

THE DESIGN AND OPERATION OF OCCUPATIONAL HEALTH PROGRAMS IN GOVERNMENTAL AGENCIES

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BACKGROUND

Responsibility for occupational health and safety programs is dispersed among various federal and state governments. Goals are basically the same — the prevention and control of occupational injuries and illnesses, and the general improvement of the health of workers and the working environment; but missions are restricted to specific areas of authority or concern. For example, at the Federal level, health aspects of such programs have been viewed traditionally as the responsibility of the Public Health Service; safety aspects, the U.S. Department of Labor; and mine safety and health, the U.S. Bureau of Mines.

Functions of federal agencies have been confined to research and development, technical assistance to states and others, dissemination of information, and to various degrees, training and promotion of improved occupational health and safety programs at the state level. To these traditional functions has been added enforcement of national safety and health standards under recently enacted legislation. The role of state agencies, which have legal responsibility for health and safety of employed workers, is provision of direct services to industry in the solution of occupational health and safety problems. The application of research and of standards of good practice, and supervision of the health of its employees while at work is regarded as the responsibility of management. Over the years, a spirit of cooperation has existed among federal and state governments, and industry and labor which contributed greatly to the progress made in reducing the toll of occupational injuries and diseases which characterized the early decades of this century, and in making the job environment a safe and healthy place in which to work.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

National Institute for Occupational Safety and Health

The National Institute for Occupational Safety and Health (NIOSH) was established within the Department of Health, Education and Welfare (HEW) by the Occupational Safety and Health Act of 1970, PL 91-596 (see Chapter I) to carry out the functions specifically assigned to it, and the research and educational functions assigned to the Secretary of HEW and delegated to NIOSH. NIOSH formally came into being with the re-designation of the Bureau of Occupational Safety

and Health, Public Health Service. It is now located administratively within the Health Services and Mental Health Administration of HEW. The reconstituted Bureau itself had its origin in the establishment of the Office of Industrial Hygiene and Sanitation by the Public Health Service in 1914, and has been active as a continuous organization entity. The passage of the Occupational Safety and Health Act of 1970 provided for the first time a specific legislative base for occupational safety and health research and training activities.

In addition to broad responsibilities under PL 91-596, NIOSH has been delegated responsibilities for carrying out the health provisions of the Federal Coal Mine Health and Safety Act of 1969, PL 91-173.

Organization and Functions. NIOSH has its headquarters offices in Rockville, Maryland, and maintains primary research laboratories and other program functions in Cincinnati, Ohio, with specialized field laboratories at Salt Lake City and Morgantown, West Virginia. Staffs are also maintained in each of the 10 HEW Regional Offices.

The "Statement of Organizations, Functions and Delegations of Authority" (printed in the June 30, 1971, issue of the Federal Register), assigns the following major functions to the Institute: "Plans, directs, and coordinates the national program effort to develop and establish recommended occupational safety and health standards and to conduct research, training, and related activities to assure safe and healthful working conditions for every working man and woman:

"(1) Administers research in the field of occupational safety and health, including the psychological factors involved; (2) develops innovative methods and approaches for dealing with occupational safety and health problems; (3) provides medical criteria which will ensure, insofar as practicable, that no employee will suffer diminished health, functional capacity, or life expectancy as a result of his work experience, with emphasis on ways to discover latent disease, establishing causal relationship between diseases and work conditions; (4) serves as a principal focus for training programs to increase the number and competence of persons engaged in the practice of occupational safety and health; (5) develops and coordinates the appropriate reporting procedures which assist in accurately describing the nature of the national occupational safety and health problems; and (6) consults with the U.S. Depart-

ment of Labor, other federal agencies, state and local government agencies, industry and employee organizations, and other appropriate individuals, institutes and organizations with regard to promotion of occupational safety and health."

Program activities are carried out through the Offices of the Director, Extramural Activities, Administrative Management, Planning and Resource Management, Research and Standards Development, Manpower Development and Health Surveillance and Biometrics. These offices are located in Rockville, Md. and Cincinnati with staffs including Associate Directors for the specific areas.

Operating programs are carried out primarily in Cincinnati by the Divisions of Laboratories and Criteria Development, Field Studies and Clinical Investigations, Technical Services, Occupational Health Programs, Training and (at Morgantown, West Virginia) by the Appalachian Laboratory for Occupational Respiratory Diseases.

Staffs are diversified and include physicians, nurse consultants, hygienists, engineers, chemists, toxicologists, statisticians, physicists, physiologists and psychologists as well as other specialized personnel.

Prior to the passage of the Occupational Safety and Health Act of 1970, NIOSH was engaged in a broad program encompassing research and field investigations on occupational diseases, technical and consultative services, and short term training. Specific functions and activities include: environmental studies of uranium mines and medical studies of uranium miners to clarify the relationship to lung cancer of occupational exposure to radioactive ore; prevalence study of chronic chest disease problems in soft coal miners; long-term study to determine the occurrence of asbestosis and lung cancer in workers in the asbestos products industry; toxicologic and pathologic research on materials anticipated or encountered in the occupational environment, including determination of acute, subacute and chronic toxicity, safe limits of exposure, modes of action and tests for hypersensitivity; development of improved analytical and field sampling methods; studies of effect of heat on well being or work performance; national noise study; engineering, medical and nursing assistance and consultative services to states, federal agencies, and other groups; survey of employee health services in 7,000 general hospitals; a research grants program; and a technical information service.

The following additional activities as authorized by the Occupational Safety and Health Act of 1970 are being carried out: conduct of research for developing criteria for recommendations of new occupational safety and health standards for submission to the U.S. Department of Labor for promulgation; conduct of a grant program for support of demonstrations and training as well as of research at universities, state and local agencies, and other public and non-profit institutions; hazard evaluations in work places upon receipt of written requests from employers and representatives of employee groups; conduct, directly or by grants or contracts, of research, experiments

or demonstrations relevant to occupational safety and health, including studies of behavioral and motivational factors involved; conduct, directly or by grants, education programs to provide an adequate supply of qualified personnel to carry out the purposes of the Act; maintenance of an analytical and instrument calibration service for the Department of Labor; publication of an annual listing of all known toxic substances and the concentration levels at which such toxicity is known to occur; with the U.S. Department of Labor, review of state plans and grants; and consultation to the Secretary of Labor on various other provisions of the Act including the collection and compilation of national health and safety statistics.

Implementation of the Coal Mine Safety and Health Act of 1969. (See also under Bureau of Mines.) NIOSH responsibilities under the Act include: (a) operation of the medical examination program in which over 60,000 underground coal miners have been provided chest X rays through contracts with coal operators or directly by NIOSH. The Morgantown facility serves as the X-ray receiving station and processes the X rays: (b) development of mandatory health standards for the protection of life and the prevention of occupational diseases of miners, including standards on noise, which are then transmitted to the Department of Interior for publication and enforcement; and (c) the conduct of studies, research, experiments, and demonstrations to prevent or control occupational diseases originating in the coal mining industry. For example, the National Study of Coal Workers' Pneumoconiosis was conducted to provide basic research information for epidemiologic purposes. Approximately 10,000 miners in 31 selected mines in 10 states were given medical examinations. A considerable amount of research is underway on the development of techniques for prevention and control including identification of hypersusceptibles and the determination of relationship between the coal mine environment and occupational diseases. Interim standards for respirable dust exposure have been published. The Morgantown facility, which conducts much of the research, has also been designated the certification laboratory for safety equipment and sampling instruments.

As authorized by the Act, the Secretary of HEW appointed a Coal Mine Health Research Advisory Council which meets periodically to advise on research priorities.

Payment of Black Lung benefits authorized by the Act is the responsibility of the Social Security Administration. By June 1971, the SSA had received 297,162 claims, processed 267,042, and approved benefits for 126,396 miners or their widows, totalling more than \$313 million.

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) was formed in April, 1971 to carry out the functions assigned to the Secretary of Labor in the Occupational Safety and Health Act of 1970. It is headed by the Assistant Sec-

retary for Occupational Safety and Health, an Office established by the Act. By order of the Secretary of Labor (Federal Register, May 12, 1971), all safety and health responsibilities, personnel, and facilities assigned to the Employment Standards Administration (formerly called the Wage and Hour Administration) were transferred to the Assistant Secretary for OSHA. The former Bureau of Labor Standards was absorbed by the newly created Administration.

Responsibilities of OSHA are carried out through 1) the Federal and State Operations, 2) Office of Standards, and 3) Office of Training and Education. Field operations are conducted on a decentralized basis under 10 Regional Administrators who report directly to the Assistant Secretary for Occupational Safety and Health. They will supervise 50 area offices. Field staffs include safety engineers, safety officers and industrial hygienists who serve as safety and health compliance officers.

The Act also established the Occupational Safety and Health Review Commission, consisting of three members appointed by the President, to adjudicate disputes arising from the enforcement of the Act. This Commission is an independent agency and is not in the Department of Labor.

Major Responsibilities of OSHA under the Occupational Safety and Health Act of 1970 include the promulgation, modification and enforcement of occupational safety and health standards; inspections and investigations of premises of industrial establishments; issuance of citations and proposing penalties for job safety or health violations; conduct of programs (with HEW) for the education and training of employees and employers in recognition and prevention of unsafe or unhealthful working conditions in covered employments; operation of the grants program to states to assist in identifying their needs and for developing plans, and to assist in the enforcement of federal safety and health standards or equally effective state standards; formulation of regulations requiring employers to keep and make available to the Secretary of Labor and the Secretary of HEW records on certain employer activities, employee exposures to potentially toxic substances or harmful physical agents, and records and reports of work-related deaths, injuries and illnesses. Interim standards with which all employers subject to the Act must comply, entitled "Occupational Safety and Health Standards" and consisting of certain National Consensus Standards and Established Federal Standards have been promulgated (Federal Register, May 29, 1971, Part II).

Other Functions and Responsibilities. OSHA is also delegated responsibility for implementing and enforcing the safety and health aspects of other Acts including the following:

The Walsh-Healy Public Contracts Act was passed in 1936, and applies to contracts for materials and supplies exceeding \$10,000. It conferred on the Department of Labor responsibility for protecting safety and health of workers, and authority to promulgate safety and health standards with which employers must comply. Safety inspectors in-

spect the establishments of contractors, and those who do not comply with rules and regulations are not permitted to bid upon future government contracts.

McNamara-O'Hara Service Contract Act applies to contracts for service to the federal government exceeding \$2,500.

Federal Construction Act was passed in 1969, and applies to federal and federally assisted or financed construction contracts exceeding \$2,000. *The Longshoremen's Act* enacted in 1959, empowered the Department of Labor to establish safety and health standards for longshoremen and shipyard workers.

Other functions of OSHA include supervision and direction of a federal employees safety program through the Federal Safety Council; conduct of safety training courses for governmental personnel, industry, and unions; and assistance to states and others in the development of safety codes and improvement of employment standards through better administration and legislation.

Bureau of Labor Statistics

The Bureau of Labor Statistics is the fact-finding agency of the Department in the field of labor economics and statistics. The collection and compilation of work-injury statistics is the immediate responsibility of the Division of Industrial Safety. Annual mail surveys of work injuries which provided the basis for frequency and severity rates per 1,000,000 hours worked have been conducted for many years on a voluntary basis in a sample of industries. Rates have been published for industry groups and by states. In 1970, 17 states participated in the collection and tabulation of the annual reports.

Under the Occupational Safety and Health Act of 1970, the Secretary of Labor, in consultation with the Secretary of Health, Education and Welfare, is authorized to develop and maintain a program of collection, compilation and analysis of statistics on work-related injuries and illnesses, other than minor injuries requiring only first-aid treatment. The Bureau of Labor Statistics was delegated the responsibility of carrying out this program (Secretary of Labor's Order 12-71; Federal Register, Wednesday, May 12, 1971), as well as the provision regarding grants to states to assist them in developing and administering programs dealing with occupational safety and health statistics. With the passage of these provisions, the federal government was authorized for the first time to collect and compile statistics on work-related injuries and illnesses on a national basis. Regulations of the Secretary of Labor entitled "Recordkeeping Requirements under the Williams-Steiger Occupational Safety and Health Act of 1970" have been published and disseminated to employers subject to the Act.

The regulations require employers to keep records on reportable injuries and illnesses as defined, and to file an annual report as prescribed with the Secretary of Labor, upon request. Because of emphasis on lack of statistics on occupational illnesses during the hearings prior to the enactment of the Act, the system designed specifies seven categories of reportable work-related illnesses.

Bureau of Employees' Compensation

The Bureau administers the Federal Employees' Compensation Act applicable to Federal civilian employees; the Longshoremen's and Harbor Workers' Compensation Act which covers private maritime employment on navigable waters in the United States, and also applies to employment in the District of Columbia; and several other Acts covering military and other personnel.

DEPARTMENT OF THE INTERIOR

Bureau of Mines

The Bureau of Mines has responsibility for protecting the safety and health of workers employed in the coal, metal and non-metallic mining industries. The Bureau has been in operation since 1910 when, as a result of a series of coal mine disasters, it was established in the Department of the Interior. Its major functions then were limited to the study of safe methods and appliances best adapted to prevent mine accidents and disasters. Subsequent legislation provided authority for coal mine inspection (1941) and in 1952, enforcement of the Mine Safety Code, including the closing of mines if imminent danger existed. The Bureau also carries out functions dealing with inspections and enforcement of health and safety standards, delegated to the Secretary of Interior, in the Federal Metal and Nonmetallic Mine Safety Act of 1966, and the Federal Coal Mine Health and Safety Act of 1969. The Bureau is composed of a headquarters in Washington, D.C., and a field organization of district offices, technical support centers and field health groups.

The Bureau through its Health and Safety Activity conducts programs of mine research and development, approval and testing of mining equipment and protective devices, certification of respirators, mine inspections and field investigations, safety education and training, and mine accident statistics analysis. It is responsible for the formulation and enforcement of health and safety standards. The Bureau has worked closely with NIOSH, HEW, in research and studies of dust diseases over the years.

Responsibilities of the Bureau under the Federal Coal Mine Health and Safety Act of 1969 include annual inspections and investigations in coal mines; development, promulgation and revision, as necessary, of improved mandatory safety standards (in consultation with HEW, and others) and the promulgation of mandatory health standards transmitted by NIOSH, HEW; enforcement of the Act's interim mandatory safety and health standards together with the Interim Compliance Panel, established by the Act to hold hearings and review permit requests from Coal operators for temporary periods of noncompliance with interim respirable dust standards; establishment of specifications for personal sampling equipment; evaluation of dust measuring instruments and those approved for usage under the Act; and expansion of education and training programs in recognition and prevention of accidents or unsafe working conditions. The Secretary of the Interior in coordination with the Secretary of HEW and of

Labor is authorized to make grants to states to assist in developing and enforcing effective coal mine health and safety laws, among other functions.

Under the Act, operators are required to carry out respirable dust sampling programs in coal mine atmospheres by devices and in a manner approved by the Secretary of the Interior and the Secretary of HEW. The samples are transmitted to the Bureau's Pittsburgh Dust Laboratory where they are weighed automatically. Some 30,000 samples are processed monthly. Data are computerized out of the Denver Office and results sent to the Districts and coal mine operators. A periodic sampling scheme has been developed which permits the Bureau to maintain control on exposures in working sections of mines, and at the same time, provide environmental data for epidemiologic purposes.

The Act also provides that operators make arrangements in advance for obtaining emergency medical assistance and transportation of miners requiring such assistance; selected agents of the operator be trained in first aid; and coal mines to have adequate supplies of first-aid equipment at strategic locations at and near working places. The Secretary of the Interior may also require operators to provide potable water and sanitation facilities.

Mandatory safety standards are being proposed for the prevention of explosions from inflammable gases that may be found in underground coal mines. These include methane, carbon monoxide, hydrogen sulfide and others.

Other Federal Agencies

A number of other federal agencies have vested authority in some aspect of occupational safety and health. For example, *the Department of Transportation*, through its assistant Secretary for Systems Development and Technology, has responsibility for the regulation of the transportation of hazardous materials in interstate and foreign commerce and the conditions under which hazardous chemicals may be shipped by carriers. Through the Hazardous Materials Regulations, it also controls the transportation and packaging of radioactive materials.

The Department of Commerce, through the Bureau of Standards, contributes greatly to the evaluation of the industrial environment through its research and central national services in broad program areas, covering basic, material, and technological measurements and standards.

The Department of Defense was established by the National Security Act Amendments of 1949, which also provided that the Departments of the Army, Navy and Air Force be military departments within it. Each of the three departments have in operation extensive occupational medicine, safety, industrial hygiene and environmental health programs conducted for the protection of the safety and health of their own employees in the various installations, bases, repair shops and shipyards in the United States.

In the Department of the Army, occupational safety and health activities are responsibilities of

the Army Environmental Hygiene Agency; in the Department of Navy, of the Industrial Hygiene and Safety Branch; and in the Department of the Air Force, of the Bio-environmental Engineering Program. Activities also cover radiological health aspects, air pollution, hearing conservation programs, disaster preparedness, acoustics and research into allied areas.

The Atomic Energy Act, amended in 1959, provides for the establishment of the Federal Radiation Council to advise the president on radiation matters affecting health, the formulation of standards, and the establishment of cooperative programs with the states.

The Food and Drug Administration, HEW, has enforced the 1960 Federal Hazardous Substances Labeling Act designed to protect consumers from the misbranding of hazardous substances used in industry and in the home.

Federal Employee Health Services

The Occupational Safety and Health Act of 1970 requires each federal agency to establish and maintain a comprehensive safety and health program for its employees, consistent with the Department of Labor's safety and health standards required of industry.

Most federal agencies have established such programs. However, depending upon appropriations, activities and number of employees, extent of services provided varies widely. Agencies may operate their own programs, or they may contract for care with the Division of Federal Employee Health, Public Health Service, or with private medical sources. The Civil Service Commission, through its Bureau of Retirement, Insurance and Occupational Health, also promotes government-wide occupational health and safety programs for federal employees in those establishments that have not as yet arranged for such services.

STATE AND LOCAL AGENCIES

Occupational Health Programs

Until the passage of the Federal Occupational Safety and Health Act of 1970, direct legal responsibility for the health and safety of employed workers rested with state governments. The first state industrial hygiene programs were established in 1913 in the New York Department of Labor and Ohio Department of Health. Growth in initiation of additional programs lagged until 1936 when Social Security funds were made available for expansion of public health programs including industrial hygiene. The mounting silicosis problems of the 1930's also influenced the creation of several programs. Other major events that precipitated their development were World War II and the designation of federal grants-in-aid from 1947 to 1950. During these three years, state and local programs reached an all-time high. The withdrawal of these funds and decreases in state appropriations resulted in retrogression of occupational health activities reflected in a loss of personnel and discontinuance of some programs. However, not all programs were affected to the same degree. Because of the basic expertise of industrial hygiene staffs, many units were given

additional responsibilities in areas of air pollution control and radiological health which helped to stabilize financial situations.

State occupational health programs are at crossroads once more. The implementation of the Occupational Safety and Health Act of 1970 may well alter the operating patterns of both state health and labor agencies.

Administration. Primary objectives of a state governmental program in occupational health are the provision of direct services in the recognition, evaluation and control of occupational health hazards and the promotion of basic preventive health services for workers in all places of employment.

The design and operation of programs will necessarily vary widely from state to state, depending upon extent of industrialization, size and type of industrial establishments, administrative support, program resources, and legislative and political mandates, among other factors. Most state and local occupational health units operate as subdivision of environmental health bureaus in departments of health. A few are independent units. The establishment of the Environmental Protection Agency as a separate federal agency may well influence state counterparts to break away from the health department. Should this be the case, as in Pennsylvania, the Occupational Health activity is likely to be transferred also. When in a state labor agency, the industrial hygiene activity functions either as a separate administrative entity, or in a division of industrial safety. Regardless of where the program operates, provision should be made for adequate financing, staffs, facilities and equipment.

Personnel. A broadly-based program requires many disciplines including industrial hygienists, engineers, physicists, chemists, physicians, nurses and supporting auxiliary staff. For an effective minimum environmental program, staff should include at least one administrator, well-trained in industrial hygiene, one full-time field industrial hygienist, one specially trained chemist, and at least one secretary-stenographer. An approximate rule-of-thumb for field industrial hygienists is one per every 35,000 workers in areas with heavy industries; and in less industrialized areas, the recommended ratio is one per every 50,000 workers.

In view of the perennial shortage of qualified and trained personnel, consideration should be given to the use of technicians and industrial health aides who could, under proper supervision, perform many of the routine tasks necessary in work environment control. Recruitment of personnel could come from qualified junior college or high school graduates. In addition to on-the-job training, these individuals should be given an opportunity to attend short-term training courses, and if indicated, time to attend and work towards a degree at some local college.

Budgets. Budget allocations should be provided for: salaries of personnel (which should be adequate in order to recruit and retain qualified personnel); travel; field and laboratory instruments, both for new and replacements; allowances for

manuals, books and professional journals, printing, postage and communications; and allowances for special consultation services in areas for which the occupational health agency lacks personnel and/or capabilities.

Legislation and Regulations. For effective operation of a program, specific statutory authority regarding investigations of occupational health hazards is generally desirable. Such legislation should include right of entry, inspections, investigations, rule making and promulgation, and enforcement powers. In actual practice, a diversity of situations exist. In some states, the authority is derived from broad powers of state health departments and labor authorities; in other states, it is specific, but may vary in extent of vested responsibilities. In others, authorities overlap or are divided between two or more departments.

The situation regarding state rules and regulations governing health and safety at work places is generally described as "chaotic." In some states, regulations may be general in scope, in others specific for industry or processes or segments of the workforce, and in others absent altogether. Separate regulations dealing specifically with prevention and control of occupational health hazards exist in a few states or may be combined with accident prevention. "Occupational Safety and Health Standards," which were promulgated by the U.S. Department of Labor in 1971, take precedence over the existing, inadequate state laws and regulations, and may well bring order and uniformity in regulations governing safety and health of workers.

Functions and Activities. The operation of state occupational health programs is based on the philosophy that corrective measures in industry for the protection and improvement of the health of workmen are accomplished largely by private efforts and funds. The important task for the state or local occupational health agency is to point out to industry how to solve its own health problems. The types of services which the occupational health agency can provide alone or in cooperation with other groups are extensive and will depend upon the agency's resources and occupational health problems in the area.

As a rule, in inaugurating a program, the first step is the development of an occupational profile of the area. This includes obtaining information on the characteristics of the labor force, types and locations of industries, prevalence of occupational diseases and injuries, availability of community resources, and functions of other agencies with responsibility for health and safety of workers.

Associated with the profile is the "preliminary" or "walk-thru" survey of a well-designed sample of industrial establishments. By this means, information is collected on potential health hazards and their control, availability of preventive health services to workers, extent of safety activities, adequacy of sanitation facilities, house-keeping practices, general ventilation and illumination. Frequently, advice on control of obvious hazards can be offered on the spot. Such surveys

also offer the program administrator an opportunity to become acquainted with the industries in the area under his jurisdiction.

A well-balanced program includes both environmental, including industrial hygiene, and medical and nursing components. Following are examples of functions comprising the *environmental* component:

1. Routine inspections, surveys and technical studies of work places for identification of hazards and their control. Surveys and studies usually require the collection of air samples for contaminant evaluation and materials for laboratory analysis, field measurements of noise, vibration, ionizing and non-ionizing radiations, heat, extremes of pressures, illumination and ventilation.

2. Supportive laboratory services including the calibration of instruments.

3. Follow-up on compliance with recommendations made for improvement or control of health hazards.

4. Professional investigation of reported or suspected occupational diseases with recommendations for elimination or control of causative agents to prevent their recurrence.

5. Consultation services on industrial hygiene matters at request of management, labor, physicians, nurses and others.

6. Review and examination of engineering plans for plant alterations and installation of environmental control equipment.

7. Development and distribution of occupational health materials such as periodic bulletins, information sheets, etc., to employers, employee groups and others concerned.

8. Maintenance of adequate records and reports including lists of new industries coming into the area.

9. Maintenance of cooperative working relationships with other official agencies such as state departments of labor, mine inspectors, state fire marshalls and industrial commissions on matters relating to health and safety at the work place.

10. Writing of needed or improved and updated regulations governing health and safety at the work place or providing assistance to the agency authorized to promulgate such rules and regulations.

Examples of medical and nursing services that can be offered to industry include:

1. Medical consultation to management, labor and private physicians on recognition and diagnosis of occupational diseases.

2. Cooperation with medical societies and individual physicians in the stimulation of proper replacement examinations in industry.

3. Medical consultation in industry regarding health services for in-plant medical departments.

4. Promotion of nursing services in industry and nursing consultation to plant nurses in improvement of health services or to first-aid workers regarding emergency first-aid procedures.

5. Promotion of and assistance with establishing cooperative preventive health services for workers in small plants.

6. Assistance with establishment of employee health services for workers in governmental state or municipal jurisdictions.

7. Consultation to community health agencies regarding extension of public health services to the working population and assistance with their implementation.

8. Participation in joint medical and environmental studies of workers exposed to specific health hazards.

Status of Currently Operating Programs. In actual practice, occupational health programs ranging from token to relatively sophisticated activities operate in practically all the states. Administration is as diversified as the scope of the programs. Ten units are located in state departments of labor, 42 in state departments of health, one in a Department of Environmental Resources (Pa.) and some 40 in local health departments. In several states, programs operate in both health and labor agencies. The smallest units usually consist of part-time or at most, one full-time industrial hygienist working alone, with reliance on others for laboratory support. Larger units may also be staffed by chemists, physicians, consultant nurses, health educators, statisticians and supporting auxiliary staff. Where air pollution and/or radiological health is part of the unit, staffs include various specialists in these areas.

Best developed phases of programs deal with engineering services. Because of continuous loss of personnel, medical and nursing activities are responsibilities of only a small number of units. On the other hand, about one-half of the state units continue to have responsibilities in areas of radiological health and air pollution control. Activities range from provision of laboratory services, monitoring of air and fall-out materials, studies of community air pollution in collaboration with other agencies, to full direction of both community and occupational aspects. In a number of instances such responsibilities have constituted a drain on the occupational health activities, whereas in others they have given the program more visibility.

Major Constraints. As is typical of many governmental agencies, problems of most currently operating units center on inadequate budgets, manpower shortages, inadequate legislative authority, inadequate salaries, poor leadership and lack of administrative support. The lack of quantitative data on prevalence of occupational diseases is also frequently mentioned as a handicap in obtaining funds, but as a rule this is not a deterrent to many of the more effective programs. Considerable knowledge exists on the kinds of occupational diseases and potential health hazards that are associated with specific occupations and industries, and this can be used as a guideline in setting up priorities.

Factors Contributing to Effectiveness of Operating Programs. These include strong leadership; sup-

port of the department and legislature; good budget justification and program planning; periodic self-appraisals of goals, accomplishments and needs; professionally competent and dedicated staffs; adequate salaries, retirement and health benefits; opportunity for graduate training, self-advancement, and self-expression as in writing articles for publication; participation of staff in activities of professional organizations; good public relations, and rapport with industry and labor; mutual inter-change of problem referrals between the occupational health unit and the labor authority; foresight and resources to tackle new problems; prompt response to requests for service; and high caliber of technical services provided.

Impact of Occupational Safety and Health Act of 1970. It is too soon to determine the impact of the Occupational Safety and Health Act of 1970 on the existing state and local occupational health units. Governors in most of the states have designated the agency or agencies to receive grants for planning and conducting occupational safety and health programs. According to the "Directory of Governmental Occupational Safety and Health Personnel, January 1972" (available from NIOSH), labor authorities were so designated in 32 states and Puerto Rico; state health departments in 4 states (Kentucky, Massachusetts, Oklahoma and South Dakota) and both state labor authority and the health department in 8 states (Connecticut, Hawaii, Louisiana, Michigan, New Hampshire, New Mexico, Tennessee and Virginia). In 5 other states, designated agencies vary. For example, in West Virginia, 4 different agencies were named, including the State Health Department. In Texas, the Occupational Safety Division (counterpart of a state department of labor) of the State Department of Health was so designated.

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CHAPTER 50

AN INDUSTRIAL HYGIENE SURVEY CHECKLIST

Robert D. Soule

Previous chapters have discussed in detail both the theoretical and practical aspects of the various interrelated considerations of which the industrial hygiene profession is comprised. In conducting any given industrial hygiene survey, the investigator must follow a prescribed set of procedures incorporating the "scientific method" of problem solving. In its simplest form, this method can be described as consisting of five distinct phases: recognition and definition of the problem, design of studies, quantification of the problem (i.e., data acquisition), evaluation of data, solution of the problem. The experienced industrial hygienist uses this approach, often without full awareness of its being used; a person relatively inexperienced in the practice of industrial hygiene requires some means of identifying and using the sequence of steps of the method.

It is the purpose of this chapter, therefore, to present in simple checklist format, the various steps required in conducting an industrial hygiene survey. Although designed primarily for the "neophyte" in industrial hygiene, such a procedural outline has value to the experienced industrial hygienist as well, since it minimizes the possibility of overlooking various aspects of a study and maximizes the overall efficiency of the survey.

Chapters in this Syllabus which discuss in detail the various points presented in this checklist are indicated by the numbers in parentheses following the specific items.

AN INDUSTRIAL HYGIENE SURVEY CHECKLIST

- Determine purpose and scope of study (2, 8, 9, 10).
 - Comprehensive industrial hygiene survey?
 - Evaluation of exposures of limited group of workers to specific agent(s)?
 - Determination of compliance with specific recognized standards?
 - Evaluation of effectiveness of engineering controls?
 - Response to specific complaint?
- Discuss purpose of study with appropriate representatives of management and labor.
- Familiarize yourself with plant operations (2, 10).
 - Obtain and study process flow sheets and plant layout.
 - Compile an inventory of raw materials, intermediates, by-products and products (2, 4, 10).
- Review relevant toxicological information (7, 8, 17, 48).
- Obtain a list of job classifications and the environmental stresses to which workers are potentially exposed.
- Observe the activities associated with job classifications (32).
- Review the status of workers' health with medical personnel (17, 48).
- Observe and review administrative and engineering control measures used (35, 36).
- Review reports of previous studies.
- Determine subjectively the potential health hazards associated with plant operations (7-10, 17, 24, 26-34).
- Prepare for field study.
 - Determine which chemical and physical agents are to be evaluated (7, 23, 25, 26-34).
 - Estimate, if possible, range of contaminant concentrations.
 - Review, or develop if necessary, sampling and analytical methods, paying particular attention to the limitations of the methods (e.g., sensitivity, specificity, (11-16, 18-21, 25-29, 31, 40).
 - Calibrate field equipment as necessary (11, 12).
 - Assemble all field equipment.
 - Obtain personal protective equipment as required (hard hat, safety glasses, goggles, hearing protection, respiratory protection, safety shoes, coveralls, gloves, etc.) (36).
 - Prepare a tentative sampling schedule.
- Conduct field study (9, 10, 13, 15, 16, 25, 26, 27, 28, 29, 31, 32).
 - Confirm process operating schedule with supervisory personnel.
 - Advise representatives of management and labor of your presence in the area.
 - Deploy personal monitoring or general area sampling units.
 - For each sample, record the following data:
 1. Sample identification number.
 2. Description of sample (as detailed as possible).
 3. Time sampling began.
 4. Flowrate of sampled air (check frequently).
 5. Time sampling ended.
 6. Any other information or observa-

- tion which might be significant (e.g., process upsets, ventilation system not operating).
- Dismantle sampling units.
- Seal and label adequately all samples (filters, liquid solutions, charcoal or silica gel tubes, etc.) which require subsequent laboratory analyses.
- Interpret results of sampling program.
 - Obtain results of all analyses (14, 18, 19, 20, 21, 22).
 - Determine time-weighted average exposures of job classifications evaluated (8, 9, 10).
 - Determine peak exposures of workers (8, 9, 10).
 - Determine statistical reliability of data, e.g., estimate probable error in determination of average exposures.
 - Compare sampling results with applicable industrial hygiene standards.
- Discuss survey results with appropriate representatives of management and labor.
- Implement corrective action comprised of, as appropriate:
 - Engineering controls (isolation, ventilation, etc.) (35-46, 52).
 - Administrative controls (job rotation, reduced work time, etc.)
 - Personal protection (36).
 - Biological sampling program (17, 48).
 - Medical surveillance (17, 48).
- Determine whether other occupational safety and health considerations warrant further evaluation:
 - Air pollution? (43)
 - Water pollution? (44)
 - Solid waste disposal? (45)
 - Safety? (47)

CONVERSION FACTORS AND EQUIVALENTS

(Arranged Alphabetically)

<p>1 acre = 4047 m² 1 atmosphere = 14.7 lb/in² = 29.92 in Hg = 760 mm Hg = 1.013 × 10⁶ $\frac{\text{dynes}}{\text{cm}^2}$</p> <p>1 bar = 10⁶ dynes/cm² 1 B.t.u. = 0.252 kilocalories = 778 foot-pounds (ft-lb) 1 B.t.u./min = 12.96 ft-lb/sec. 1 B.t.u./hr-ft² = 0.0003154 watts/cm²</p> <p>1 calorie = 4.186 Joules 1 calorie/sec-cm² = 13.272 B.t.u./hr-ft² = 4.186 watts/cm² 1 candela = Footcandles × D² (Distance in feet from source to illuminated object) = lumens = $\frac{12.57 \text{ ft.}^2 \text{ (area of a sphere of 1 ft radius)}}{12.57 \text{ ft.}^2 \text{ (area of a sphere of 1 ft radius)}}$</p> <p>°C (Centigrade) = [°F (Fahrenheit) - 32] ÷ 1.8 1 centimeter/second (cm/sec) = 1.97 ft/min = 0.0224 mile/hr = 1.9685 ft/min</p> <p>1 cubic centimeter (cm³) = 0.0610 cubic inch (in³) 1 cubic foot (ft³) = 28.32 liter = 7.481 gallons (gal) 1 cubic foot (ft³) of air at 70°F and 1 atmosphere weighs 0.075 lb 1 cubic foot (ft³) of water (H₂O) at 62°F weighs 62.32 lb 1 cubic meter (m³) = 35.315 cubic feet (ft³) = 1000 liters (l)</p> <p>1 dyne/cm² = 0.0021 lb/ft²</p> <p>1 electron Volt (eV) = 1.6 × 10⁻¹² ergs</p> <p>°F (Fahrenheit) = 1.8 × °C (Centigrade) + 32 1 foot (ft) = 30.48 cm 1 ft of water (H₂O) = 0.4335 lb/in² 1 footcandle = 1 lumen incident/ft² = 10.764 lumen incidents/m² = $\frac{1 \text{ lumen}}{1 \text{ lumen/ft}^2}$ = 10.76 LUX (surface area in sq. meters) 1 foot lambert = $\frac{1 \text{ lumen (reflected or emitted)}}{\text{ft.}^2}$ = 1 foot candle (reflected or emitted) 1 gallon (gal) = 3.785 liter 1 gal (U.S.) of H₂O at 62°F weighs 8.33 lb. 1 gram = 15.43 grains = 10³ milligrams (mg) 1 gram-calorie = 0.00397 B.t.u.</p>	<p>1 gram/cm³ = 62.43 lb/ft³ = 8.345 lb/gal</p> <p>1 Hertz = 1 cycle/sec 1 horsepower (hp) = 0.707 B.t.u./sec = 550 ft-lb/sec = 0.75 kilowatt = 2545 B.t.u./hr</p> <p>1 inch (in) = 2.540 cm 1 in. of mercury (Hg) = 0.4912 lb/in² = 13.57 in H₂O</p> <p>1 Joule = 10⁷ ergs = 0.239 calories</p> <p>°K (Kelvin) = 273 + °C 1 kilogram (kg) = 2.205 pounds (lb) 1 kilometer (km) = 1000 m = 0.6214 mile</p> <p>1 liter = 1.057 quarts (U.S., liquid) = 0.03531 ft³ = 1000 cubic centimeters (cm³ or cc) Lumen = Footcandles × Area (sq. ft.) = candela × 12.57 ft² = Foot lamberts × sq. ft. area reflecting or emitting light flux.</p> <p>1 meter (m) = 3.281 feet (ft) = 39.37 inches (in) = 10⁶ microns (μ) = 10³ millimeters (mm) = 10² centimeters (cm)</p> <p>1 milligram (mg) = 10³ micrograms (μg) 1 mg/m³ = 0.000437 grains/ft³ 1 millimeter (mm) Hg = 1.36 cm of H₂O</p> <p>1 ounce (oz) = 28.35 grams</p> <p>Pi (π) = 3.1416 1 pound (lb) = 453.6 grams = 16 ounce (oz)</p> <p>1 pound/square inch (lb/in²) = 2.31 ft. H₂O</p> <p>°R (Rankine) = 460 + °F</p> <p>1 square foot (ft²) = 0.0929 square meter (m²) 1 square inch (in²) = 6.452 square centimeters (cm²)</p> <p>1 square kilometer (km²) = 0.3861 square mile (mile²) (U.S.)</p> <p>1 Volt = 1 Joule/coulomb 1 Watt = 1 Joule/sec</p>
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INDEX

- ACCIDENT CONTROL.** See **SAFETY.**
- AEROSOLS,** direct reading instruments for, 181
properties of, 181
source devices, 134
toxicity, 69
- AIR CONTAMINANTS,** batch mixtures of, 123
effects on respiratory system, 155
flow dilution systems, 126
properties of, 577
sampling techniques for gases and vapors, 167
sizing, 155
threshold limit values, 98
types, 139
- AIR FLOW,** 573
devices for air movement, 581, 620
fundamentals, 575
instruments for, 583
make-up air, 580, 623
measurements, 589
systems, evaluation of, 583, 584
surveys, 593
- AIR POLLUTION,**
legislation, 630
stack emission control, 629
- AIR QUALITY ACT OF 1967,** 630
- AMERICAN CONFERENCE OF
GOVERNMENTAL INDUSTRIAL
HYGIENISTS,** 53, 84, 86
heat stress guide, 425
TLV for noise, 327, 526
ultraviolet radiation, 361
- AMERICAN INDUSTRIAL HYGIENE
ASSOCIATION,** 86, 526, 531
- AMERICAN NATIONAL STANDARDS
INSTITUTE,** 81, 86, 530
- ANALYTICAL CHEMISTRY,** 26, 207
classical methods, 26
industrial hygiene in, 207
instrumental methods, 27
ion exchange, 217
separation processes, 207, 221
solvent extraction, 208
- ANALYTICAL METHODS,** 26
atomic absorption spectrophotometry, 241
batch extraction, 211
batch technique, 219
column chromatography, 219
continuous extraction, 211
countercurrent distribution, 211
electrochemical, 28, 183
emission spectroscopy, 247, 254
exclusion chromatography, 221
fluorescence spectrophotometry, 238
gas chromatography, 257
gas-liquid chromatography, 262-264
gel permeation chromatography, 221
gravimetric, 27
infrared spectrophotometry, 27, 235
ion exchange extraction, 217
liquid-liquid partition chromatography, 27, 221
solvent extraction, 208
thermal diffusion, 221
thin layer chromatography, 219, 221
ultraviolet spectrophotometry, 27, 229
visible light spectrophotometry, 27, 224
volumetric, 26
x-ray diffraction, 28
x-ray fluorescence, 28
zone refining, 221
- ANATOMY OF FUNCTION,** 433
anatomical failure points, 439
glossary of terms, 488
kinetic chains, 437
kinetic elements, 435
lever systems, 433
limb movement, 439
- ANTHROPOMETRY,** 440
definition of, 440
glossary, 488
industrial seating, 441
selection and evaluation of tools, 458
workplace dimensions, 443
- BIOCHEMISTRY,** 31
carbohydrate metabolism, 42
detoxification processes, 46
energy production, 31
enzymes, 34
hemoglobin structure, 32
lipid metabolism, 41
mitochondrial oxidative phosphorylation, 44
monitoring, 46
protein synthesis, 36
waste removal, 45
- BIOMECHANICS,** 431
anatomy of function, 433
anthropometry, industrial, 439-441
definition, history, 431
evaluation, 472-479
glossary, 488-492
handtools, selection and evaluation, 458
materials-handling and lifting, manual, 461
measurement, 470
motion economy, principles of, 444-47
work tolerance, 447
- CALIBRATION,** 101
collection efficiency, 101-102
flow and volume, 104
instruments, 101, 104
methods and procedures, 103
sample stability, 102
sensor response, 102
standards for, 102
techniques, 104
types of, 101
- CHEMISTRY,** review of, 19, 61
analytical, 26
inorganic, 19
organic, 22
- CLEAN AIR AMENDMENTS OF 1970,** 630
- CLOTHING.** See **PROTECTIVE CLOTHING.**
- CODES,** definition of, 85
enactment of, 88
respiratory protective devices, 526
- COLD,** exposure to, 569
protective clothing for, 569, 572
windchill index, 426
- COLLECTION DEVICES,** 142
combustion incinerators, 643
comparison and evaluation of, 645
cyclones, 145, 633
efficiency of, 119
electrostatic precipitators, 143, 639
elutriators, 144
filtration, 142, 636
gas adsorbers, 641
gas and vapor, 167-168
gravity chambers, 631
impingement, 143
mechanical separators, 631
membrane filters, 143

INDEX — continued

- thermal precipitation, 143
- wet collectors, 637
- CONTROL**, community noise, industrial, 667
- dermatoses, occupational, 507-509
- heat and cold exposures, of, 563
- noise exposure, of, 533
- occupational environment, 511
- quality, 277
- safety engineering, 686
- solid waste, 657
- stack emissions, 630
- water emissions, 647
- CONVERSION FACTORS AND EQUIVALENTS**, 713
- DERMATITIS (OCCUPATIONAL)**, 503
- barrier creams, for, 508
- causes of, 505
- definition and history of, 503
- engineering controls for, 507
- personal hygiene, 508
- prevention of, 507
- protective clothing for, 508
- types, clinical, 507
- DETECTOR TUBES**, 189-193
- DIRECT READING COLORIMETRIC DEVICES**, 188
- DIRECT READING PHYSICAL INSTRUMENTS**, 186-188
- aerosol photometry, 182
- chemiluminescence, 183
- combustion, 183
- coulometry, 183
- electrical conductivity, 183
- flame ionization, 184
- gas chromatography, 184
- photometry, 184
- polarography, 185
- radioactivity, 185
- thermal conductivity, 183
- DUST**, characteristics of, 139, 577
- sampling for, 145
- EARWEAR**, 527
- ECOLOGY**, 7
- EDUCATION**, in control of occupational environment, 515
- in community noise control, 679
- in control of solid waste, 666
- in industrial hygiene, 4
- EMISSIONS**, solid waste, 657
- stack, 629
- water, 647
- ENVIRONMENT**, control of, 10
- evaluation of, 95-100
- people in, 8
- standards of quality for, 75
- thermal, measurement of, 413
- EQUIPMENT**, collection devices, types, 631
- gas and vapor collectors, 181
- heat measuring, 413
- ionizing and non-ionizing radiation detectors, 361, 389
- light measuring devices, 354
- particulate collectors, 639
- sound and vibration measuring equipment, 342
- ERGONOMICS**, glossary, 488
- history of, 431
- work tolerance, 447
- EXPONENTS**, laws of, 11
- exponential function, 14
- EXPOSURE LIMIT VALUES**, concentration/ measurement, 88
- source of data, 85
- uses, 87
- EYE**, effects of non-ionizing radiation, 363, 365
- protection from accidents, 687
- protection from lasers, 367, 368
- toxic chemicals, effect of, 65
- FLOW DILUTION SYSTEMS**, 126
- devices for aerosols, 134
- devices for gases and vapors, 127
- FUMES**, defined, 577
- types, 139
- sampling for, 139, 146
- GAS CHROMATOGRAPH**, 184
- applications, 257, 264
- calibration, 272
- columns, types of, 262
- components, 259
- definition of, 257
- design of, 259
- development of, 257
- operation, 271
- qualitative analysis, 269
- quantitative analysis, 271
- special techniques, 274
- theoretical aspects, 258
- GASES**, basic sampling techniques, 167
- direct reading instruments, for, 181
- effects, on respiratory system, 495
- grab sampling, 170
- ideal gas law, 21
- integrated sampling, 171
- known concentrations, 123
- methods of analysis, 177
- properties of, 182, 577
- sampling criteria for, 167
- source devices for, 127
- toxicity of, 69, 498
- GRAB SAMPLING**, gases and vapors, 170
- other applications, 170
- GUIDES**, definition of, 85
- series, hygienic, American Industrial Hygiene Association, 86, 531
- HANDTOOLS**, biomechanical considerations, 455
- HEALTH**, effects of environmental pollution, 204
- examinations, 201-203
- occupational, programs
- in industry, 693
- concepts, 694
- facilities for, 697
- integration of physical and environmental data, 695
- professionals in, 693
- record keeping, 697-698
- special programs, 699
- in government, functions of
- NIOSH, DHEW, 703
- functions of Department of Labor, 704-705
- functions of Department of Interior, 706
- responsibility for, 703
- responsibility of other Federal agencies, 706
- promotion of, human, 197
- services, Federal employees, 707
- State and local agencies, 707
- HEARING**, audiometry, 318
- conduction of sound, 309, 310
- loss classifications, 315

INDEX — continued

- mechanism of, 309
- noise exposure, effects on, 318
- perception of sound, 312
- HEAT**, control of occupational exposures, 563
 - control of engineering, 563
 - guide for assessing stress and strain, 425
 - illness, classifications and prevention, 410
 - indices of heat strain, 403, 420
 - indices of thermal stress, 418
 - loss, 402
 - measurement of thermal environment, 413
 - physiology of, 399
 - regulation of body temperature, 399
 - response to stress, 402
 - tolerance factors, 406
- HYDROCARBONS**
 - aliphatic, aromatic, 23
 - halogen derivatives, 24
 - oxygen derivatives, 24
- ILLUMINATION**. See **LIGHTING**.
- INDUSTRIAL HYGIENE**, check list for
 - conducting survey, 711
 - chemistry, 207
 - history, 1, 2
 - mathematical terms, 11
 - needs, 4
 - programs, 4
 - recent developments, 2
 - role of industrial hygienist, 198
 - scope and function, 3, 4
- INSTRUMENTS**, air flow systems, performance
 - of, 583
 - calibration of, 97, 101, 593
 - direct reading, colorimetric devices, 188
 - listing of, 190-193
 - direct reading, physical, for determining
 - concentrations of aerosols, gases and vapors, 182,
 - listing of, 186-188
 - for calibration, 101
 - dry gas meter, 106
 - flow velocity meters, 115
 - flowrate meters, 109
 - frictionless piston meters, 105
 - positive displacement, 109
 - spirometer, 105
 - water displacement, 105
 - wet test meter, 106
 - integrating, 425
 - selection for air sampling, 145
 - thermal environment measurement of, 414-418
 - to evaluate work environment, 96
- ION EXCHANGE EXTRACTION**, general
 - experimental techniques, 219
 - principles and terminology, 217
 - properties of materials, 218
- IONIZING RADIATION**, biological aspects, 387
 - definition, 377
 - dosimetry, 385
 - exposure categories, 386
 - irradiation by external sources, 391
 - irradiation by internal sources, 394
 - physical aspects, 379, electromagnetic, 379,
 - particulate, 382
 - quantities and units, 378
 - radiation protection, 389
 - terminology, 378
- LASER RADIATION**, biological effects, 363
 - exposure control, 367
 - exposure criteria, 364, 365
 - eye protection, 367, 368
 - measurement, 366
 - sources and uses, 362
- LEGISLATION**, enacted — **Air Quality Act**
 - of 1967, 630
 - Atomic Energy Act of 1954**, 88
 - Clean Air Amendments of 1970**, 630
 - Federal Coal Mine Health and Safety Act**
 - of 1969, 3, 82, 88
 - Federal Metal and Nonmetallic Mine Safety Act**
 - of 1966, 2
 - Occupational Safety and Health Act**
 - of 1970, 3, 86, 88, 89, 90, 99, 357, 519, 583, 606, 683, 686, 687, 698, 709
 - significance of, 89
 - Public Law 84-159**, 630
 - Radiation Control for Health and Safety Act**
 - of 1968, 357
 - Social Security Act of 1935**, 85
 - Walsh-Healey Act of 1936**, 88, 89
 - Workmen's Compensation Act**, 2
 - enforcement of, 91, 92
 - examples of citations, 91, 92
 - stack emissions, for, 630
- LIGHTING**, design of, 353
 - illumination requirements, for industry, 350
 - industrial, equipment, 352
 - procedures, 356
 - purpose, 349
 - results, evaluation of, 356
 - surveys, 355
 - terminology, 349
- LOCAL EXHAUST SYSTEMS**, 597
 - advantages, components, 597
 - design of, 613
 - principles of, 598
- LOGARITHMS**, common, 12
 - computation, 13
 - conversions, 13
 - natural, 13
- MATHEMATICS**, conversion factors
 - and equivalents, 713
 - graphing, 13
 - review of, 11
 - statistics, 15
- MEDICINE (OCCUPATIONAL)**, 197
 - approach to control, 201
 - medical examinations, 201
 - opportunities for research, 204
 - preventive medicine, 198
 - role of industrial hygienist, 198
 - role of nurse, 197
 - role of physician, 197
 - therapy, 203
- MISTS**, definition of, 577
 - sampling for, 140
- NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH**, organization of, 703
 - responsibilities of, 89, 336, 703, 704
- NOISE**, acceptability criteria, 325, 671
 - community, industrial sources, 667
 - abatement at plant, 679
 - acceptability by community, 671
 - exterior sources, 668
 - generating mechanisms, 667
 - materials handling, 670
 - measurement and evaluation, 671
 - pollution levels (NPL), 672
 - reduction at source, 676
 - control, analysis outline, 533
 - determination of source, 331
 - measures, 533
 - effects of excessive exposure, 318
 - hearing conservation program, 533

INDEX — continued

- measuring equipment, 321
 - calibrators, 322
 - frequency analyzers, 323
 - impulse meters, 322
 - sound level meters, 321
 - sound monitors, 324
- propagation characteristics, 307
- source modification, 538, 549
- speech interference, 328
- sound absorption, 550, 552, 559, 560
- survey techniques, 330
- transmission loss, 556-559
- NON-IONIZING RADIATION, 357**
 - laser, sources, 362
 - effects, 363
 - control, 367
 - measurement, 366
 - microwave, control of, 373
 - effects, 371
 - measurement, 372
 - sources, 368
 - ultraviolet, control of, 362
 - measurement of, 361
 - sources, effects of, 359
- OCCUPATIONAL ENVIRONMENT, control of, 10, 511**
 - by isolation, 512
 - by substitution, 511
 - by ventilation, 514
- evaluation of, 95
- exposure data, 79
- hazards in, 511
- part of total ecological system, 7
 - chemicals, energies, organisms, 8
 - people, 8
- standards (quality), 82
- OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970. See LEGISLATION.**
- OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, 703, 705**
- ORGANIC CHEMISTRY, basic concepts, 22**
- PARTICLES, airborne, 155**
 - collection of, 639
 - dust, 139
 - effects, on respiratory system, 498
 - fume, 139
 - measurement techniques, 160
 - mist, 139
 - related techniques, 162
 - sampling for, 139
 - sizing, 155
- PERSONAL PROTECTIVE DEVICES,**
 - barrier creams, 508
 - corrosive chemicals protection, 529
 - earwear, 527
 - emergency equipment, 530
 - eyewear, 367
 - heat and cold, 530
 - noise protection, 527
 - protective clothing, 528
 - respiratory protection, 519, 687
 - approval schedules, 519, 530
 - atmosphere supplying, 523
 - gas and vapor removing, 521
 - heat problems, for, 525
 - particle-removing, 519
 - program for industry, 526
 - self-contained, 524
 - special-purpose, 520
 - training, 525
 - types, 523-524
 - worker acceptance, 525
 - safety in, 687
 - skin protection, 530
- PHYSIOLOGY, basic cell functions, 51**
 - circulatory system, 56
 - defense mechanisms, 60
 - digestive system, 58
 - energy balance, 58
 - hormonal control mechanisms, 53
 - internal environment, 52
 - neural control mechanisms, 52
 - regulation of water and electrolytes, 57
 - respiratory system, 54
- PROTECTIVE CLOTHING. See PERSONAL PROTECTIVE DEVICES.**
- QUALITY CONTROL, Chi Square test, 293**
 - control charts, 278, 280, 286, 288
 - determinate error, 279
 - errors, 278
 - graphic analysis, 292
 - in detector tubes, 194
 - indeterminate error, 283
 - intra-laboratory programs, 294
 - principles, 277
 - variance, 294
 - Youden's graphical technique, 293, 294
- RADIATION, ionizing, 377**
 - non-ionizing, 357
- REGULATIONS, definition, 85**
 - enactment of, 88
- RESPIRATORS. See PERSONAL PROTECTIVE DEVICES.**
- RESPIRATORY SYSTEM, 54**
 - air conducting system, 494
 - anatomy and physiology of, 493
 - breathing, 55
 - control of respiration, 55
 - gases and particles, effects, 495, 496
 - industrial contaminants, influence of gases, 495,
 - dust particles, 496
 - inhalation exposure, 64
 - injury, manifestations of, 498
 - reaction to external agents, 497
 - residence time of particles, 501
- REVIEW, biochemistry of, 31**
 - chemistry, 19
 - mathematics, 11
 - physiology, 51
- SAFETY, 681**
 - accident control, precontact
 - stage, 683
 - contact stage, 687
 - post contact stage, 688
 - accident investigation, 688
 - detection system components, 683
 - economic loss, 682
 - engineering controls, 686
 - hazard classification, 684
 - historical perspective, 671
 - measurement of program effectiveness, 690
 - source of injuries, 473, 682
- SAFETY AND HEALTH LEGISLATION. See LEGISLATION.**
- SAMPLING, basic techniques, 167**
 - continuous (integrated), 171
 - gases and vapors, for, 167
 - grab (instantaneous), 170
 - heat, for, 414-418
 - ionizing and non-ionizing radiation, 361, 372, 385, 389
 - light, 355
 - noise, 330, 331
 - particulate matter, 139

INDEX — continued

- sound and vibration, 342-343
- stack sampling, 630-33
- train for particulates, 141
- SEPARATION PROCESSES,**
 - gas chromatography, 257
 - ion exchange, 217
 - other, 221
 - solvent extraction, 208
- SIZING METHODOLOGY, 155**
- SKIN, cutaneous irritants, 506**
 - defense mechanisms, 503
 - dermatitis, causes of, 505
 - laser radiation, effects of, 363-364
 - ultraviolet radiation, effects of, 360
- SMOKE, definition of, 577**
 - sampling for, 140
- SOLID WASTE (INDUSTRIAL), control, 664**
 - conversion, 661
 - disposal of, 663
 - generation of, 658
 - role of industry, 665
 - role of public agencies, 664
 - scope of, 657
- SOLVENT EXTRACTION, 208**
- SOUND, absorption, 307, 550, 552, 559, 560**
 - basic terminology, 299
 - decibel, 300
 - frequency analyses, 304
 - frequency bandwidths, 306
 - intensity, 302
 - levels, combining of, 303
 - measurement, 300, 321
- SPECTROPHOTOMETRY, 223**
 - atomic absorption, 241
 - fluorescence, 238
 - infrared, 235
 - terminology, 223
 - ultraviolet, 229
 - visible light, 224
- SPECTROSCOPY, EMISSION, 247**
 - applications in industrial hygiene, 253
 - definition, history of, 247
 - quantitative analysis, 252
 - sample types, 251
 - system components, 248
- STATISTICS, quality control application, 278**
 - curve fitting, 17
 - frequency distributions, 15
 - measures of central tendency, 15
 - measures of dispersion, 16
 - terminology in industrial hygiene, 17
 - testing hypotheses, 16
- STANDARDS, air quality, 75, in workroom, 76**
 - application of, 83
 - asbestos, 89
 - basic principles of, 75
 - definition of, 85
 - development of, 78, 80, 86
 - enactment, 88
 - established by ACGIH (TLV), 80, 86, 530,
and ANSI, 81, 86, 530
 - Federal, 82
 - Foreign, 82
 - respiratory protective devices, 526
 - utilization of, 82
 - ventilation, 607
- SURVEYS, air flow system, 593**
 - basic field, 98
 - industrial hygiene, checklist, 711
 - industrial hygiene, physician's standpoint, 698
 - interpretation of findings, 99
 - lighting, 355
- TOXICOLOGY, INDUSTRIAL, 61**
 - classification of materials, 68
 - disciplines involved, 61
 - dose-response relationships, 62, 87
 - exposure routes, 63-65
 - history, 61
 - intensity of action, 67
 - response criteria, 65
- ULTRAVIOLET RADIATION, 357**
 - biological sources and effects, 359
 - exposure control, 362
 - exposure criteria, 361
 - measurement of, 361
- U.S. ATOMIC ENERGY COMMISSION, 88**
- U.S. DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF
STANDARDS, 87, 706**
- U.S. DEPARTMENT OF HEALTH, EDUCATION,
AND WELFARE, PHS, 2, 86, 703**
- U.S. DEPARTMENT OF INTERIOR,
BUREAU OF MINES, 88, 526, 687, 703, 706**
- U.S. DEPARTMENT OF LABOR, 703, 705**
- U.S. DEPARTMENT OF TRANSPORTATION,
706**
- VAPORS, definition, 577**
 - direct reading instruments for, 182
 - properties of, 182
 - source devices, 127
- VENTILATION SYSTEMS, air moving devices,
581, 620**
 - classifications, 573
 - definition, 573
 - design for industrial hygiene, 609
 - dilution, 577
 - fan laws, 621
 - fan selection, 581, 621
 - fan vibration, 622
 - general, 573, 609
 - glossary, 574, 575
 - local exhaust, 574, 597, 598, 600, 604, 613
 - make-up air, 580, 623
 - standards and regulations, 606
 - systems, design of, 609
- VIBRATION, characteristics, 338**
 - control, 345, limitations of, 347
 - effects, 333, 335
 - exposure criteria, 336
 - industries affected, 336
 - in exhaust systems, 622
 - measurements, 342
- WATER, INDUSTRIAL, control of
emissions, 647, 652**
 - waste water, identification of,
648, sources of, 648-651,
treatment methods, 654.