Research and testing laboratories

World at work: Research and testing laboratories

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Spotlight on a diverse industry

Manufacturing facilities typically focus on the creation of a finite array of products in large volumes. Consequently, the potential hazards inherent to these workplaces are limited in scope, although they may be high in output. On the other hand, a research and testing laboratory performs testing and diagnostic evaluation of samples, a setting not typically within the production line sequence; hence, the likelihood of exposures to large volumes of potentially hazardous agents is usually much lower. However, the sophisticated analytical procedures conducted in laboratory settings often involve the use of a variety of exotic and potentially hazardous agents. It is this array of hazards, combined with differences among potentially exposed individuals, that makes the laboratory setting a unique working environment.

TASKS OF THE JOB

Laboratories are ubiquitous in today's world, are designed to fulfil various roles, and can vary markedly in size, from that of a small closet area to multiple floors in large buildings. Commercially operated laboratories provide analytical testing services for products, such as processed food, or are involved in the research and development of new products. Governments operate laboratories for quality control purposes to ensure product integrity and performance. Governments also operate forensic laboratories for the identification of evidence in crimes or to determine cause of death. Healthcare facilities maintain medical, clinical, and/or veterinary laboratories to accommodate the processing of clinical specimens for medical diagnoses, whereas universities house laboratories directed at research endeavours. Based on data from the United States Bureau of Labor Statistics, in 2003 there were more than 430 000 persons employed in medical, diagnostic, veterinary, and/or testing laboratories—that is, approximately 0.3% of the civilian workforce (http://www.bls.gov/oes/2003/may/oessrci.htm).

Regardless of their purpose or setting, all laboratories share certain characteristic tasks. In a broad sense, the tasks inherent to laboratory work include some or all of the following: development of testing protocols and sampling strategies; instrument calibration and internal quality assurance; product sampling and collection; transport and delivery of samples to the laboratory; receipt and recording of sample entry; sample preparation; sample analysis; calculation and reporting of results; and waste disposal. Of these tasks, those of greatest concern for potentially hazardous exposures involve sample collection, preparation, and analysis.

All laboratories perform analyses using equipment and techniques that subject samples to extreme physical, chemical, radiological, and/or biological conditions, often simultaneously. In turn, these procedures represent potentially hazardous exposures to workers in and around these settings. Effective implementation of controls and protective measures for these workers requires an in-depth appreciation of the complexities of the laboratory work environment.

In addition to the various potential hazards that may be present in the laboratory work setting, it is important to consider the diversity of the potential at-risk population. First are the laboratory workers themselves. These individuals are recruited, hired, trained, and receive direct compensation for their efforts; their adherence to accepted work practices can be a condition of continued employment or annual performance evaluations. However, these kinds of administrative controls may not extend to other individuals who can spend time in a laboratory, including students, volunteers, and visiting scholars. Because of the cyclical nature and variable duration of such exchanges and visits, these persons may not be subjected to the same surveillance measures, workplace monitoring, hazard awareness training, safety performance assessment, controls, or expectations afforded to usual laboratory employees.

HAZARDS OF THE JOB AND IN THE WORKPLACE

The potential hazards present in a laboratory environment can be classified, from a pragmatic standpoint, into four main categories: chemical, physical, radiological, and biological. Each agent class exhibits a unique set of concerns, warranting specialised attention.

Chemical hazards

Given their large number, a detailed discussion of individual chemical agents used in laboratory settings is beyond the scope of this article. However, analysis of laboratory samples typically involves a series of elaborate processes that allow the isolation of a specific characteristic of a compound. In the processing and analysis of these samples, a wide array of exotic hazardous chemicals may be used, which can be broadly classified by the health and safety risks inherent in their use. These risk categories include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitisers, hepatotoxins, nephrotoxins, neurotoxins, haematopoietic system toxins, and agents which damage the lungs, skin, eyes, or mucous membranes.[1] The most likely routes of exposure are inhalation and absorption through skin or mucous membranes.

In comparison to private industry as a whole, where trends in the incidence of both work related skin disorders and acute toxic inhalations have been declining steadily since 1998, rates in laboratory settings have either fluctuated or increased (table 1).

Physical hazards

In addition to the hazards represented by the intrinsic toxicity of a chemical agent, its physical state may also pose a health hazard (for example, combustible liquids, compressed gas, explosive, flammable, pyrophoric compounds, and compounds that are unstable or water reactive).

From an ergonomic standpoint, laboratory analytical techniques can require long periods of standing on hard floors or sitting in one position, together with the performance of repeated tasks, increasing the chances of low back pain and other musculoskeletal discomfort. Work surfaces not matched to the worker's height and inadequate task lighting in the work area can also cause work discomfort. Repetitive procedures such as opening and closing vial caps, pipetting (fig 1), and sample sorting hold the potential to result in repetitive motion injuries or other cumulative trauma. Similar concerns exist when prolonged periods of data entry or other computer based work are required. In selected laboratory settings, such as