

## INDUSTRIAL HYGIENE PROBLEMS WITHIN RESEARCH LABORATORIES

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TRADITIONALLY, industrial hygiene has been associated with the evaluation and control of environmental stresses within manufacturing industries. Industrial hygienists always have recognized a need to understand better the complex nature of industrial operations. Manufacturing processes are studied individually, contaminants are isolated, the degree of hazard is measured, and unnecessary or hazardous exposures are controlled. Although this pattern has not changed, the demand for greater industrial productivity and space exploration has opened new avenues of concern. Today, the industrial hygienist faces new problems such as exposure of people to noise, microwaves, laser and maser radiations, and to propellants and chemicals used to eliminate plant fungi from the nose cones of space-exploration vehicles. The search for specialized technical knowledge is, as never before, a necessary and continuing process.

Research installations afford fertile grounds for study which can provide a better understanding of the future industrial health problems in their formative stages. Because of the availability of industrial and Federal grants, research laboratories have mushroomed so that they seriously challenge many manufacturing industries in terms of total persons employed. The recent growth of such laboratories within Pennsylvania has been dramatic. A conservative estimate shows that, within a period of 5 years (1958-63), the number of installations

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conducting research increased by nearly one-fourth. There is every indication that this trend will continue.

### Evaluation of Research Installations

Industrial research installations employ a highly trained technical staff representing a substantial investment. Recognizing the need to serve the worker irrespective of his place of employment, the division of occupational health of the Pennsylvania Department of Health conducts comprehensive evaluations of such installations. The purpose of such study is twofold, namely, to assess the character of operations in terms of immediate hazards to research personnel and to gain knowledge about future stresses and air-contamination hazards in the manufacturing and service industries. The research installations fall conveniently into two categories—those engaged in pure research and those performing research for improvement of, or in connection with, a manufactured product.

Not all industrial research is conducted within the confines of industrial establishments. For example, about a dozen educational institutions in Pennsylvania perform diversified experimentation ranging from development of a colorimetric analysis for the silica content of silicotic patients to a study of the feasibility of introducing learning machines into schools. Because additional money is available through the National Defense Educational Act (matching funds for equipment and supplies), our universities have been motivated toward pure research projects.

### Hazards Uncovered

In addition to educational institutions, the industrial research complex in Pennsylvania is of significant size. In 1963, approximately 629 in-

dustrial establishments were actively engaged in some form of research. Research directors and personnel in these establishments generally have advanced degrees and are familiar with work hazards, but they are not always familiar with proper safety and industrial hygiene techniques. Most take adequate precautions, but some regard exposure to gases like hydrogen sulfide or sulfur dioxide as harmless. Mercury contamination on the laboratory bench and floor is, on occasion, taken for granted. In one instance, a chemist with a doctorate degree was not aware of the hazards associated with the carcinogen, beta-naphthylamine. On the other hand, the business manager of the same installation, who did not profess to be familiar with chemistry, was aware of the dangers. At another site a scientist contracted a severe dermatitis from handling acetone while preparing samples for observation with an electron microscope. This man was proud of his knowledge of the dangers of ionizing radiation, but he did not know that acetone could harm his skin.

At one location, graduate engineers designed custom electroplating plants. Using glass tanks, the engineers arranged plating baths on the floor in various configurations until the best material flow was achieved. Then varying strengths of solution and plating amperages were tried until a proper plating thickness was obtained. These operations were performed in a room about 10 by 20 by 10 feet, cluttered with rusty pipe, corroded tubing, and contaminated tools. Since there was no exhaust ventilation, the mists that formed resulted in eye irritation and a choking sensation. Such a condition would have caused workmen complaints in many manufacturing plants.

Highly trained research personnel are not oblivious to health hazards. They would be the first to confess that a certain technique causes severe headache or sneezing. A few are likely to ignore symptoms because they become so absorbed in what they are doing. They admit that they should take proper precautions. Because their experiment is progressing so well, they simply do not take the time. Once these research personnel are made aware of hazards, they become proponents of good hygienic practice, seeking the industrial hygienist's advice to help solve their problems.

A second kind of laboratory employee is the highly skilled technician assisting in advanced research. This employee is frequently unfamiliar with the toxic properties of the chemicals he is handling. On a visit to a chemical research laboratory, we found a technical-grade rodenticide being weighed under a makeshift exhaust hood constructed from a bottomless barrel and suspended below an open propeller-type fan. The turbulence created by this system served only to disperse the contaminant and increase personnel exposure. The employees who had constructed this so-called exhaust system were unaware that it could not work. In another incident, a technician operated a homemade trichloroethylene degreaser constructed from a kitchen sink. The draining board was equipped with a series of infrared lamps which dried suspended metallic parts and evaporated the solvent from the open-sink well. A lengthy discussion with this technician as to the precautions to be used and the modifications required to make this system functional convinced him of the need to procure a commercial degreaser. Frequently, such a person is amazed to learn that many of the safeguards he needs are available commercially.

A third category of research installation personnel are not directly associated with research as such but are exposed to its hazards. These include maintenance and janitorial workmen. Tearing down a laboratory hood or repairing a ventilating system can result in serious chemical burns and systemic poisoning. A mercury-contaminated mop can expose secretarial and other office personnel to contamination. Recently, during a tour of a facility, one of our industrial hygienists noticed an unlocked door at the end of a dimly lit corridor. The door was posted with two signs—CAUTION. RADIOACTIVE MATERIALS. WATCH YOUR STEP. The door opened to a room below grade, accessible only by a vertical ladder. This doorway could cause a serious fall, and the situation was quickly corrected.

#### **Benefits From Evaluation**

Many research installations have highly skilled safety representatives. Too frequently, however, these persons are employed in only an

advisory capacity. Many do not have the authority to enforce safety practices, nor are they informed of new projects and layout changes. Periodic inspections of research facilities by trained industrial hygienists tend to strengthen the safety engineer's position in his organization. Safety representatives welcome assistance and helpful suggestions from the industrial hygienist. A visit from a trained observer is most vital to the smaller laboratories which do not have, and probably could not afford, the services of persons versed in health protection and safety.

In providing service to the research installation, the governmental occupational health program benefits by being able to tool up for future hazards in industry. Some of the solvent formulations and new chemical linkages in plastics that we have previously seen in research laboratories are now coming into use in industrial plants. In addition, some of the laser-generating devices observed on the laboratory bench when the evaluation project was first begun are now used in industry. Many examples could be cited to show the advantages of inspecting research installations routinely and offering them service.

When the evaluation project was being considered in 1964, many problems had to be examined and resolved. Research installation personnel are generally unfamiliar with the inspection procedures applied to industry. They are engaged in proprietary activities, and it was feared that they might resent outside interference. They operate on tight time-schedules which cannot be interrupted. Such persons, it

was believed, might resist and refuse advice from the outside altogether.

Despite some apprehension, the evaluation project was, however, initiated. Contrary to expectations, the service offered was gratefully accepted. In one instance early in the project, a research director requested that we make a complete tour of his facility, not being aware that an inspection was the intent of our visit. Most research personnel are eager to discuss their activities. They freely discuss means of minimizing their exposure to contaminants and listen avidly to any suggestions given. They are willing to discuss errors and correct unhealthful situations. Most of all, research personnel appreciate learning whom they may call for consultation and assistance.

Our experience so far in this project has been gratifying. We anticipate that the project will continue since research laboratories are not free from occupational hazards. If anything, they are conducive to a dangerous environment.

The cost of occupational disease represents a significant expense to the employee, the employer, and the general public. In research, many famous scientists have suffered from exposure to the products they have developed. It is not known, nor can it be estimated, how many research workers have been affected by the materials and machines they have developed. Yet both from the humanitarian and the economic standpoint, research installations should be models of healthful working environments. Industrial hygienists have an important and essential role in protecting the health and well-being of the researcher.

## Erratum

In the article "Health and Safety in Summer Camps" by Dr. Paul B. Stanilonis and Dr. Roger J. Meyer, published in *Public Health Reports* in April 1966, the statement on page 309 that "A ruling permitting nurses to practice without a Vermont license has been enacted for summer camps" is in error. The authors wish to point out that there has been no official ruling that registered or practical nurses may practice in Vermont summer camps without a license (Vermont Statutes Annotated, title 26, ch. 24, secs. 1551-1562, 1961).