CHAPTER 9

THE SIGNIFICANCE AND USES OF GUIDES, CODES, REGULATIONS, AND STANDARDS FOR CHEMICAL AND PHYSICAL AGENTS

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INTRODUCTION

The passage of the Social Security Act (1935), assured the eventual acceptance in the United States of the philosophy that the worker had the right to earn a living without endangering his health. During the period since 1935 a number of states[1,2,3,4] adopted codes and regulations governing conditions of work to prevent injury to health and in many instances established threshold limit values which limited levels of exposures in the working environment.

The adoption of state codes and regulations governing the control of the working environment led to greatly accelerated research to obtain data both for the establishment of rational threshold limit values and for their extension to cover as many agents as possible. This research, in turn, led to new procedures for studying the effects of environmental agents on worker health.[5] Significantly, this research revealed that many agents which gave rise to acute responses from high exposure levels over a relatively short period of time elicited a different response to lower levels of exposure to the same agents over a prolonged period of time.

Through data obtained both from epidemiologic and animal research, a body of knowledge has been acquired which permits establishing the rationale for threshold limit values. This rationale is succinctly stated by Hatch:[6] "1) There exists a systemic dose-response relationship between the magnitude of exposure to the hazardous agent and the degree of response in the exposed individual, and 2) there is a graded decrease in the risk of injury as the level of the exposure goes down, which risk becomes negligible when exposure falls below a certain tolerable level. Thus, in the face of recognized potential dangers associated with certain physical and chemical agents, these principles say that such agents can be dealt with safely at some acceptable level of contact above zero and, therefore, that they do not have to be eliminated altogether from industry in order to protect the workers' health."

PROMULGATION OF GUIDES, CODES, REGULATIONS AND STANDARDS

Two general procedures are used in the establishment of occupational safety and health laws. The first is through statutes promulgated by legislative action. The second procedure is through codes, regulations and standards promulgated by agencies with rule-making authority. The latter procedure is, by far, the most common one and is more readily responsive to need for changes. Promulgations through either course of action have the same force and effect of law.

A code is a body of law established either by legislative or by administrative agencies with rule-making authority. It is designed to regulate completely, so far as a statute may, the subject to which it relates. "New York State Industrial Code Rule No. 12 Relating to Control of Air Contaminants in Factories" is an example of such a code.[7]

A regulation is an authoritative rule dealing with details of procedure; or, a rule or order having the force of law, issued by an executive authority of government. The State of Michigan "Regulation Governing the Use of Radioisotopes, X Radiation and All Other Forms of Ionizing Radiation" is an example.[8]

A standard is any rule, principle or measure established by authority. The term "occupational safety and health standard" under the Occupational Safety and Health Act of 1970 means "a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment."[9]

A guide is an instrument that provides directive or guiding information. Examples of guides are the "American Industrial Hygiene Association Guides"[10] and the "Threshold Limit Values of Airborne Contaminants and Physical Agents" adopted by the American Conference of Governmental Industrial Hygienists.[11] Although such guides, per se, do not have the force of law, their values may be incorporated into codes, regulations and standards that do have the force of law.

SOURCES OF DATA FOR EXPOSURE LIMIT VALUES

Exposure limit values are based on data arising out of experimental animal and human studies and from data on industrial experience obtained through clinical and epidemiologic studies of workers. Interrelated data from the three sources give the most rational data upon which to base exposure limits. Animal and human experimental data are most suitable for deriving biologic re-

sponse data on single substances or specific combinations of substances. Workers, however, are seldom exposed to such limited combinations of substances in their work environment. Also, the personal habits of workers, such as cigarette smoking, consumption of alcoholic beverages, and use of drugs may alone have a profound influence on the health profile of workers, or they may have an additive or synergistic action on exposures in the work environment. The health of the worker represents the influence of his twenty-four hour a day environment over a lifetime. Thus procedures and data are needed which will distinguish between health patterns from on and off-the-job stresses. Well designed epidemiologic studies can delineate the influence of multiple on and off-the-job stresses in the environment and have the advantage of being able to study workers over a lifetime.

Research to obtain biologic response data upon which to base exposure limit values is very costly and time consuming. The resources for such studies come mainly from government, industry and foundations. The research may be carried out at facilities operated by the government, educational institutions, foundations, consultants and industry. The Occupational Safety and Health Act of 1970 will stimulate research at all these levels for obtaining data upon which to base exposure limit values.

NATURE AND SOURCES OF EXPOSURE LIMIT VALUES

As stated previously, occupational health codes, regulations and standards may be both general and specific in their coverage depending on their objectives and the procedures intended for their implementation. Any one act may cover a single or several elements to accomplish the stipulated requirements including such areas as threshold limit values, methods and procedures for monitoring the environment, methods of control, use of respiratory protective equipment and protective clothing, and handling of waste.

The establishment and use of exposure limit values are so fundamentally a part of occupational health, codes, regulations and standards that special attention is devoted to their development, significance and use.

The American Conference of Governmental Industrial Hygienists publishes annually a list of "Threshold Limit Values of Airborne Contaminants and Physical Agents."[11] The lists are reviewed annually and values are updated as relative data becomes available. Intended changes are published as a part of the annual list and comments supported with data are requested. The threshold limit values of the American Conference of Governmental Industrial Hygienists are airborne concentrations of substances and levels of physical agents below which values it is believed that nearly all workers may be exposed repeatedly eight hours per day, forty hours per week, without adverse effect. In the use of these values, medical surveillance is recommended to detect workers who are hypersusceptible to specific chemicals or physical agents, so that they can be removed from the exposure or given special protection. Ceiling values in connection with threshold limit values represent exposure values which should not be exceeded and relate to substances which are fast acting and whose threshold limits are more appropriately based on a particular biologic response. In instances where the cutaneous route is an important source of absorption, substances are marked with the notation "skin" to stress this property since the threshold limit value refers only to inhalation as the source of entry of the agents into the body.

The American National Standards Institute, Inc., publishes consensus standards of acceptable concentrations for chemical and physical agents.[12] The standards are useful in establishing engineering procedures for the prevention of objectionable levels of chemical and physical agents in the work environment. Acceptable concentration values are presented in terms of a time-weighted eight-hour workday, acceptable ceiling concentrations within an eight-hour workday, and acceptable maximum peak concentrations for short specified durations. American National Standard acceptable concentrations are values below which ill effects are unlikely. The values are not to be used as the basis for establishing the presence of occupational disease.

The Commonwealth of Pennsylvania Department of Health has established a list of short-term limits as a part of the "Regulations Establishing Threshold Limit Values in Places of Employment."[13] The short-term limit is the upper limit of exposure for which a workman may be exposed to a contaminant for a specified short period. Short-term episodes are included in the daily average concentrations for compliance with the established threshold limit values for contaminants to which workers may be exposed for an eight-hour workday.

The Committee on Toxicology of the National Research Council (operating arm of the National Academy of Sciences and National Academy of Engineering) publishes a list of recommended emergency exposure limits.[14] These recommended emergency exposure limits are not intended to be used as guides in the maintenance of healthful working environments but rather as guidance in advance planning for the management of emergencies.

The American Industrial Hygiene Association publishes a Hygienic Guide Series[10] covering an extensive list of chemicals. A hygienic guide for a given material contains the following information: Significant Physical Properties: Hygienic Standards (limits) for eight-hour, time-weighted exposures, short exposure tolerance, and atmospheric concentrations immediately hazardous to life; Toxic Properties, including exposure via inhalation, ingestion, skin contact and eye contact; Industrial Hygiene Practice, including industrial uses, evaluation of exposures, hazards and their recommended controls; and Medical Information, including emergency treatment and special medical procedures.

The National Institute for Occupational Safety and Health, Public Health Service, Department of Health, Education, and Welfare has a responsi-

bility for developing and publishing criteria dealing with toxic materials and harmful physical agents which will describe safe levels of exposure for various periods of employment.[9] The Institute also is responsible for conducting and publishing research, including industry-wide studies, which will lead to the development of criteria documents.

A number of official agencies and organizations publish recommended exposure limits for specific agents. Examples include: National Bureau of Standards Handbook No. 59 "Permissible Dose for Ionizing Radiation"[15] and Handbook No. 93 "Safety Standards for Non-medical X Ray and Sealed Gamma Ray Sources;"[16] "Intersociety Guidelines for Noise Exposure Control"[17] developed by an Inter-society Committee representing the American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, Industrial Medical Association, and the American Academy of Ophthalmology and Otolaryngology.

A number of organizations have programs for developing threshold limits for biologic materials, i.e., urine and blood. The National Institute for Occupational Safety and Health, Office of Research and Standards Development,[18] has developed a procedure whereby consultants are appointed to a committee for the purpose of establishing biologic threshold limits for specific substances. The Permanent Commission and International Association on Occupational Health[19] has established a committee for developing international standards for levels of contaminants and their metabolites in biologic materials. The American Industrial Hygiene Association established a Committee on Biochemical Assays to study and recommend procedures for determining levels of specific contaminants and their metabolites in biologic materials, and recommend levels indicative of excessive exposure.

The International Labour Office,[20] Geneva, Switzerland, publishes model codes, codes of practice, guides and manuals in the areas of occupational safety and health. The publications cover both chemical and physical exposures and treat the subject in depth.

SIGNIFICANCE AND USE OF EXPOSURE LIMIT VALUES

Exposure limit values are the crux of most occupational health codes, regulations and standards. If there is no exposure to a harmful agent it follows that the presence of this agent does not create a health problem. Also the toxicity of a material per se, though extremely important, is not the sole criterion of whether or not a health problem is present where the material is encountered. The terms "toxicity" and "hazard" are not synonymous. Many factors, in addition to the toxic nature of a material, are important in evaluating a hazard potential. These include the chemical and physical properties of the toxic substances, the ability of the toxic substances to interact with surrounding materials, and the influence of surrounding conditions such as temperature and humidity on the toxic substances, as well as the concentration, stability, and conditions of use of the toxic substances and the conditions under which they are encountered.

The toxicity of a substance expressed in terms of a threshold limit value, however, is an important criterion and concept in evaluating the presence of a health hazard. As stated in the introduction, threshold limit values are based on the concept of a dose-response relation between the agent and its health effects on the worker, that this is of a graded nature, and that consequently there is a lower level of exposure at which level the substance will exert no deleterious effect on the worker. The application of this knowledge to assure that workers are not exposed to concentrations above these threshold values is an important concept in the prevention of occupational diseases. Due to individual variations in susceptibility and the many unknown factors in the working environment and their effects on a given toxic material, the threshold limit value of a material is not a fine distinction between a safe and dangerous condition. Though levels of exposure may be kept within a designated threshold limit value, this is no assurance that an individual worker may not show some deleterious effects if he has unusual susceptibility. The importance of ceiling levels, skin absorption, etc. must also be considered especially if they are contained as an integral part of the threshold limit value.

Biologic standards, i.e., the concentration of a specific agent in the urine or blood, represents the body burden of that agent and may be used as a monitor of the exposure of a worker to a specific substance. Thus biologic levels of a material represent the integrated relation of a combination of the complex chemical and physical characteristics of an exposure on the worker and can be used to indicate where excessive exposures have occurred, when removal from further exposure is indicated, etc. As with threshold limit values, biologic standards do not represent a fine line of distinction between safe and dangerous conditions and alone are not definitive of a state of disease. It must also be stressed that the body burden of an agent represents all sources and routes of exposure and is not limited to industrial exposures. Habits, hobbies, etc. that may involve factors which influence the absorption and retention of a substance may be important.

The application of exposure limit values in the evaluation of the work environment requires a knowledge of the limit values, of their application and meaning, and of acceptable methods and procedures for measuring exposure levels. The latter is discussed separately under the heading "Selection of Methods and Procedures for Measuring Exposure Levels."

Threshold limit values are expressed as time-weighted averages for an eight-hour workday and forty-hour workweek. The time-weighted averages for specific substances, unless designated by special categories or ceiling limits, permit limited excursions above the threshold limit value provided they are compensated by offsetting excursions below the value.[11]

In the application of threshold limit values to mixtures of toxic substances, in the absence of

other information, their effects are considered additive. Thus their additive factor should not exceed unity in terms of their individual exposure concentrations over the threshold limit values.

Threshold limit values are becoming increasingly significant since they are used in most occupational health codes, regulations, and standards as the yardstick for measuring compliance. Exceeding the values can bring on severe penalties. It is extremely important that the employer have worker exposure monitoring data assuring compliance with relevant standards. These monitoring data should include time-weighted averages, extent of excursions above time-weighted averages, ceiling levels, and short-term exposure levels as relevant.

In addition to data monitoring exposure levels, data on levels of exposure in the general room area and at contaminant disseminating sites are useful in assuring the ability of the control system to adequately contain the contaminant and of its continuing satisfactory performance.

SELECTION OF METHODS AND PROCEDURES FOR MEASURING EXPOSURE CONCENTRATIONS

The measurement of exposure concentrations in the working environment assume utmost importance since compliance to standards are based upon comparison of existing levels of exposure with values stipulated in the standards. In the adoption of exposure limit values into standards, it must be assumed that there are valid, tested and reproducible procedures for the collection and analysis of the agent involved. Seemingly small errors or departures from accepted practices may have a considerable impact, on the one hand on the health protection afforded the workers through application of the standard should inadvertently low values be obtained, and on the other hand on the economic loss involved for compliance should inadvertently high values be obtained in measuring exposure levels.

In some standards acceptable methods and procedures are listed for measuring exposure levels for compliance. Where this is not done, reliance must be placed upon the experience and competence of the persons involved. The decisions include not only methods and procedures to be used but also the assurance of representative samples, the proper calibration of equipment, the use of internal controls, and a sampling regimen that will satisfy compliance requirements. For these reasons, laboratories engaged in measuring worker exposure levels, either through the collection of airborne samples or biologic fluids, should be accredited for this purpose.[21]

ENACTMENT OF OCCUPATIONAL HEALTH GUIDES, CODES, REGULATIONS, AND STANDARDS

A number of official agencies have rule-making authority for the enactment of occupational health legislation for the protection of the worker.

The most recent and comprehensive legislation of this nature, Public Law 91-596 enacted by the 91st Congress,[9] "establishes authority in the Secretary of Labor for the adoption and enforcement of standards for safe and healthful working conditions of working men and women employed in any business affecting commerce." The safety and health standards promulgated under the Walsh-Healey Act, as well as other established federal standards relating to construction work, ship repairing, shipbuilding, shipbreaking and longshoring operations were adopted as safety and health standards under the Federal Occupational Safety and Health Act, and are subject to revision under that Act. Exceptions to this primarily relate to the Atomic Energy Act of 1954, and the Federal Coal Mine Health and Safety Act of 1969 since the Occupational Safety and Health Act of 1970 does not apply where other federal agencies regulate under applicable federal law.

The Occupational Safety and Health Act established a National Institute for Occupational Safety and Health within the Department of Health, Education, and Welfare to conduct research and training, develop criteria, publish a list of toxic substances, and make inspections relative to these responsibilities. The Act also provides for the participation of state official agencies in carrying out the provisions of the Act.

The Federal Metal and Nonmetallic Mine Safety Act[22] vests authority in the Secretary of the Interior for promulgating and carrying out health and safety standards "for the purpose of the protection of life, the promotion of health and safety, and the prevention of accidents in Metal and Nonmetallic Mines."

The Federal Coal Mine Health and Safety Act of 1969[23] vests authority in the Secretary of the Interior to promulgate and enforce standards for the protection of life and the prevention of injuries in a coal mine. The Act directs the Secretary of Interior to develop and promulgate, as may be appropriate, improved mandatory safety standards and to promulgate mandatory health standards transmitted to him by the Secretary of Health, Education, and Welfare. The Act also provides cooperation and assistance to states in the development and enforcement of effective state coal mine health and safety programs.

The Bureau of Mines, Department of Interior, also has responsibility for the approval of respiratory devices for protection against the inhalation of gaseous and particulate substances.[24]

The Atomic Energy Commission has authority for establishing radiation standards in a number of areas. Examples include "Standards for Protection Against Radiation"[25] and "Licenses for Radiography and Radiation Safety Requirements for Radiographic Operators."[26] The former sets forth a very detailed set of standards which have the effect of law. The latter specialized standard was published because of the large number of isotope sources used for radiography and the fact that many overexposures had occurred during radiographic procedures.

Several state agencies have responsibilities for establishing and enforcing standards for protecting the health of workers coming within their jurisdictions. The enactment of the Occupational Safety and Health Act of 1970, however, had a

profound influence on the Federal-State relationship in this area since the latter covers all workers engaged in activities related to commerce. Designated state agencies with standards and programs approved by the Department of Labor can by agreement undertake the enforcement of the Federal Act within their boundaries.

SIGNIFICANCE AND IMPACT OF OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

The Occupational Safety and Health Act of 1970 has brought important, new dimensions in safeguarding the health of workers and in the practice of industrial hygiene. Although the impact of many of these newer dimensions is immediate, new interpretations and applications of the Act are made by the courts as the need arises. Thus it will be many years before the full impact of the Act is fully realized.

The coverage of the Act is comprehensive and has brought into its jurisdiction numerous workers heretofore excluded from such benefits. Generally, the Act applies to all workers employed in places of work, engaged in a business affecting commerce, except for government employees.

To appreciate the impact of the Occupational Safety and Health Act it is necessary to review briefly the coverage by regulations and the practices prior to its enactment.

Prior to 1936 the only regulations and guides relating to occupational health were administered by state and local governmental agencies. In most instances the guides and regulations were very general, difficult of enforcement, and relied on professional judgment with respect to compliance. Most of the states had no programs relating to occupational health, and those that existed were far too minimal in staffs and funds to carry out effective programs.

The Walsh-Healey Act of 1936 (41 U.S.C. 35; 49 Stat. 2036) which enabled the Federal Government to establish standards for safety and health in work places engaged in activities relating to Federal contracts, was the forerunner in establishing today's concepts of occupational health regulations. The 1936 Act stimulated research into the cause, recognition, and control of occupational disease and led to the development of occupational health programs by official organizations, insurance companies, foundations, managements and unions. Subsequently other Federal legislation had further impact on the promulgation of Federal safety and health standards. These include the Service Contract Act of 1965 (41 U.S.C. 351; 79 Stat. 1034), Public Law 85-742, Act of 1958 (33 U.S.C. 941; 72 Stat. 835), Public Law 91-54, Act of 1969 (40 U.S.C. 333; 83 Stat. 96), and the National Foundation of Arts and Humanities Acts (79 Stat. 845). The interim period between 1936-1970 also saw a number of states issuing occupational safety and health regulations to cover workers in their jurisdictions. None of the occupational health programs in official agencies during this period, however, were adequate in scope, staff, or funds to carry out their responsibilities.

The lack of uniformity within the various regulations established by Federal, state and local official agencies led to great confusion in industries that operated interstate. Programs by industry for compliance with regulations had to vary from state to state and could not be established on a uniform corporate-wide basis.

The Occupational Safety and Health Act of 1970 has brought a restructuring of programs and activities relating to safeguarding the health of the worker. Uniform occupational health regulations now apply to all businesses engaged in commerce, regardless of their locations within the jurisdiction. Threshold limit values have been incorporated into the regulations and now have the effect of law.

In the earlier years, the establishment of threshold limit values, whether with the effect of law or used as guides, was done more on the basis of professional opinion and judgment than on the basis of facts. Data were minimal on the health effects of exposures to most materials encountered in industry. Uniformity of procedures and methods for the collection and analysis of airborne contaminants was generally lacking. The interpretation of compliance with a regulation or threshold limit value was often that of professional judgment. Information on investigations and inspections relative to violations and compliance of standards was usually restricted to the official agency and management concerned. Likewise, medical data obtained through the examination of workers in many instances were not available to the medical department of the industry.

The Occupational Safety and Health Act of 1970 has more clearly defined procedures for establishing regulations, the conduct of investigations for compliance, and the handling and availability of exposure data on workers, the keeping of records, etc.

The Act provides for a greatly accelerated program by the National Institute for Occupational Safety and Health (NIOSH) to conduct research on the health effects of exposures in the work environment, to develop criteria for dealing with toxic materials and harmful agents, including safe levels of exposure, to train professional personnel for carrying out various responsibilities prescribed by the Act, and in general, to conduct research and assistance programs for protecting and maintaining worker health.

The first standard promulgated on the basis of a criteria document developed by NIOSH was "Standard for Exposure to Asbestos Dust" (*Federal Register* Vol. 37, No. 110 — Wednesday, June 7, 1972). This standard is especially significant because as the first of such permanent standards for a number of target hazardous materials, it is anticipated that it will serve as the basic model for other standards to come.

The asbestos standard includes sections on definitions; permissible exposures; methods of compliance; work practices; personal protective equipment; method of measurement; monitoring, both personal and environmental; caution signs and labels; housekeeping; recordkeeping, including

employee notification; medical examinations; and medical records.

This standard differs from prior standards in OSHA regulations, which specified only the permissible concentrations of airborne contaminants or permissible levels at physical exposures (Occupational Safety and Health Standards, Paragraphs 1910.93, 1910.95, 1910.96 and 1910.97 of the *Federal Register*, Vol. 36; No. 105, May 29, 1971). The far reaching provisions of the new standard include the specification of methods of compliance, which include engineering controls such as ventilation and wet methods; personal protective equipment such as respirators, and including shift rotation of employees to reduce exposure; caution signs and labels, not only for the work place in which asbestos is handled but also for products containing asbestos fibers; recordkeeping, including a requirement that employees exposed to airborne concentrations of asbestos fibers in excess of the limits shall be notified in writing of the exposure as soon as practicable but not later than five days of the finding; and medical examinations, including preplacement, annual and termination of employment examinations and specifying the minimum requisite examination procedures and tests which shall be included.

The interpretation of the general duty clause requirements for providing a safe and healthful working environment and the publication of the permanent asbestos standards add new dimensions to the protection of employee health. Both emphasize that final responsibility for compliance with the provisions of the Occupational Safety and Health Act remains with the employer.

The Act prescribes procedures for use by the Secretary of Labor in promulgating regulations. It is of special interest that threshold limit values for exposures to toxic materials and harmful agents are contained in the regulations, and have the effect of law. Since procedures are given for measuring exposure levels to specific materials and agents in the standards promulgated by the Department of Labor, the use of professional judgment as required in the past for such activities is largely obviated, as is also the interpretation of the values obtained. The employee or his representative now has the right to observe monitoring procedures and have access to data on exposure levels. Disagreements on the validity of monitoring data and its meaning are now relegated to the courts for settlement. Professional skills and judgments are still required, however, in applying the intent of the many aspects of the Act in safeguarding workers' health.

The Act has had a similar impact on the medical and nursing programs in industry.[27] Many medical programs in industry had already seen the transformation from the earlier emphasis on the treatment of traumatic injuries to the modern concept of the prevention of occupational diseases and injuries. This trend, however, has not been universal and the fact remains that a vast number of workers still do not have immediate access to medical and nursing services.

Among the changes in industrial medical programs brought on by the Act is the maintenance of medical records on employees and the access to data contained in them. All practicing physicians representing employers are now required to keep records of the occupational injuries and illnesses of their employees. Standards for specific materials and agents prescribe the nature of medical examinations to be given the employees, the length of time the employer must maintain the records, and who may have access to these records data. Specifically, both the Assistant Secretary of Labor for Occupational Safety and Health and the Director, National Institute for Occupational Safety and Health, and authorized physicians and medical consultants may have access to these data. Also, medical data from examinations required by the regulation shall be given the employer, and upon request by the employee, must be given to the employee's physician.

The industrial physician, with the knowledge that the employee has information on both his exposure levels to toxic materials and harmful agents and on his health status, must now maintain a preventive program for follow-up of situations where excessive exposures have occurred or where biochemical or medical tests indicate early or impending changes in employee health patterns. Since the health profile of a worker represents the effect of his twenty-four hours a day environment, the industrial physician is finding it prudent to obtain information on workers' off-the-job activities and habits, such as hobbies, smoking, use of drugs, that either may directly affect their health or may have an additive influence to on-the-job stresses.

There has been a similar change in the practices of industrial nursing over the past decades.[28,29,30] The Occupational Safety and Health Act of 1970 will provide a major impetus not only in increasing the number of industrial nurses available for medical services to workers, but also in using their fullest capability both in carrying out preventive medical programs and in maintaining and promoting the optimal health of the worker. In the early practice of industrial nursing, activities were largely centered around the emergency treating of traumatic injuries and were prescribed in written orders of a physician. Advancing industrial technology along with modern concepts of preventive medical services soon assured that the industrial nurse could no longer accept such a limited role. The industrial nurse, in addition to giving specific medical services, is now called upon to give broad health counseling to the worker in his overall environment. The Act will increasingly propel the industrial nurse to give a more comprehensive service in promoting worker health. This will necessitate a close working relationship with both the industrial hygienist and the safety officer, and will require a knowledge of the toxic materials and harmful agents in the in-plant environment.

A number of sources are available for keeping informed on enforcement aspects relating to the Act as well as citations and their review by the Occupational Safety and Health Review Commission where appeal has been made by the employer.[31,32,33] The following citations issued by the Occupational Safety and Health Administration

and their review, where appealed, by the Review Commission, show the impact which the Act will have on occupational health and the practice of industrial hygiene and of the importance of keeping informed on these decisions.

A landmark ruling defining the employer's responsibilities with respect to providing a safe and healthful working environment is contained in Case 10 before a Hearing Examiner of the Occupational Safety and Health Review Commission, U.S. Department of Labor. The case involves the Omaha, Nebraska plant of the American Smelting and Refining Company (ASARCO) and a citation dated July 7, 1971. The citation alleged that ASARCO, at a plant in Omaha, Nebraska, was in violation of Section 5 (a) (1) of the Act, which provides that "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees."

The following description of the alleged violation is set forth in this citation:

"Airborne concentrations of lead significantly exceeding levels generally accepted to be safe working levels, have been allowed to exist in the breathing zones of employees working in the lead-melting area, the retort area, and other work places. Employees have been, and are being exposed to such concentrations. This condition constitutes a recognized hazard that is causing or likely to cause death or serious physical harm to employees."

ASARCO contended that the levels of airborne lead found in its Omaha plant during an OSHA inspection, in excess of the threshold limit value (TLV) of 0.2 milligram per cubic meter of air (0.2 mg Pb/M³) did not constitute a recognized hazard causing or likely to cause death or serious physical harm to its employees in view of the protective safety measures in effect. These included the use of respirators, transferring employees from high exposure jobs and its biological sampling program.

The Act, however, places the responsibility upon employers to provide safe and healthful working conditions for its employees, as far as possible. It does not allow employers to provide unsafe, unhealthful or hazardous working conditions for its employees even though the adverse effects of such working conditions are attempted to be minimized. ASARCO's first responsibility, as set forth by the Hearing Examiner, was to provide safe and healthful working conditions, by reducing the levels of airborne concentrations of lead to the generally recognized safe level of 0.2 mg Pb/M³, or as close to that figure as possible.

ASARCO argued that no hazard likely to cause death or serious physical harm to employees existed at its Omaha plant because no evidence was presented that any of its employees suffered from lead intoxication or had been in any way injured by the airborne concentrations of lead found to exist at its plant. It should be stated here that ASARCO also collected air samples and the results of analyses generally confirmed the findings of the OSHA representative. The Hearing Examiner, however, found that proof of a violation of Section 5 (a) (1). of the Act does not depend upon proof that a hazard has produced injury. All that is required is a showing that the hazard is likely to cause serious physical harm or death.

During the hearing, it was found that ASARCO's preventive program, consisting of blood lead determinations, transferring of employees from job to job and the availability of approved respirators in work places having high concentrations of lead "simply has not worked."

The Hearing Examiner, after review of all evidence, found that the levels of airborne concentrations of lead significantly in excess of the threshold limit value (TLV) of 0.2 mg Pb/M³ constituted a violation of Section 5 (a) (1) of the Act, upheld the original citation and affirmed the proposed penalty of $600.00. This finding, that concentrations of an airborne material above the threshold limit value alone constitutes a violation of the Act, is a profound interpretation of the employer's responsibilities with respect to providing a safe and healthful working environment.

On May 28, 1971, the Occupational Safety and Health Administration issued a citation for serious violation for exposure to mercury.[34] Excessive concentrations of mercury vapor in the work environment were found by investigators from the National Institute for Ocupational Safety and Health. Visible pools of mercury were found in many areas. In response to the citation, the management claimed that the pools of mercury resulted from pipeline leakage when the mercury cell operation was shut down for scheduled maintenance and equipment installation. The management stated that the condition had been corrected and that steps had been taken to tighten up maintenance and housekeeping procedures.

A citation for serious violation of section 5 (a) (1) of the Act was issued by the Occupational Safety and Health Administration following an accident in which three employees were killed and two seriously injured from exposure to hydrogen sulfide gas.[35] The quantity of hydrogen sulfide gas evolved at an operation from the slurry, when partially decomposed fish were treated with a mild solution of sulfuric acid, could not have been sufficient to cause serious injury or death. A further investigation revealed that deadly quantities of hydrogen sulfide gas could have been evolved through another operation. Another worker cut a hole for ventilation through a metal floor-ceiling resulting in the reaction of the iron with the sulfur in phenothiozene thus forming iron sulfide, which reacted with the sulfuric acid. Judge William J. Bronz, Occupational Safety and Review Commission (Docket No. 31), dismissed the citation and proposed penalty. He ruled that past experience did not indicate the need for protection when working with the slurry. The employer could not have reasonably foreseen the probability of serious injury or death to employees arising out of such an episode.

A citation was issued relative to workers being subjected to noise levels in excess of those permitted under 2 9 C F R 1910.95 (b) (1).[36] The

employer contended that he had complied with the regulation by providing employees with protective equipment. Judge James A. Cronin, Jr., Occupational Safety and Health Review Commission (Docket No. 158), ruled that the citation and penalty were appropriate. He stated that the employer was aware that the employees were not wearing the ear muffs provided for protection from noise, and had taken no affirmative action, even though an inspector from the Occupational Safety and Health Administration had indicated the violation. He further brought out that the Senate Report on the Act did not intend for 5 (b) relating to the employees' duty under the Act to diminish the employer's responsibility.

A citation was issued for the failure of a company to provide protective gloves to employees working with a solvent in violation of 2 9 C F R 1910.132(a).[27] Three employees were working with "Stoddard Solvent" five days a week, 8 hours a day. The "Stoddard Solvent" was a petroleum distillate containing paraffins, napthenes, and aromatics. Evidence indicated that the solvent could cause irritation upon prolonged exposure. The citation was affirmed by Judge Harold A. Kennedy, Ocupational Safety and Health Review Commission (Docket No. 79). It was brought out that although the solvent was not classified hazardous under the context of the consideration by any known agency, this did not mean that it was not a hazard within the meaning of the standard. The fact that employees who had used the solvent intermittently for years had received no injuries did not reduce the inherent risk or the duty to provide protective equipment.

A citation was issued for alleged violation of 2 9 C F R 1910.252 (f) (2) (i) relative to lack of adequate ventilation at a welding and cutting site.[28] The employer asserted that there was no violation of the regulation and that the compliance officer had incorrectly calculated the volume of the welding bays and had failed to establish substantial evidence of lack of mechanical ventilation. Judge Joseph L. Chalk, Occupational Safety and Health Review Commission (Docket No. 262), ruled in favor of the employer. It was noted that the volumes of the welding bays, divided by fiberized glass curtains, could not be calculated to imaginary lines at the ends of the bays and should include all space reasonably open to the welding area.

A citation was issued for serious violation of 2 9 C F R 1918.93 (a) (1) (i) and (ii).[29] Fifty-four employees were working in a ship's hold in concentrations of carbon monoxide between 100 and 200 ppm. The citation was affirmed and the penalty deemed appropriate by Judge John J. Larkin, Occupational Safety and Health Review Commission (Docket 296). The Captain's claim of lack of knowledge of the fact was not mitigating since the current standard under the longshoring law had been in effect for a number of years. The Captain had not examined the testing equipment, nor required that records of measurements be kept as specified by the standard. Following measurements for carbon monoxide by the compliance officer, employees were removed from the hold of the ship. The employees were returned to the hold before a second measurement for carbon monoxide was made by the compliance officer, which showed no decrease in the carbon monoxide concentration.

SUMMARY

The significance of and guidance from guides, codes, and regulations has changed with advances in the art and science of industrial hygiene and in the enactment of recent laws. The implications, interpretations of, and application of the Occupational Safety and Health Act of 1970 will continue to be developed as standards are promulgated by the Secretary of Labor and as they are interpreted by the administrative and judicial processes specified by the Act.

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the INDUSTRIAL ENVIRONMENT — its EVALUATION & CONTROL

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FOREWORD

In 1958 the Public Health Service's Occupational Health Program introduced the Syllabus, a compilation of training aids, in conjunction with courses presented by the Service to industrial hygiene personnel.

Training people in the profession of industrial hygiene was not a new concept in 1958. The Occupational Health Activity of the Public Health Service was established in 1914 to protect and preserve the health of the American worker. From the very beginning, one of the tenets of our organization was the promotion and improvement of industrial hygiene and industrial medicine.

In 1970 Congress passed the Occupational Safety and Health Act. This Act specifically instructed the National Institute for Occupational Safety and Health (NIOSH) to ". . . 1) develop and establish recommended occupational safety and health standards, and 2) perform all functions of the Secretary of Health, Education and Welfare under Sections 20 (Research and Related Activities) and 21 (Training and Employee Education) of this Act."

This third edition, which has become an industrial hygiene textbook rather than a syllabus, is the most comprehensive to date. The subject matter is extremely broad, covering topics from mathematics to medicine. The first few chapters, in addition to providing historical information, cover such areas as mathematics, chemistry, biochemistry, physiology and toxicology. Other chapters deal with specific areas of interest to those concerned with evaluating the potentially harmful effects of physical and chemical air contaminants. New chapters have been added on safety, solid waste, and control of water pollution. It is not possible to provide sufficient information in any of the chapters to make the reader an authority; rather, the book is to be used in conjunction with other training aids. References are included at the end of each chapter for further study.

Authors of chapters in this edition were selected for their expertise in the particular subject covered. In reviewing the affiliations of the authors, it is interesting to note that there are 15 representatives from universities, 19 from industry, and 12 from the consulting field, as well as several representatives from State agencies and technical societies.

The appreciation of the National Institute for Occupational Safety and Health is extended to the contractor, George D. Clayton & Associates, Southfield, Michigan, and the contributing authors. They have shared their expertise at a time when overwhelming demands are being made upon them.

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