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Conducting Worksite Investigations

Bruce Bernard

A health care worker developed a severe case of H1N1 influenza, despite being given a surgical mask to use when caring for a patient. She had read on a Web site that N-95 respirators may have prevented her from getting sick. Why were these preventive measures not in place? Who could she get to look into these recommendations?

A poultry processing worker, standing and cutting chicken legs every 3 seconds on an evisceration line, developed eye irritation and a nagging, persistent cough at work, especially when spraying chicken meat. She knew about ergonomic hazards at work, but she wondered whether her cough might be due to some work exposure. She spoke with her line supervisor about this, but she was rebuffed and told to get back to work. She wondered how she could find out whether her symptoms were work-related.

Prisoners used claw hammers to demolish old video display monitors to reclaim recyclable metals. They had heard that the powdery dust covering them might contain heavy metals. Although they were given wrist-length gloves, the dust got on their arms and clothes, and left a gritty taste. They were concerned about thick, grainy mucus coming from their noses due to inhalation of this material.

A dealer at a casino worried about constant cigarette smoke filling the air. A nonsmoker, she was tired of her clothes smelling like smoke, and she wondered whether she was at increased risk of cancer and heart disease as a result. Had not everyone known that cigarette smoke was carcinogenic? What could she do about this exposure?

A man was not surprised when his doctor told him he had hearing loss. He had worked for many years at an animal shelter, where the dogs, kenneled in cement stalls, barked loudly every time he walked by. He had never worn hearing protectors—they had not been offered to any workers. He thought it was time to raise these issues with co-workers and management.

RECOGNITION OF POTENTIAL HAZARDS

There are many reasons why public health practitioners conduct onsite workplace investigations. Most workplaces have fewer than 100 employees and do not have onsite occupational safety and health specialists. Employers often rely on consultants for assistance.

A worker's illness or injury may trigger the need for an onsite workplace investigation to determine its cause and, if work-related, how to correct or control it. Sometimes occupational health and safety specialists are requested to conduct an investigation by employees or managers concerned about workplace exposures or health complaints from employees. Sometimes government agencies request onsite investigations because of increases in injuries or illnesses or newly recognized hazards. Sometimes workers'

compensation or other insurance companies request investigations to make recommendations to companies, when claims for work-related injuries or illnesses have increased.

Other common triggers for workplace investigations include the following:

- Blogs, Web sites, trade publications, insurance communications, or newspapers report that specific occupational injuries or illnesses are due to onsite work processes or tasks.
- Similar workers or workplaces identify specific injuries or illnesses.
- Professional publications or communications call attention to newly recognized occupational hazards.
- Workers begin to report new symptoms after changes in work processes or tasks.

This chapter lays out the general principles of workplace investigations, concerning recognition of potential hazards, preparation for onsite investigations, conducting these investigations, making useful and practical recommendations, and proactively intervening to implement them. After identifying uncontrolled hazards, exposures, or working conditions, the goal is controlling or reducing them to acceptable risk levels—or eliminating them entirely—and then to ensure that periodic reevaluations are done as part of routine operations. Boxes 34-1 through 34-4 describe four different occupational health issues and worksite investigations that address these issues.

IMPORTANCE OF WORKSITE OBSERVATION

There is no substitute for being onsite and witnessing work processes and tasks in "real time." Observation leads to a better understanding of exposures and working conditions, and it assists in developing better strategies for intervention. It helps with formulating recommendations for specific engineering controls, such as local ventilation, and administrative controls, such as

Box 34-1. Silica Exposure among Roofing-Tile Workers

Issue

Exposure to respirable crystalline silica particles places workers at risk for the development of silicosis, an irreversible condition that decreases lung function and increases lung cancer risk. Workers who develop silicosis can have a marked decrease in their quality of life due to difficulty breathing, cough, chest pain, and exercise intolerance. To diagnose silicosis, the treating physician must determine that the patient has a history of work-related exposure to respirable silica, confirmed by either a chest X-ray or a lung biopsy. Without the exposure history, silicosis can be misdiagnosed as another chronic lung ailment, such as emphysema or pulmonary fibrosis due to other causes.

Investigation

The National Institute of Occupational Safety and Health (NIOSH) conducted a site visit in response to a request from a union concerning roofing-tile workers in Arizona. There was concern that employees were exposed to hazardous levels of dust while sawing cement roofing tiles. At the outset, employees were unaware that the tiles contained a high content of silica. The roofing company, which installed about 800 roofs each month, employed about 400 workers; for most of them Spanish was their primary language.

Site visits were made to four construction sites to obtain samples of cement-tile dust and data on dust composition and particle size. Employees' silica exposures were aggravated by gas-powered leaf blowers used to remove dust and debris from the tiles during installation.

Although investigators brought with them Spanish interpreters, workers' local Mexican dialect made translation difficult. Workers reported that wearing respirators was very difficult because of the heat, and their sweat made proper face seals impossible. Workers were given questionnaires, chest X-rays, and pulmonary function tests to establish baseline evaluations. Most of them had normal lung function; none had moderate or severe impairments. After controlling for smoking, investigators found that decreasing lung function correlated with increasing years of dry-cutting cement tiles. No chest X-rays suggested silicosis. Employees stated that they wore respirators and hearing protectors infrequently. Although some employees reported respiratory symptoms consistent with silica overexposure, none said that they knew the hazards of silica overexposure. More than 75% of employees had been exposed to respirable silica levels above permissible limits. Some had been exposed to levels of total and respirable dust, noise, and carbon monoxide above permissible limits.

Source: National Institute for Occupational Safety and Health. NIOSH health hazard evaluation report (HETA #2003-0209-3015), Diversified Roofing Inc., Phoenix, Arizona. Washington, DC. NIOSH, November 2006.

Box 34-2. Chlorine Exposure among Lifeguards at an Indoor Swimming Resort

Issue

Chlorine is a broad-spectrum, inexpensive disinfectant that is active against most microorganisms, including bacterial spores. Eye and upper respiratory tract irritation, which are frequent symptoms of chlorine exposure, are usually intermittent. Chloramines, which are chlorine-related compounds, are suspected as a major cause of symptoms when chlorine is used as a disinfectant because of the interaction between chlorinated water and nitrogenous material. Exposures to chlorinated compounds may occur in indoor water parks, which have become more popular in the United States and Canada since 2000. To reduce energy costs, some of these facilities recirculate previously heated air, which may contain irritating concentrations of chlorine and chloramines.

Investigation

The National Institute of Occupational Safety and Health (NIOSH) received a request from a local health department to investigate symptoms of eye, nose, and lower respiratory tract irritation among employees at a large indoor water park resort. At the initial site visit, investigators met with representatives of management, lifeguard employees, and the local health department representatives to discuss issues and tour the facility. Industrial hygienists collected area air samples for trichloramine, soluble chlorine compounds, and endotoxin, and they measured air temperature and relative humidity. Investigators performed water-chemistry tests, and collected water samples for *Legionella*, fecal coliform bacteria, mycobacteria, endotoxin, sulfites, and sulfates. They conducted reviews of the designs of the water and ventilation systems.

Medical investigators initially conducted private interviews with employees and then designed a questionnaire survey, which they administered to lifeguards and a comparison group consisting of employees not working in the pool area. The questionnaire covered demographics and workplace information, smoking status, medical history, episodes of pneumonia or chest "flu" with fever and cough since working at the water park, and work-related symptoms within the previous 4 weeks. Participation was voluntary and written informed consent was obtained from the parents of all study participants under age 18. Lifeguards completed an additional questionnaire, at the end of their work shift on days when air sampling for chloramines was done, concerning symptoms experienced at work that day. Health outcomes of interest included the following: *(a)* work-related respiratory symptoms (cough, wheezing, shortness of breath, and chest tightness); *(b)* mucous membrane irritation (cough, sore throat, and eye and nose irritation); *(c)* systemic symptoms (fever, body aches); and *(d)* skin rashes. (Symptoms associated with acute upper respiratory infections were not included.) Symptoms were considered work-related if they occurred during work and improved when away from work. Symptoms of chest "flu" with fever and cough at work and recurrent episodes of pneumonia identified possible cases of hypersensitivity pneumonitis.

Lifeguards had significantly more work-related respiratory symptoms, eye and nose irritation, fever, body aches, and skin rashes in the 4 weeks prior to questionnaire completion than unexposed employees. Lifeguards had significantly more work-related cough and eye irritation when hotel occupancy was high. Trichloramine concentrations, which were similar to those in other indoor swimming pools, were nevertheless at levels reported to cause irritation of mucous membranes. Endotoxin levels in the air in almost all pool areas exceeded the American Conference of Governmental Industrial Hygienists (ACGIH) proposed recommended limit values for endotoxin exposure. Water-chemistry test results met state standards. No *Legionella*, mycobacteria, or fecal coliform bacteria were found in any water sample. Placement of the air-supply diffusers and return-air inlets 30 to 80 feet above deck level made it difficult to provide adequate air movement and mixing at the pool surface and deck levels; it also created the potential for short-circuiting supply air to the exhaust. After the resort made changes to the ventilation system, respiratory irritation among workers and visitors decreased.

Source: Chen L, Dang B, Mueller C, et al. Investigation of employee symptoms at an indoor waterpark. Health hazard evaluation report (HETA 2007-0163-3062), Great Wolf Lodge, Mason, Ohio. Washington, DC: National Institute for Occupational Safety and Health, June 2008.

rotating workers to minimize exposure to hazardous tasks or processes. It also enables a health and safety specialist to recognize hazards or unsafe conditions that may go unnoticed by workers or employers.

Evaluating a workplace often requires a multidisciplinary approach. Input by employees and employers, physicians, engineers, chemists, health physicists, and social scientists may be needed to successfully address hazards and unsafe work conditions. The most successful approaches coordinate many disciplines and incorporate effective communication between employees and employers for recognizing, evaluating, and controlling hazards and unsafe working conditions. A multidisciplinary approach may not be practical for many workplace situations. However, each person evaluating a workplace must be knowledgeable of possible contributions of other professionals in solving problems. For example,

Box 34-3. Environmental Tobacco Smoke Exposure among Casino Dealers

Issue

Longstanding National Institute of Occupational Safety and Health (NIOSH) policy, based on findings of the Surgeon General, states that workers should not be involuntarily exposed to environmental tobacco smoke (ETS), which is associated with increased risk of lung cancer, other respiratory disease, and heart disease. There is no risk-free level of ETS exposure. Nonsmokers exposed to ETS at home and at work increase their risk of developing heart disease by 25% to 30% and lung cancer by 20% to 30%. Almost half of all nonsmoking U.S. residents are regularly exposed to ETS. (See Box 7-1 in Chapter 7.)

Investigation

NIOSH received a request from gaming employees in three casinos in Las Vegas who were concerned that their workplace exposure to ETS was causing acute and chronic disorders. During onsite evaluations that NIOSH performed at the three casinos, casino dealers expressed concern about respiratory disorders associated with ETS exposure. Some dealers were selected for environmental and biological monitoring to determine exposure to a specific tobacco carcinogen, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), and its metabolite, NNAL, the presence of which in urine indicates ETS absorption.

Industrial hygienists performed, in the gaming areas, both full-shift personal breathing-zone sampling and area-air sampling for nicotine, respirable particles, and other components of cigarette smoke. Preshift and postshift urine samples were collected from 114 casino dealers to determine whether NNAL levels increased during work shifts. Casino dealers had measurable airborne levels of ETS (including nicotine, toluene, and hydrocarbons). As evidenced by measurable urinary NNAL, they had absorbed NNK, a carcinogen in ETS. Investigators recommended that casinos prohibit smoking and develop smoking cessation programs for their employees.

Box 34-4. Indoor Air Quality and Cancer

Issue

Almost 70% of workers in the United States are employed in nonindustrial, nonagricultural, indoor work environments. The proportion of National Institute of Occupational Safety and Health (NIOSH) investigation requests since 1972 for indoor environmental quality (IEQ) problems has increased 100-fold, now representing 56% of all requests. Over one-half of these IEQ requests mention mold or water damage as an environmental exposure concern, and about one-fourth mention asthma or cancer as a health concern. (See Chapter 7.)

Investigation

NIOSH received a request from managers of office buildings regarding ongoing employee and union concerns about a possibly higher rate of cancer among current and former employees of the buildings. No cause for these cancers had been identified, but employees were concerned about potential exposure to jet fuel and deicing compounds from the nearby airport, asbestos and water damage in the buildings, and overall poor air quality. The health hazard evaluation (HHE) focused on the employees in two, adjacent three-story brick office buildings, which had been constructed in the early 1960s. NIOSH investigators reviewed reports on asbestos remediation in these buildings, responses to complaints from building occupants, and environmental sampling during the previous 14 years. They evaluated management surveys of cancer diagnoses among building employees. Investigators spoke with representatives from the Ohio Environmental Protection Agency about any past or current environmental contamination issues. They spoke with representatives from the state cancer registry. They visited the site, met with management and union representatives, performed a walk-through survey of the buildings, measured IEQ comfort parameters, and looked for evidence of water damage, water incursion, visible mold, and other problems. They presented cancer findings to employees. They then had a closing conference with management and union representatives. Twenty different types of cancer had been diagnosed among building employees in the previous 25 years, the most common of which were cancers of the breast (17 cases), lung (7 cases), and prostate (4 cases)—the three most common cancers in the United States. Airport runoff of jet fuel and deicing fluid had entered the Rocky River, next to one of the buildings. But these substances are not known to cause cancer, and the river was not a source of drinking water for building occupants. Much of the asbestos in the buildings had been removed, but some was still managed in place and posed no hazard to building occupants. The investigators identified minor IEQ problems, such as water damage to ceiling tiles and walls and poor maintenance of fan coil units, but these problems are not known to be associated with the types of cancer diagnosed among building employees. They found no evidence that reported cancers were associated with work—the numbers and types of cancers were not unusual and there were no significant work-related hazardous exposures. Investigators recommended that management and the union encourage employees to learn about *(a)* known cancer risk factors, *(b)* measures they could take to reduce their risk for preventable cancers, and *(c)* availability of cancer screening programs.

a physician studying a work environment should have not only knowledge of the health effects of specific chemical exposures but also a basic understanding of the relevant chemistry, chemical-sampling techniques, and engineering requirements for control.

To recognize potential hazards at a workplace, one should become familiar with work processes, review a list of possible exposures from chemical and physical agents, consider job activities in work areas of interest, and study possible control measures for exposures or hazards that may be present. One also needs to determine how managers respond to workers' reports of symptoms. Managers' commitment to respond promptly to these reports and investigate potential causative factors provides clues on how they approach workplace problems and how committed they are to prevention.

THE NIOSH HEALTH HAZARD EVALUATION PROGRAM

The National Institute for Occupational Safety and Health (NIOSH), part of the Centers for Disease Control and Prevention (CDC) within the Department of Health and Human Services, is the U.S. federal agency responsible for conducting research and making recommendations for the prevention of work-related injuries and illnesses. The NIOSH Health Hazard Evaluation Program responds to requests for workplace evaluations from employees, unions, employers, and other governmental agencies. A health hazard evaluation (HHE) is an investigation of a workplace to assess whether workers are exposed to hazards or harmful conditions. The NIOSH HHE program, using a team consisting of an industrial hygienist and an occupational medicine physician with training in epidemiology, conducts 300 to 400 investigations annually. Through the HHE program, NIOSH identifies current hazards and recommends practical, scientifically valid solutions for reducing exposures, controlling harmful conditions, and preventing disease, injury, and disability. Workplace investigation techniques used by the NIOSH Health Hazard Evaluation Program are described next. They can be adapted for use at most workplaces.

Preparing for a Workplace Investigation

Gathering Information

Investigators develop overall plans, collaboratively determine specific questions to be answered, and plan the investigative strategy. Initial telephone calls obtain information about the workplace problem with the person who requested the investigation, workers, managers, and other people. Initial information is obtained on workplace operations, the materials or chemicals used, hazards present, processes and work tasks, time sequence and duration of existing problems or concerns, previous actions taken to address the problem, recent process or materials changes, and the urgency of the situation. Emergency situations—those that are immediately hazardous to life or health—should be referred immediately to the Occupational Safety and Health Administration (OSHA). Investigators determine whether managers are aware of any potentially work-related health problem at the workplace. If there is a labor union that represents workers who may be affected or exposed, it is informed about the investigation and requested to provide relevant information, if available, on workers' medical care and work tasks.

At the time of the initial telephone call, determine which parties need to be included in the investigation: employers, workers, any worker representatives (from local and national unions), medical care providers, other health professionals, and local and state health department representatives, as deemed appropriate. Critical to a successful investigation is involvement of employees and their representatives, such as union stewards, as well as managers and other employer representatives from the start. Because employees have a unique understanding of job tasks, and working conditions, information gained from them is especially valuable in determining whether hazards exist and assessing them. Involving employees from the start helps to improve the quality of the investigation, minimize oversights, and enable them to fully understand the need for the investigation and gain their cooperation.

Usually, with little background investigation, early clues help determine the scope of necessary work. For example, illness among many workers

in different jobs in various departments likely indicates the need for a full-scale, workplace-wide investigation. Alternately, if suspected problems are confined to isolated tasks or relatively few workers, only a more limited, focused investigation may be necessary.

On the initial phone call, determine what health and safety hazards might be encountered onsite and what personal protective equipment (PPE) members of the investigative team might need during the site visit. If respirators are required onsite, only personnel who have been medically cleared, trained, and fit-tested can use them.

Roles of the Investigative Team

For the industrial hygienist, preparation for a field investigation begins with identifying exposures of concern, determining whether there are appropriate sampling and analytical procedures that will need to be performed, determining analytical chemistry or microbiological services needed, determining proper instruments to be selected, and making an industrial hygiene equipment list. Determining appropriate sampling usually requires being onsite or having enough information beforehand to know exactly what needs to be sampled, where, and why; performing sampling in a rush and obtaining unneeded data points (because "it may be the only opportunity to sample") is rarely fruitful. Preparation for sampling includes arranging for equipment, supplies, and analytical services, and knowing any shipment requirements for hazardous materials.

For the occupational medicine physician, preparation involves searching medical literature, reviewing medical records, and having the diagnostic and examination skills to sort out what may be work-related in the workplace. Medical support staff responsibilities may include designing a study; developing the investigative protocol; obtaining necessary approval from a human subjects review board; preparing consent forms and questionnaires and other data-collection forms; and arranging for field-study materials, personnel, and medical tests.

If biological testing is to be conducted, arrangements need to be made for clerical support, data-collection forms, supplies for venipuncture and collection of urine or other biological samples, as well as forms to request tests not routinely performed by clinical laboratories, such as those for metals, pesticides, volatile organic compounds, polychlorinated biphenyls, furans, dioxins, polycyclic aromatic hydrocarbons, and phthalates. Plans also need to be made for special studies, such as pulmonary function tests, chest X-rays, neurobehavioral tests, and other tests that may require a consultant.

Obtaining Needed Information before the Site Visit

Many manufacturers have technical and other information on their Web sites on product lines, work processes, financial status, and managerial systems. Major unions also have useful information on their Web sites. Information on Web sites also includes research findings, technical experts, and survey instruments.

If the worksite is a manufacturing facility, investigators need to learn about goods produced, chemicals and other substances used, and intermediate products formed in the production processes. Much of this information can be obtained before the site visit through discussions with employees, employers, and technical experts, or on the Internet.

Before the site visit, obtain records on exposure monitoring, purchasing, production, health and safety policies and operating procedures, all of which can help in determining the exposures of most concern. Employee rosters, staffing lists, employee turnover rates, and floor plans may also provide useful information. Reviewing these documents prior to the site visit will help give investigators a better understanding of potential hazardous exposures and company procedures to respond to hazardous situations. The site visit will help to determine whether these procedures are operational. Once background information is obtained, the leader of the investigation assembles an investigative team.

Material safety data sheets (MSDSs) on hazardous substances, which are mandated at manufacturing plants by the OSHA Hazard Communication Standard, can be requested from management. Workplaces in other industries will generally not have MSDSs; however, containers of hazardous substances that they use, such as cleaning products and insecticides, are required to have hazard warning labels that can provide some toxicity information.

OSHA Logs and Other Existing Records

Investigators can request to obtain *(a)* the logs of injuries and illnesses that are required by OSHA, and *(b)* plant medical records, workers' compensation claims, insurance claims, absentee records, and job-transfer applications, all of which can yield useful information on work-related injuries and illnesses. If workers in certain departments or processes have higher rates of health problems than others, especially if they have the same type of injuries or illnesses, this suggests specific areas for investigation. Jobs with increased rates of certain symptoms, such as lightheadedness or concentration problems, may also have higher risks for acute injuries.

In 2004, OSHA mandated access to illness and injury log summaries available at each workplace, so that information could be easily collected during an investigation. OSHA now requires that employers post, in a common area wherever notices to employees are usually posted, a summary of job-related injuries and illnesses. The summary must list the total number of job-related injuries and illnesses that occurred in each year since 2003. OSHA also requires the posting of annual average number of employees and total hours worked during the calendar year, so that workplace incidence rates can be calculated. Companies with no recordable injuries or illnesses must still post the form. All summaries must be certified by a company executive. OSHA also requires employers to make a copy of the summary available to employees who move from worksite to worksite, such as construction workers, and employees who do not regularly report to any specific worksite.

Medical and First-Aid Records

Investigations of suspected work-related injuries and illnesses should also include review of first-aid and medical records to understand the magnitude and seriousness of such problems. The Health Insurance Portability and Accountability Act (HIPAA) requires that *(a)* specific medical-release authorization from individual workers be given before access to their medical records can be obtained, and *(b)* employers and onsite health care providers protect individual health data. Exempt from HIPAA requirements are public health officials, who are authorized by law to have access to individual health information for the purpose of preventing or controlling disease, injury, or disability—including for investigations and interventions. Examination of employee first-aid and medical records may offer leads to jobs or operations that may cause or contribute to other work-related problems.

Specifics of a Workplace Investigation

The Initial Worksite Visit

The primary purposes of the workplace site visit are to *(a)* determine, while onsite, the severity and extent of the problem; *(b)* identify possible causes; *(c)* see if, at an early stage of the investigation, that there may be possible solutions to the problem; and *(d)* ascertain whether further assessment is needed. The initial site visit can be usually completed in 1 or 2 days, but it may take longer, if additional time is needed to complete it without a follow-up visit.

A good way to start the site visit is with a meeting with all those involved, including the facility manager, the chief local union official (or other worker representative if employees are not represented by a union), health care professionals, engineering and maintenance workers familiar with the facility, and consultants who are familiar with the facility. Discuss plans for confidentiality of information from worker interviews and personnel and medical records, and procedures for videotaping, photographing, and other recording. Review personal protective equipment requirements and any other relevant safety procedures to be used during the investigation.

Walkthrough Observational Survey

A walkthrough survey, which can be the most important part of the investigation, should include managers, employees, their representatives, including the person who requested the workplace investigation, unless that person has requested confidentiality or has declined to participate (Fig. 34-1). Usually, the main purposes of the walkthrough survey are to observe facility operations, identify potential hazards, and talk informally to employees, managers, and others about the problem.

Figure 34-1. An industrial hygienist and an occupational medicine physician pause for questions from a worker during a workplace walkthrough survey. (Courtesy of the National Institute for Occupational Safety and Health.)

The walkthrough allows observation of workers performing job tasks, use of PPE or protective clothing, placement of materials, tools, physical layout of the workplace, and the organizational climate. Many potentially hazardous operations can be detected by visual observation during the walkthrough. Using lists obtained beforehand of chemicals, raw materials, products, and by-products assists in identifying hazardous inhalational and skin exposures. Knowledge of fuels used in burning processes assists in identifying air contaminants. Observation of ventilation systems helps to determine needs for improved control measures. The walkthrough can assist in understanding job tasks that place workers in specific jobs at risk and can help determine the need for additional industrial hygiene sampling, worker interviews, and medical testing.

The dirtiest, dustiest operations are not necessarily the most hazardous. For example, dust particles that cannot be seen by the unaided eye can be the most hazardous because they are of respirable size. The absence of a visible dust cloud does not necessarily mean that there is no airborne dust. Odors are not reliable indicators of exposure: Odors might not be detected of vapors and gases present in concentrations considerably above their permissible levels, and ability to detect an odor often decreases as exposure continues.

Workers' Job Tasks

It is important to obtain a list of workers' routine job tasks and requirements in areas of the workplace being investigated. Changes in job requirements or modifications of work techniques or processes may have profoundly affected hazardous exposures. Shift work or overtime work requirements may contribute to prolonged exposure of workers, which may not occur on an 8-hour work schedule.

Most job tasks can be described in terms of *(a)* tools, equipment, and materials used; *(b)* workstation layout and physical environment; *(c)* task demands; and *(d)* organizational climate in which the work is performed. More definitive

procedures for collecting information on job tasks can include the following:

- Videotaping to observe workers performing tasks for a time-activity analysis
- Photographing workstation layout, tools, materials, and chemicals used
- Recording workstation measurements and characteristics of work surfaces, including heights, edges, reach distances, and slip resistance
- Determining perceived exertion of workers

While screening tools, such as checklists have been widely used in many investigations, most have not been scientifically validated. Combining checklist observations with data on symptoms offers a way of reducing uncertainty.

Focusing on Jobs

Jobs associated with the most, or the highest rates of occupational illnesses and injuries, deserve the most attention. Jobs in which recent cases have occurred deserve priority attention. Priority for job analysis and intervention should be given to those jobs in which *(a)* the most people are affected, or *(b)* changes in work exposures or processes are taking place or planned. Jobs associated with workers' complaints of fatigue and discomfort should be ranked next in priority for analysis and intervention. Finally, where screening suggests presence of significant risk factors or exposures for occupational illnesses or injuries, more detailed job analyses should be done. Jobs with higher levels of exposure or multiple risk factors may indicate a need for control.

Selection of Instruments to Evaluate the Work Environment

Industrial hygiene sampling (Fig. 34-2) is sometimes necessary on the initial site visit to determine the range of exposures to begin planning for more definitive sampling (Chapter 26). Direct reading instruments and/or detector tubes are generally used because of their portability and

Figure 34-2. Industrial hygienists collect follow-up samples for a silica exposure among roofers. (Courtesy of the National Institute for Occupational Safety and Health.)

ease of use. In-depth quantitative air sampling is generally not done on the initial site visit.

Interviews

The lead investigator should establish a schedule to interview the following people:

- Managers and other employer representatives
- Workers (Although it is reasonable to interview specific workers at their request or the request of others, it is important to interview a cross section of workers. Group interviews can supplement individual interviews.)
- Union representatives
- Physicians, nurses, and other health and safety personnel
- Representatives of the human resources department

Conducting Symptom Surveys

Symptoms surveys can assist in focusing on specific concerns of workers and in identifying possible work-related disorders that might otherwise go unrecognized. These surveys provide information to narrow the focus of investigation. In addition to questions about workers' job titles and tasks, the location, frequency, duration, and intensity of symptoms will help to determine the focus of the investigation. By definition, symptom surveys rely on self-reports—a potential limitation. An epidemiologist can assist with questionnaire design and data analysis.

Medical examinations: A disadvantage of using OSHA logs or company-based medical information to identify possible cases of work-related injuries or illnesses is the lack of uniform definitions. In the NIOSH HHE program, investigations have included limited physical examinations focused on specific organ systems or parts of the body. Data obtained can help establish the prevalence of work-related conditions and whether any might be related to work. Prevalence data for a comparison group of unexposed or lesser-exposed workers may be helpful. Standardized periodic medical examinations, performed at some workplaces, may provide valuable clues, but they are generally not designed for continuous surveillance.

Integration of data: All those involved in the investigation should meet onsite to discuss and integrate their findings and plan next steps.

Summarizing Onsite Information and Holding a Closing Conference

Hold a closing conference before the initial worksite visit is completed to discuss what has been accomplished. Invite those present at the opening conference and other key employees and managers. New recommendations can be made and previous ones can be modified. Future activities and reports can be discussed.

Activities after the Site Visit

Maintain all records, notes, forms, and other data from the site visit in locked files. Check and decontaminate all sampling equipment. Arrange for laboratory analysis of samples. Review and check analytical results for reliability. Make arrangements for coding, entry, analysis, and storage of medical data.

Follow-up Reports

Within a few days of the initial site visit, write a letter to managers and employees and their representatives, summarizing the findings of the visit. The letter should use clear language and provide a clear understanding of possible health effects associated with the hazards encountered. A telephone conference call can also communicate information on a health hazard—or its absence—and alleviate any misunderstandings or concerns heightened by publicity. It can also facilitate timely implementation of control measures. Any results and recommendations reported by telephone should be included in a subsequent written report. Preparation of the final report to employers and employees should integrate both the industrial hygiene/environmental and medical/epidemiological components of the investigation.

Considering Recommendations of a Worksite Investigation

The occupational health and safety three-tier hierarchy of controls—widely accepted as an intervention strategy for controlling workplace

hazards—is useful in outlining recommendations in the report. The three tiers are as follows:

1. Engineering controls
2. Administrative controls (changes in work practices and management policies)
3. Personal protective equipment (PPE)

Engineering Controls

Recommendations should begin with examination of existing engineering control strategies to determine whether the following are evident:

1. Work is set up to reduce worker exposures.
2. Substitution has been attempted to reduce harmful material exposures.
3. Work operations are isolated or enclosed to reduce worker exposures.
4. Wet methods are being used to reduce generation of dusts.
5. Local exhaust and general ventilation are adequate.
6. Shielding from radiant heat, ultraviolet light, radiation, and other forms of energy is used.
7. Modifying presentation of parts on assembly lines has been attempted.
8. Equipment is height-adjustable, tools are in adequate proximity, and objects handled are of appropriate weight.
9. Appropriate procedures are in place for housekeeping, waste disposal, eating and washing, and use of toilet facilities.

Administrative Controls

Recommendations regarding administrative controls are usually directed to management, because they concern work policies that reduce or prevent exposures. Administrative control recommendations can address issues such as the following:

1. Scheduling shifts and rest breaks
2. Rotating workers in and out of specific jobs
3. Evaluating production quotas and performance standards concerning their impact on workplace stress, work pace, and worker control
4. Providing meaningful light-duty jobs, as deemed appropriate, to allow injured or ill workers to maintain contact with fellow employees and gradual return to normal activities, while providing for specific medical needs
5. Providing periodic training of employees on work risk factors and recordkeeping
6. Implementing medical management and surveillance programs
7. Implementing workplace smoking policies

Most administrative recommendations should be seen as *(a)* temporary measures until engineering controls can be implemented, or *(b)* measures to use when engineering controls are not technically feasible. Since administrative controls do not eliminate hazards, managers must ensure that practices and policies are diligently followed. Administrative controls, such as worker rotation or allowing more rest breaks, are "stop-gap" measures—not permanent solutions.

Personal Protective Equipment

Personal protective equipment measures do not substitute for good engineering or administrative controls or good work practices. Personal protective equipment recommendations should be implemented only with the assurance that these other controls and practices have already been considered. When use of PPE is deemed necessary, appropriate training must be on proper use and maintenance of PPE.

Implementing controls normally consists of *(a)* initial testing of the selected measures, *(b)* modifying these measures based on initial testing, *(c)* implementing them on a large scale, and *(d)* evaluating their effectiveness. By testing and evaluating measures, one can determine whether they achieve the desired outcome and identify any necessary modifications. Workers can provide valuable input into testing and evaluation. Worker acceptance of changes is important to the success of the control measures. Workplace control measures often start by targeting problems clearly identified in the workplace investigation and those problems that appear easiest to solve. Early success can build confidence and experience needed later to solve more complex problems.

Evaluating Effectiveness of Controls

Periodically evaluate implemented controls to determine whether they have reduced hazards and/or decreased injuries or illnesses, and to ensure that control measures have not introduced new risk factors. Follow-up evaluation should occur no sooner than 6 weeks after implementation of control measures to avoid discarding effective control measures that may not have yet demonstrated their benefits. Evaluation may also include a symptom survey and completion of a risk-factor checklist or another job-analysis method. Results of a follow-up symptom survey can be compared with those of the initial symptom survey to determine the effectiveness of control measures in reducing symptoms. (Be aware that some ergonomic control measures lead to changes in work methods, requiring workers to use different muscle groups, which may make them sore during the "break-in" period.)

Proactive Approaches

To this point, the topics outlined in this chapter have represented *reactive* approaches for workplace investigations. In contrast, *proactive* approaches are geared to preventing problems from developing. Proactive measures emphasize designing work tasks and processes to avoid causes of occupational illnesses and injuries. They include design of operations that ensure proper selection and use of tools, job tasks and processes, workstation layouts, and materials that are unlikely to harm workers.

Essential Considerations

Ideally, workplace problems are identified and resolved in the planning process. In addition, general occupational health and safety knowledge, learned from an ongoing health and safety program, can be used to build an approach more oriented to prevention. Management commitment and employee involvement in planning are essential. For example, management can set policy to require health and safety considerations for any equipment to be purchased, and production employees can offer ideas on the basis of their experiences for alleviating potential problems.

Decision makers who are planning new work processes, especially those involved in the design of job tasks, equipment, and workplace layout, must become more aware of health and safety factors and principles. Designers must have appropriate information and guidelines about risk factors for occupational illnesses and injuries and ways to control them. Studying past job designs can help determine what improvements are needed.

Because design strategies try to target the causes of potential occupational illnesses and injuries, engineering approaches are preferred over administrative approaches—they eliminate risk factors instead of only reducing exposure to them.

FURTHER READING

Centers for Disease Control and Prevention. Health hazard evaluations. Available at: http://www.cdc.gov/niosh/hhe/.
This Web site provides the complete guide to the nuts and bolts of the NIOSH Health Hazard Evaluation Program.

National Research Council and Institute of Medicine of the National Academies. The Health Hazard Evaluation Program at NIOSH. Reviews of Research Programs of the National Institute for Occupational Safety and Health. Washington, DC: National Academies Press, 2009.
A useful resource on the NIOSH Health Hazard Evaluation Program.

Occupational Safety and Health Administration. Screening and surveillance: a guide to OSHA standards. OSHA 3162-12R. Washington, DC: U.S. Department of Labor, 2009. Available at: http://www.osha.gov/Publications/osha3162.pdf.
A quick reference for locating and implementing the screening and surveillance requirements of OSHA standards.

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

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