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Construction Can Be Hazardous to Your Health

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Introduction

Over 9.6 million construction workers were employed in the United States in 2001 to help build roads, residential housing and commercial office buildings, and physical infrastructure to our country. This type of work exposes many construction workers to hazardous work tasks and unhealthful working conditions [1-2] Health and safety may or may not be a priority for the contractor. Workers may not receive medical examinations, assessments, and monitoring based on their occupational exposures. Some of the reasons for this include: health is a complex issue; long-term strategies are required; benefits are not immediate and consequently difficult to demonstrate; exposure to hazards with different health risks can be multiple and vary with site conditions; low profile; "macho" culture is inherent in the construction industry; mobile and temporary workforce; and lack of expertise within the industry. [3]

Research and findings on Ontario's construction workers found occupational exposures to various chemical substances at levels considered potentially hazardous. Contaminants found in the construction projects include dust from wood, concrete, diesel exhaust, and welding fumes. Asbestos and lead exposures also were prevalent among certain trades [4] In this particular case, a large construction contractor, construction manager, subcontracting trades, and an architectural firm were hired to design and manage the re-construction of an international airline terminal. Plans were drafted to renovate the existing airline terminal in order to provide more interior space for passenger arrivals and departures, administration offices, customer service areas, and shops. Health and safety plans were developed to provide oversight of the entire construction process as well as assist with the management and facilitation of the project. No attempt was made to coordinate the construction work activities with the architect or provide oversight for health and safety of workers and the general public. Over time, site work conditions began to deteriorate, which allowed both airline workers and passengers to become exposed to a variety of airborne and surface contaminants.

Symptoms of Exposure to Airline Workers and Public

A designated site health and safety representative for the contractor conducted regular inspections until being dismissed early on from the project. The project manager, a certified public accountant, assumed the duties as the replacement for the site health and safety representative. It was discovered later during a deposition that New York City building codes, at that time, did not require a formally trained site health and safety representative to be on-site at all time. Since then, the public law was amended to require designated safety personnel who meet specific educational and training criteria during building construction, renovation, and demolition activities.

Five workers employed by an international airline testified that they became sick after only six months into the project. None of these airline workers had either a previous medical history or complained about any prior illness before the construction work began inside the terminal. These individuals suffered from debilitating headaches, skin irritation, difficulty breathing, eye and skin irritation, nose bleeds, diarrhea, feeling of tightness in the chest, wheezing, and a raspy voice with a barking cough. Other airline personnel testified their hands began to swell and becoming extremely irritated along with peeling and bleeding. Some workers smelled a sweet odor before becoming sick. Several airline workers eventually became permanently disabled and one worker later developed chronic obstructive pulmonary disease (COPD) and subsequently died because of her illness.

Construction workers were tasked to remove asbestos pipe insulation and fiberglass insulating materials inside the ceiling plenum, removing gypsum wallboard and the fiberglass suspended ceiling tiles, jack hammer the concrete floor and install a new epoxy-based terrazzo floor in the terminal. Some workers experienced a metallic taste in their mouth along with headaches and fatigue, which was most likely attributable to periodic welding, cutting, and brazing inside the ceiling plenum to remove the existing piping and install new plumbing and heating systems.

Passengers departing and arriving on international flights constantly complained to airline personnel about the surface dust outside the construction area and the odor in the air. Although plywood construction barriers were installed around the construction area, there was evidence that plastic sheeting was not in-place to enclose the top of the construction barrier into the ceiling plenum. Local exhaust ventilation was not provided anywhere, except during asbestos abatement. Large portable floor fans were installed to help reduce the dust and odor concentration in the air while installing the terrazzo floor. Wet methods were used to grind the concrete floor but housekeeping efforts were non-existent outside the containment barriers to clean up the residual dust. Dust and vapors generated from demolition and reconstruction processes were allowed to settle or become re-suspended in the air and circulate through the existing ventilation system. Surface dust was observed on all of the equipment, machinery, furniture, and articles throughout the airline terminal. Other than routine housekeeping within the public spaces, building surfaces remained contaminated during the entire construction project.

The airline workers reported the symptoms to their management. Material safety data sheets (MSDS) were provided to the airline workers only after exhaustive discussion between the various parties. There was no attempt by either the construction manager or trade subcontractors to discuss the issues with the assigned architect or hire a qualified health and safety consultant. Workers eventually discovered they may be potentially exposed to epichlorohydrin, phenol, tetrahydrofuran, diglycidyl ether, and formaldehyde vapors from the epoxy resin used in the

terrazzo floor; crystalline quartz silica and the alkaline, hygroscopic, and abrasive properties of calcium oxide in the cement dust; fiberglass dust from removing the existing insulation in the ceiling plenum and walls; and friable asbestos fibers in the pipe insulation.

Measured Occupational Exposure

After countless discussions between terminal and construction management and their contractors; few changes were made. Subsequently, the affected airline workers filed several non-formal complaints with federal OSHA. Consultants were hired by the general contractor to evaluate selected areas of the terminal at the discretion of the construction management firm. Another independent consultant hired by the airline focused on potential occupational exposure based on the type of construction being performed at that time. These consultants were not permitted to conduct a comprehensive site risk assessment or evaluation of all the occupational exposures affecting the airline workers. Most of the heavy demolition and re-construction work was performed during the evening hours when there was little activity inside the terminal.

Ambient air sample results for asbestos fibers were not provided for review by the abatement contractor. Wipe or micro-vacuum samples were not collected to evaluate the amount of asbestos fibers in the residual surface dust. Although measured air concentrations of the selected toxicants were well below federal OSHA maximum permissible exposure limits (PELs) and ACGIH threshold limit values (TLVs); fiberglass and crystalline silica was found in the settled dust. Bulk samples collected during the terrazzo floor buffing operation contained 59.2% calcium, 1.5% crystalline quartz silica, 35.1% dolomite, 1.1% calcium silicates, 0.5% feldspar, 0.7% muscovite, and 1.9% miscellaneous material. Air sample results also indicated the presence of low levels of epichlorohydrin and phenol in the air. Similar test results were obtained from the Occupational Health Foundation when evaluating a four-story office building being constructed in Washington, DC (1991-1992). Respirable crystalline quartz silica dust levels ranged from 0.07 and 0.234 mg/m^3 of air during cutting and chipping concrete and 0.08 mg/m^3 during grinding of the terrazzo floor.

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) is a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles and gases[,(5)]. Many previous definitions of COPD have emphasized the terms like “emphysema” and “chronic bronchitis”, which are no longer included in the definition of COPD. Emphysema is the destruction of the gas exchange region in the lower alveoli. It is a pathological term used clinically to describe several structural abnormalities in those patients with COPD. Chronic bronchitis is the clinical term used to describe the presence of cough and sputum production over a period of two years. Chronic bronchitis does not reflect the major impact of airflow limitation on the morbidity and mortality in COPD patients. Cough and sputum production can sometimes occur with the development of airflow limitations. On the hand, airflow limitations may develop without cough or sputum production.

COPD that is defined as occupational usually develops slowly, given the airflow limitation is chronic, and does not reverse itself despite discontinued exposure. Clinical diagnosis for asthma alone cannot be used for the diagnosis of COPD. Cigarette smoking is by far the predominant factor for developing COPD [6-7] Work-related COPD diagnosis should be based on a proper occupational history, which consists of a chronological list of all jobs, activities, potential respiratory irritants at each job, and an assessment of the duration of exposure, use of personal protective equipment, description of the ventilation and overall hygiene of each workplace. The examining or treating physician should consider epidemiological and experimental studies of respiratory irritating agents known to cause chronic obstructive bronchitis such as sulfur dioxide, mineral dusts, vanadium and endotoxin. Other chemical agents like cadmium, coal, and silica are occupational cohorts for emphysema.

A large cohort of Swedish male construction workers were followed from 1971 to 1999[8]. Workers were exposed to inorganic dust (asbestos, man-made mineral fibers; dust from wood, cement, concrete and quartz; gases and irritants from epoxy resins, isocyanates; organic solvents; fumes from asphalt, diesel exhaust; and metal fumes from a job-exposure matrix. When all subjects, including smokers, were statistically analyzed, there was an increase in mortality from COPD among those construction workers with any airborne exposure (RR 1.12)

In a Poisson regression model, including smoking, age, and major exposure groups, exposure to any inorganic dust was associated with an increased hazard risk (HR 1.10), especially among non-smokers (HR 2.3). The fraction of COPD among all workers with any airborne exposure was 10.7 percent whereas COPD was 52.6 percent among those workers who never smoked and exposed to any airborne contaminants.

Conclusions

Within a reasonable degree of scientific certainty, these airline workers and the general public inside the international terminal were exposed intermittently to a variety of respiratory irritants due to a lack of engineering and administrative controls, coordination with the architect, and supervision on the jobsite. Some of these chemical contaminants identified during the demolition and re-construction of the airline terminal include: glycidyl ether, polyamines like diethylene triamine and triethylene tetramine, tetrahydrofuran, calcium oxide in the cement dust, crystalline quartz silica, formaldehyde, asbestos, and fiberglass. Both occupational exposure and toxicity were consistent with clinical symptoms of these affected airline workers. Construction workers who performed these particular work tasks were most likely exposed to higher air and surface concentrations during the various work-related activities, especially since adequate engineering and administrative controls were not provided and the use of personal protective equipment lacked enforcement and supervision. The fact that one airline worker eventually died from COPD and four other airline workers became permanently disabled from these exposures is a tragedy. The health of all affected workers should be protected during each construction activity.

Based on this case study, it is evidently clear that consultants who were hired to evaluate these worker complaints were not allowed to conduct a more comprehensive health risk assessment, evaluate the exposures completely, and collect the necessary air and surface samples throughout the entire project. In addition, a qualified health and safety representative should have inspected the jobsite regularly and addressed the complaints expressed by others working nearby. Early

intervention may have prevented these occupational exposures and provided a cleaner atmosphere for the airline workers and their international passengers as well as the construction workers themselves. The cost of any worker's health or the cost a human life should not be factored into the cost of doing business in the construction industry. Better communication and coordination efforts between the architect, construction manager, subcontractors, health and safety personnel, and consultants are paramount to ensure a safe and healthful jobsite.

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