "breathing problem." Three workers from three different departments reported respiratory complaints only. Of these three employees, one is a nurse's aide and performs escort service duties, one is a nutrition care assistant whose duties include delivering food trays to patients' rooms, and the other is a housekeeper. Two of these three workers had seen a number of physicians, and one person was diagnosed as having asthma.

In the dietary department, no single product was identified as possibly being the source of the adverse health effects. Three workers with respiratory complaints all identified a liquid spray deodorant used in the patients' rooms as possibly creating or exacerbating their breathing problem. The MSDS sheet did not identify any hazardous substances or respiratory irritants. Also, two of these three workers complained of breathing difficulties when using a cleaning product which contained (according to the MSDS) less than 10% of quaternary ammonium chloride and ethanol. For every one ounce of this product, it should be diluted with one gallon of cold water. One of the three workers also identified a cleaner which contained 10-20% of ethanolamine as causing a "problem." Again, this percentage is based on the concentrated form of the chemical as listed on the MSDS. According to the directions, four to 12 ounces of this product should be mixed with a gallon of water.

Screening Questionnaires

Demographics

Seventy-eight employees completed the administered questionnaire; 53 were female (68%). The participants' ages ranged from 18 to 69 (median age was 44). There were 33 current smokers (42%), 10 former smokers (13%), and 35 who had never smoked (45%). The pack-years were calculated using the number of packs of cigarettes smoked per day multiplied by the number of years smoked. The current smokers and former smokers had an average of 16 pack-years of smoking.

Employment Status

Sixty-one of the participants (78%) worked the day (started work between 5:00 a.m. to 10:00 a.m.) shift, 15 (19%) worked the afternoon (started work between 1:00 p.m. to 5:00 p.m.) shift, and two reported that they worked both shifts.

Each participant's tenure was calculated by subtracting their date of hire from their interview date. Because information on breaks in service was not collected, tenure will be overestimated in anyone who was not continuously employed. The participants' tenure was quite varied: eight employees (10%) had worked less than six months, and an equal number had worked more than 20 years. The median tenure of this group was 10 years.

Symptoms

Table 1 presents the prevalence of reported symptoms and cigarette smoking history. Six participants reported attacks of shortness of breath with wheeze. Three experienced this symptom prior to starting work, two reported experiencing this symptom after starting work, and one did not provide information about when the symptom first appeared.

Additional questions were asked to determine the work-relatedness of reported chest tightness and dermatitis. Responses to these questions seem to indicate a link in some participants between the worksite and these two symptoms. Of the 26 workers who reported chest tightness, 10 stated that the chest tightness first appeared after they entered the worksite. Skin conditions improved or cleared up when workers were away from their jobs (e.g., sick leave, vacation, weekends) in 31 of the 34 participants who reported symptoms of dermatitis during the previous 12 months (Refer to Tables 2 and 3).

Spirometry

Pre- and post-shift spirometry were offered to all 78 employees who participated on Friday, April 24, 1992, and Monday, April 27, 1992. At least one spirometry session was completed by 76 of the participants (97%). Thirty-five of the workers (45%) participated in all four spirometry sessions. A spirometric evaluation over a work shift, including pre- and post-shift sessions on either Friday or Monday, was

obtained for 72 (92%) of the participants. Due to rotating shift work, only 25 individuals (32%) were evaluated on the "first" and "last" days of their work week. Only these participants can be evaluated for lung function improvement while they were away from work over the weekend. This allowed the evaluation of pulmonary function changes at the worksite, in a cross-shift and cross-week analysis.

Baseline Spirometry

Eleven individuals had abnormal baseline spirometry results. A mild restrictive pattern was found in one individual (a former cigarette smoker who recently had lung surgery).

Of the 10 workers with obstructive changes noted on their spirometry, there were seven women and three men. Six of the 10 had a mild pattern, three had a moderate pattern, and one had a severe pattern. Of these 10, eight were current cigarette smokers, one was a former smoker, and one had never smoked. The median age of the individuals with obstructive patterns was 55 years old, with a median of 21.3 pack-years of cigarette use, compared to 65 workers with normal spirometry, having a median age of 41 and a median of 16 pack-years of cigarette use. Eight of the 10 persons with obstruction stated they had received a diagnosis of at least one of the following lung conditions: (1) chronic bronchitis, (2) emphysema, (3) asthma, or (4) another lung problem not previously mentioned. The non-smoker had mild obstruction with a history of asthma for 23 years (Refer to Table 4).

Cross Shift Spirometry

Three of the 72 participants (4%) experienced a change of greater than or equal to 10% in FEV1 over their work shift. Two of the three also had abnormal baseline spirometry results indicating obstructive changes.

One of the individuals with cross-shift changes in FEV1 was a housekeeper who had never smoked and had adult onset asthma. This employee described chest tightness and dermatitis when exposed to Wallglide™ and Sanimaster III™ cleaning products. Another smoked a total of 26 pack-years, experienced chest tightness on Mondays, and listed problems with dermatitis while in the kitchen. This "float" employee performed various jobs at the facility (kitchen, housekeeping, and laundry) and had been employed less than one year. The other employee with cross-shift variability, smoked a total of 28 pack-years, experienced chest tight before entering, after entering, and after leaving the worksite. This employee described severe dyspnea (having to stop for breath when walking at own pace on level ground). This employee had severe obstruction with an underlying diagnosis of emphysema.

Weekend Improvement Spirometry

Twenty-five individuals had sufficient spirometry data to evaluate if there was any lung volume improvement over a two-day weekend. One of these participants showed a marked increase in FEV1 from Friday p.m. to Monday a.m., and the baseline spirometry revealed that this individual also has a severe obstructive pattern.

Belt Spirometry

Portable belt spirometry results were obtained from five individuals who had cross-shift changes in spirometry, or had described work-related respiratory symptoms in the questionnaire which was suggestive of having airway variability related to the work-site. Each participant's portable belt spirometry readings were compared to their initial spirometry results (performed four to seven months previously). All participants provided three reproducible efforts, and had results that were similar to those obtained while being coached by a NIOSH technician in April, 1992.

Three individuals had tracings on the belt spirometer that suggested variability in airflow; however, the portable spirometry results revealed no trends of work-related pulmonary function impairment. Of the two participants who experienced initial cross-shift changes in pulmonary function, one was found to have no variability in airflow when tracings of pulmonary function were followed at work and away from work. The variability of airflow initially detected was related to submaximal efforts in the maneuvers, which were noted in the tracings obtained in the portable maneuver. The second employee who had variability of airflow on the initial exam was found to have variability of airflow by further testing with the portable spirometer. This airflow variability was associated with occupational and non-occupational exposure, which is consistent with asthma of non-occupational origin. The third employee who was initially identified as having cross-shift changes, was unable to undergo further testing, due to the severity of the emphysema.

Dermatology

Fourteen employees were examined by the dermatologist. The results of the examination indicated that four workers had irritant dermatitis, and five others had allergic contact dermatitis (four of which were related to exposure to latex or rubber gloves). One individual had contact dermatitis of the eye lids. All of these work-related skin conditions appeared to be caused by workplace chemicals or gloves. Two participants had possible urticaria by history, with no lesions at the time of exam, and three others had other skin lesions; tinea (fungal infection), sun reaction (poikiloderma civatte), and localized chronic eczema (lichen simplex chronicus); however, these conditions were not related to occupational exposures.

B. Environmental

Bulk Samples

The analysis of the bulk samples indicate that the composition of the solutions were consistent with their respective MSDS, except for the KitchenBrite™ Pan Sanitizer. The results of this sample revealed that it contained iodine compounds, although the MSDS did not list any hazardous substances. During the initial site visit, it was noted that the MSDS and the label on the KitchenBrite™ Pan Sanitizer did not state the same contents. The label indicated that the solution contained an iodine complex, and the analysis of the bulk sample confirmed this fact.

Hazard Communication Program

The hazard communication program was evaluated. The hospital was deficient in following areas:

(a) there was no written program,

(b) some of the chemical containers in the storage areas were not properly labeled,

(c) the MSDSs were not easily accessible by the employees,

(d) the workers were also not trained in the hazards of the chemicals which they were using or the appropriate protective clothing which should be worn.

VII. Conclusions and Recommendations

This investigation was designed to determine whether workers had respiratory or dermatological effects related to exposures at the worksite. Questionnaires, and pulmonary function testing did not reveal specific respiratory disorders related to the work environment. However, cases of dermatitis (both allergic and irritant induced) apparently related to the workplace chemicals and gloves were identified.

Various social dynamics have created a "toxicologic-hysteria dichotomy"[15] between the previous contractor for the housekeeping department, the union, and the management of the facility. The problem is posed as being either that there is a toxic exposure responsible for the symptoms or the employees are "hysterical."[16,17] Workers in this situation continually press for more investigations to prove whether the building is safe. It is not unusual to have several investigations of the building over time. Employees believe the building is unsafe and are concerned because they must work inside the building without any reasonable avenue of escape. Even employees who have no health complaints or physiological signs of anxiety can develop significant concern about the building.[12] In this investigation, medical complaints focused on dermatological concerns and respiratory irritation. The use of latex gloves, combined with the common use of irritant chemicals in the housekeeping and dietary departments, has apparently resulted in cases of dermatitis.

Respiratory irritation can result from many of the same chemicals that cause dermatological irritation. Some of the workers evaluated had impaired pulmonary function. With exposure to respiratory irritants, or with an increased demand placed on the ventilatory requirements, workers may experience respiratory distress.

Based on the data available from the initial questionnaire and spirometry, there were two individuals with cross-shift variability which suggested a work-related responsiveness to the airways. Other individuals had symptoms and histories of possible airway variability at work but had no such changes on spirometry. No exposures were identified that could account for the widespread symptoms that have been reported by the workers.

With further investigation, a number of workers did show abnormal variability in airflow detected by monitoring airway function every two hours for eight days both at work and at home. However, the airflow limitation in these workers was not temporally related to work. Although the medical findings do not indicate a respiratory health hazard, there are specific recommendations regarding general safety and chemical exposures which are presented below.

1) According to OSHA Title 29, Code of Federal Regulation 1910.1200, the hospital is required to transmit all information regarding the hazards of the chemicals used at this facility to the employees. This can be accomplished by means of a comprehensive hazard communication program, which includes a written program, labeling of containers, distribution of accurate and updated MSDSs, and employee training regarding the hazards of chemicals and protective measures which should be taken. Employee training should include identifying the physical and health hazards of the chemicals in the work area, the measures employees can take to protect themselves from these hazards, an explanation of both the labeling system and MSDSs, and how the employees can obtain and use this information. This program may be included as part of the contractual agreement with the cleaning supply contractor, but ultimately it is the hospital who is responsible for the effectiveness of this program.

2) Qualitative analysis verified that one of the samples contained compounds which were listed on label, but not on the MSDS. According to OSHA [29 CFR 1910.1200(d)],[18] The Servicemaster® Company is required to assess the hazards of the chemicals which they produce and to distribute accurate hazard information to the employer.

3) Appropriate protective clothing can almost always prevent dermatitis by blocking the chemical contact with the skin. Wrist-length latex surgical gloves do not provide sufficient protection against the cleaning compounds used by the housekeeping and dietary staff. Either nitrile butyl rubber or neoprene gloves and aprons should be required to protect the worker against chemical exposures at this facility. As part of the hazard communication program, the employees should be trained on the specific type of glove and apron which should be worn for specific chemical usage. This information can be found in the MSDSs.[13] Also, the glove should cover the entire portion of the hand/arm which is exposed to the cleaning solution. Chemical goggles should be worn to prevent splashes into the eyes. Safety equipment, such as eye washes and showers, should also be installed and maintained.

4) The current method of using a visual assessment to mix the cleaning solutions is inaccurate and may lead to improper dilutions. Potentially, this may result in an increased exposure of workers to solutions with a high concentrate to water ratio. The workers mixing the cleaning solutions should adhere to the manufacturer's specifications.

5) Spray bottles should not be used to apply the cleaners, as this creates a mist that can be inhaled and may cause irritation to the respiratory system, a particular hazard to individuals with asthma or with hyperreactive airways. Frequently, irritating agents which may have little or no effect in healthy people can precipitate episodes of airway obstruction in these workers.[19]

6) As a prudent practice, a safety and health committee should be formed, and should consist of (but not necessarily be limited to) representatives of the infection control committee, the employee health group, the employees, the union, and the management. This committee should play an active role in deciding which chemicals are allowed on-site. The committee should evaluate why and how the product will be used, along with the potential hazards associated with the product. Also, the committee should re-evaluate use of any product believed to cause adverse health effects in workers using the product. If appropriate, less toxic chemicals should be substituted.

7) As a food service facility, the hospital is required to abide by the regulations set forth by the West Virginia State Board of Health. Equipment, such as the food disposal and metering devices for cleaning solutions on the sinks, should be repaired and properly maintained. Also, floor trapped drains should be filled with water, instead of covered with plastic.

VIII. Authorship and Acknowledgements

Report Prepared By:

Teresa M. Buchta, M.S.
Industrial Hygienist
Industrial Hygiene Section

Steve Short, D.O.
Medical Officer
Medical Section

Field Assistance By:

Beth Knutti
Medical Officer
Medical Section

Originating Office: Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies

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1. Fairmont General Hospital
2. Retail, Wholesale, and Department Store Union
3. The Servicemaster® Company
4. OSHA Region III

X. References

1. Bureau of Labor Statistics [1991]. Occupational injuries and illnesses in the United States by industry. Washington, DC: U.S. Department of Labor, 1988, Bulletin 2366.

2. NIOSH, The Association of Schools of Public Health [1988]. Proposed national strategies for the prevention of leading work-related diseases and injuries: dermatologic conditions. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health Publication No. 89-136.

3. Emmett E [1987]. Occupational dermatoses. In Fitzpatrick TB, Eisen AZ, Wolff K, et al (eds). Dermatology in General Medicine, 3rd ed, vol 1. New York: McGraw-Hill, pp 1567-1575.

4. Proctor NH, Hughes JP [1991]. Chemical hazards of the workplace, 3rd edition. New York: Van Norstrand Reinhold.

5. Levy BS, Wegman DH [1983]. Occupational health recognizing and preventing work-related disease, 2nd ed. Boston, MA: Little, Brown, and Company.

6. Lammintausta K, Kalimo K, Aantaa S [1982]. Course of hand dermatitis in hospital workers. Contact Dermatitis 327-332.

7. Lammintausta K, Maiback HI [1990]. Contact dermatitis due to irritation. In Adams RM (ed): Occupational Skin Disease, 2nd ed. Philadelphia, PA: WB Saunders, pp 1-25.

8. Stewart LA [1992]. Occupational contact dermatitis. Immunology and Allergy Clinics of North America *12*:(4)831-846, November.

9. Balmes JR [1991]. Surveillance for occupational asthma. Occupational Medicine: State of the Art Reviews *6*:(1)101-110, January-March.

10. Newman-Taylor AJ [1980] Occupational asthma. Thorax *35*:241-245.

11. Burge PS, O'Brien IM, Harries MG [1979]. Peak flow rate records in the diagnosis of occupational asthma due to colophony. Thorax *34*:308-316.

12. American Thoracic Society [1987]. Standardization of Spirometry-1987 update. Am Rev Resp Dis *136*:1285-1298.

13. Knudson RJ, Lebowitz MD, Holberg CJ, Burrows B [1983]. Changes in the normal maximal expiratory flow-volume curve with growth and aging. American Review of Respiratory Disease *127*:725-734.

14. American Thoracic Society [1991]. Lung Function Testing: Selection of reference values and interpretative strategies. Am Rev Resp Dis *144*:1202-1218.

15. Baker DB [1989]. Social and Organizational Factors in Office Building-Associated Illness. Occupational Medicine: State of the Art Reviews *4*:(4)617.

16. Messite J, Baker DB [1984]. Occupational health problems-a mixed bag. In Cohen BGF (ed): Human Aspects in Office Automation. Amsterdam, Elsevier, pp 7-14.

17. Baker DB [1989]. Social and organizational factors in office building-associated illness. Occupational Medicine: State of the Art Reviews *4*:(4)607-624, October-December.

18. OSHA [1991]. OSHA safety and health standards. 29 CFR 1910. U.S. Governmental Printing Office. Washington, D.C: Occupational Safety and Health Administration.

19. NIOSH [1986]. Occupational respiratory diseases. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS Publication No. 86-102.

Table 1
Symptoms by Smoking History
Fairmont General Hospital
Fairmont, West Virginia
HETA 92-004

Symptom	Current Total = 33		Former Total = 10		Never Total = 35		Total Total = 78	
	Number	%	Number	%	Number	%	Number	%
Chronic Cough	10	30	1	10	7	20	18	23
Chronic Phlegm	10	30	0	0	4	11	14	18
Exertional Dyspnea	6	18	1	10	5	14	12	15
Work-related Chest Tightness	3	9	2	20	5	14	10	13
Attacks of Shortness of Breath with Wheeze	3	9	0	0	3	9	6	8
Non-seasonal Rhinitis	3	9	0	0	3	9	6	8

Table 2
Symptoms Reported by Work Areas
Fairmont General Hospital
Fairmont, West Virginia
HETA 92-004

Work Area and (Number of Employees)	Chronic Cough	Chronic Phlegm	Dyspnea	Chest Tightness	Attacks of Shortness of Breath & Wheeze	Rhinitis	Dermatitis Symptoms
Housekeeping (20)	5 (25%)	6 (30%)	4 (20%)	10 (50%)	3 (15%)	1 (5%)	7 (35%)
Kitchen (15)	1 (7%)	1 (7%)	1 (7%)	5 (33%)	0 (0%)	0 (0%)	7 (47%)
Dietary (12)	3 (25%)	2 (17%)	3 (25%)	4 (33%)	2 (17%)	3 (25%)	7 (58%)
Laundry (11)	2 (18%)	1 (9%)	1 (9%)	2 (18%)	1 (9%)	1 (9%)	3 (27%)
Cafeteria (6)	1 (17%)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (50%)
Entire Hospital (4)	1 (25%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	2 (50%)

Table 3
Symptoms by Job Title
Fairmont General Hospital Incorporated
Fairmont, West Virginia
HETA 92-004

Job Title and (Number of Employees)	Chronic Cough	Chronic Phlegm	Dyspnea	Chest Tightness	Attacks of Shortness of Breath & Wheeze	Rhinitis	Dermatitis Symptoms
Housekeeping/Floor Care (29)	9 (31%)	5 (17%)	5 (17%)	12 (41%)	3 (10%)	3 (10%)	8 (28%)
Dietary Clerk (11)	3 (27%)	3 (27%)	1 (9%)	4 (36%)	2 (18%)	3 (27%)	8 (73%)
Cook (8)	0 (0%)	0 (0%)	0 (0%)	3 (38%)	0 (0%)	0 (0%)	5 (62%)
Food Service (8)	1 (12%)	1 (12%)	2 (25%)	2 (25%)	0 (0%)	0 (0%)	5 (62%)
Laundry (8)	1 (12%)	1 (12%)	1 (12%)	1 (12%)	1 (12%)	0 (0%)	1 (12%)
Cashier (5)	1 (20%)	1 (20%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (20%)

Table 4
Baseline Spirometry
Fairmont General Hospital
Fairmont, West Virginia
HETA 92-004

	CIGARETTE SMOKING HISTORY					
	Current Number=32		Former Number=9		Never Number=35	
	Mean	SD	Mean	SD	Mean	SD
FVC (l)	3.57	0.92	4.15	1.14	3.93	1.00
Percent Predicted FVC	98.9	11.3	102.4	17.5	106.7	13.8
FEV1 (l)	2.71	0.90	3.39	1.11	3.20	0.84
Percent Predicted FEV1	90.1	17.4	98.8	15.0	103.9	14.9
FEV1/FVC Ratio	75.1	12.1	81.1	7.9	81.5	6.3