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Industrial Hygiene Codes

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WITH a subject as ambiguous as "Industrial Hygiene Codes," it is necessary to start with some qualifications. For the purposes of this discussion the term "code" will be limited to its more official connotation,—that of a compilation of principles, rules, and regulations promulgated by an official agency to aid in the interpretation of a law. As an example, in New York State, the Board of Standards and Appeals, an agency of the Department of Labor, has adopted by authority of the Labor Law a wide variety of rules relating to industrial operations, each of which is designated as a Code. These rules have the force of law, and enable the appropriate official agency to investigate or to take legal action against anyone not conforming to them in practice.

Because the term "code" has been used as synonymous with "standard," it is desirable to differentiate these concepts in their present significance in industrial hygiene. Particularly, with respect to the idea of an acceptable concentration of a toxic agent, there has developed a definite distinction in their meanings. "Standard" has come to mean a criterion established by recognized technical authority with general consent, a guide to good practice, and free from the legal implication of "code." It may prescribe certain "minimum" values, a level of conditions below which it is unwise or even dangerous to go, or it may designate a set of criteria which are recognized as optimum practice—an objective distinctly above that which generally is being done, or even likely to be done for some time by a major segment of the industry.

With the general purposes of codes developed by governmental agencies for the enforcing of certain minimal criteria of industrial practice there can be little disagreement. The many examples, more commonly inadvertent but occasionally deliber-

ate, of flagrant violation of safe operating principles are ample justification for official controls. As a corollary agreement, with the establishment of the basic labor law, the increasing complexity of industry requires amplification of the general law by specific regulations. These are often of value in protecting industry from capricious and arbitrary decisions of enforcing agencies, as well as being more efficient in forcing compliance through a direct and clearly defined mechanism.

There is a definite, continuing trend in the various states and larger cities, to establish codes relating to an increasing number of industrial activities. With the crystallizing of certain industrial hygiene concepts, and an expanding need for more complex industrial environmental controls, it is natural that these ideas should be considered for incorporation in official regulations. It is at this point, however, that disagreement, even among those individuals who are regarded as well versed in industrial hygiene matters, becomes evident. The disagreement pertains to the manner in which the information should be related to the regulations, and to the specific values, particularly those designated as "maximum allowable concentration" values.

In several of the states, specific maximum allowable concentration values have been incorporated in the appropriate codes for the control of hazardous substances. In others, the limits serve merely as a guide to the enforcing agency. It is reported that in one state the legislature considered the enactment of a law containing a table of such limits, with all of the implied rigidity of such a procedure, but fortunately the bill did not pass. The recent action of the State of California may serve to illustrate one pattern.

Within the past year, as a part of the general Industry Safety Orders, specific "maximum acceptable concentration" values for 146 dusts, fumes, and vapors were adopted. These values largely correspond with those recommended by the Committee

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on Threshold Limits of the American Conference of Governmental Industrial Hygienists. In the publication of these orders, the limiting concentrations are given as an appendix prefaced with a good statement of the qualifications and limitations of such figures. However, reference to earlier paragraphs leaves little doubt but that these specific values can be used for enforcement purposes. In the section on the "Control of Ventilation" it is stated, "Whenever harmful dusts, fumes, mists, vapors or gases exist or are produced in the course of employment, in quantities giving rise to *harmful exposure* of employees . . . such hazards shall be controlled by the application of general ventilation, local exhaust ventilation or other effective means such as pressure ventilation . . ." A *harmful exposure* is defined as "exposure to dusts, fumes, mists, vapors, or gases of such duration and such concentration as to produce effects herein defined as harmful. *Concentrations which are considered to be the maximum acceptable for various substances are listed in Appendix A.*" Thus, a number of specific substances are assigned legal limiting values. The situation with respect to harmful physical agents, specifically, ionizing radiations, is similar excepting that it is stated, "The Division of Industrial Safety plans to hold hearings on revision of the (values) annually."

The Code Relating to the Removal of Dust, Gases, and Fumes adopted by New York State in 1931 illustrates, when compared with the recent California orders, the considerable change in approach which has occurred. Although this rule is still operative in New York, modification, including a table of specific limiting values (containing only 52 items) was developed but not adopted in 1942, and is currently being considered for revision. The principle of defining a specific limit for a particular hazardous substance has since been incorporated in other Codes pertaining to special industries. The relatively indefinite criterion of the 1931 Code was, "All machinery creating dust or impurities in quantities *tending to injure the health of employees shall be equipped with proper hoods and pipes connected to an exhaust fan . . . to remove such dusts or impurities.*" It is obvious that the designation of specific limits would

considerably clarify the job of the enforcement agency.

Since the question of "maximum allowable concentration" values is such an important factor in considering the virtues and defects of industrial hygiene codes regulating exposures to hazardous agents, it is proper to discuss the current status of this perennially disputed subject. The concept of a concentration of a particular hazardous material which will not prove harmful (or in varying degree of acceptance, uncomfortable) even though an individual is exposed daily and for an indefinite period, is to most industrial hygienists a very useful one. The discrepancy in opinion, however, as to the possible validity of such a value—and especially to the significance of a given set of data establishing a limit for a particular substance, is considerable.

There has been a change from the relatively ready acceptance of a proposed maximum allowable concentration of a few years ago to the present mood of cautious scrutiny. We have lived long enough with some of our earlier conclusions to see them modified, and we are less certain of our other values. In addition, we have been justifiably alarmed at the rigid authority which a value acquires with repetition (even though uncritical) and the threat of even greater immutability by incorporation in legal regulations.

The activities of the organizations which have been most widely recognized in the establishing of standards have contributed to the confusion. On the one hand, the limited output of the American Standards Association Committee on Allowable Concentrations of Toxic Dusts and Gases implied an increasing doubt as to the availability of adequate data for other than a few materials. On the other, the Committee on Threshold Limits of the American Conference of Governmental Industrial Hygienists issued annual reports containing values on well over a hundred items, and including certain materials of which, it was generally felt, there was sufficient information only for a "guestimate." A careful examination of the purposes of both groups in developing standards shows that their activities are far from irreconcilable, that it may well be desirable to have both of them continue

setting and publishing standards, however, where the significant difference in their treatment of the studies upon which the standards are based and, in addition, the criteria by which they were made. It is inevitable that there will be differences, and occasional appreciable differences, but it is clear that in the majority of cases these are a matter of interpretation not based upon different data.

There is now a serious apathy among the various state agencies to incorporate in codes the values established by the American Conference of Governmental Industrial Hygienists, in spite of the expressed opinion of some members of the Threshold Limits Committee against such a practice. On the one hand, the obvious responsibility of an enforcing agency for specifying standards, on the other, is the frequent criticism of hygienists employed in industry for selecting a limit and their reluctance to have values determined under conditions which they could have no part in. It is out of the question that state codes are adopted without public hearings, but it is difficult for a committee formed to draw up a code will have the technical competence to make the best judgment on a wide list of substances, or that such a committee is the best means for weighing technical material upon which standards will be based. It would be much better to add authority to a given standard by having it originate from a technical body, representing a wide range of industrial hygiene activity. The American Standards Committee on Allowable Concentrations of Toxic Dusts and Gases at one time seemed to have these conditions in mind, but the limited results, as judged by the standards adopted, have given rise to doubts as to whether its work will meet the needs of the industry.

The varying degree of difficulty in setting standards presents one of the most serious problems. A promising approach has been repeatedly made through the establishment of classes or grades of exposure according to the amount of available data, and fixing a given level. Where

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setting and publishing standards. It is important, however, where there is a significant difference in their results, to document the studies upon which their conclusions are based and, in addition, so far as possible, the criteria by which the decisions were made. It is inevitable that there will be differences, and occasionally, really appreciable differences, but it should be made clear that in the majority of instances these are a matter of interpretation, and not based upon different sets of factual data.

There is now a serious apprehension that the various state agencies will increasingly incorporate in codes the values approved by the American Conference of Governmental Industrial Hygienists, in spite of the openly expressed opinion of some members of that Threshold Limits Committee warning against such a practice. On the one side, is the obvious responsibility and need of the enforcing agency for specific criteria. On the other, is the frequent disagreement by hygienists employed in industry with the selected limit and their reluctance to accept values determined under conditions in which they could have no part. It will be pointed out that state codes are adopted only after public hearings, but it is doubtful that the committee formed to draw up or revise the code will have the technical competence for the best judgment on a widely diversified list of substances, or that such hearings are the best means for weighing the highly technical material upon which limits must be based. It would be much more desirable to add authority to a given standard by having it originate from a common technical body, representing all phases of industrial hygiene activity. The American Standards Committee on Allowable Concentrations of Toxic Dusts and Gases at one time seemed to have these qualifications, but the limited results, as judged by the number of standards adopted, have raised serious doubts as to whether its past performance will meet the needs of the situation.

The varying degree of validity of standards presents one of the most difficult problems. A promising suggestion has been repeatedly made that standards be established in classes or categories, according to the amount of available evidence for fixing a given level. Where there was a

considerable amount of pertinent data, sufficient agreement could be expected to permit the establishment of a reasonably fixed value. While there will be continued objection from some individuals to the use of such information in codes, much of the present criticism of this action would be avoided. Intermediate and lower categories would include those values with lesser validity, and these would be used merely as guides. While all values, as at present, would be subject to revision as additional information was developed, the intermediate and lower level figures would be given a limited tenure, requiring regular and systematic review.

Codes can be characterized as to the manner in which they function. In one type, the "definitive" code, the engineering specifications are described in great detail, requiring compliance as to gauge of metal, size of ducts, velocity or volume of air flow, etc., of the equipment or device for controlling the hazardous condition. Enforcing agencies emphasize that these are matters which can be checked by less technically trained inspectors. In addition, guidance as to an adequate design and construction is essential, particularly in the smaller plants, if competent engineering skill is not available. These arguments are countered by industry which complains of the restriction imposed, of the difficulties encountered in substituting newer, and perhaps more economical and more effective controls for the methods dictated in the code.

A second type of code is the "performance" code. Here the emphasis is on the end result, which is described and defined—and the method for achieving it is left, in great part, to industry. The difficulties from the enforcement view are the paucity of criteria for defining the acceptable environment, and the necessity of greater technical competence in personnel investigating the industrial conditions. Industry, however, has greater freedom as to methods for controlling the hazard.

If it is agreed that codes are necessary to secure safe and healthful conditions under certain circumstances (and the author subscribes to the viewpoint), one or the other, or a combination of the two, of the above types of code must be employed. The

definitive code may appear to be the easier to enforce—and perhaps the easier to comply with—for many standard operations and processes. It lacks, however, the directness and versatility of the “performance” approach in dealing with the actual problem, the hazardous condition. With the increasing ability to define the desired end and to evaluate the actual circumstance of exposure, there is a trend toward the adoption of performance codes. The California Safety Orders are of this type. In addition, the suggested model or standard code recently prepared by a committee of the American Conference of Governmental Industrial Hygienists was expressly a “performance” type. In New York, a recent revision of the Product Finishing Code, to supplant and extend the regulations originally covering product spray painting, is a good example of compromise between the two principles, although no specific concentrations are given.

With this background, let us consider the probable directions of Industrial Hygiene Code making, and what can be done to assure reasonable, valid, and workable regulations. In the first place, it is likely that our increasingly complex society and technology will require more rules and regulations. The present trend is toward the adoption of performance codes, although enthusiastic and perhaps premature acceptance as mandatory of too many unverified “permissible concentration” values may react to slow the development.

A major need is a constantly expanding set of criteria which will be broadly accepted and which will define safe, healthful, and reasonably comfortable working conditions. Values may be developed for a number of purposes, but one set or class must describe minimal standards—levels of performance below which it is unsafe and unwise to go. These standards should be set by mutual agreement, in an organization where the greatest competence and experience of all phases of industrial hygiene activity can be represented. Such values as meet a certain degree of validity can be properly designated, and might be incorporated in mandatory regulations, if in the opinion of enforcing agencies that action seemed desirable. For materials about which information was less complete

and less accurate, tentative values can be assigned and these used as guides while further data is collected.

It is unlikely that poorly substantiated values included as mandatory features of a code would be sustained in a legal action unless there was clearly defined objective evidence of injury. The inclusion of such less well verified limits, and attempts to enforce them, must cast doubt on the validity of even the more securely established values. To meet the objections raised by enforcement agencies, that smaller units of industry will be penalized because of the absence of definitive data on engineering controls, such information could be incorporated in the codes as suggested techniques, permissive but not mandatory. At present, in New York, where such engineering details are in the code, the mechanism for obtaining exceptions is irksome and in my opinion needlessly involved. Appeals for variation cannot be granted by the Division of Industrial Hygiene, even though it concurs, but must be carried through to the Board of Standards and Appeals. With a performance code, the designated standard can be achieved by any one of a number of methods (with a few limited exceptions such as precluding the use of respirators where ventilation or confinement should be applied).

In the successful development of this program the cooperation of governmental and private industrial hygiene forces is essential. Industry cannot, and an enlightened industry will not, contend that the control of working conditions is solely their prerogative. Neither can the governmental hygienist insist that the setting and enforcing of standards or permissive limits is solely his responsibility. The job is sufficiently big for all of those concerned, and even with their maximum effort, will lag far behind in effective accomplishment. We must persuade the ultraconservative that action must be taken even when the facts are not quite as complete as we would like them.

We must suppress the uncritical enthusiasm of those who believe that a magic exists in numbers, even though tenuously arrived at. The need for information is very real and much can be accomplished by intelligent and positive cooperation.

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THE MOST effective and efficient is an enclosure consisting of two or three sides with all other side or sides open for tank (Figs. 1, 2 and 3). The top of tank hood is an overhead canopy. Each of the four sides is generally open to air flow.

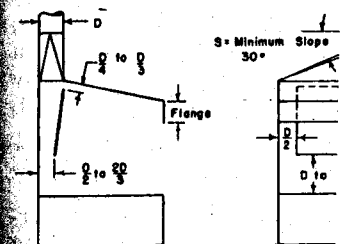


Fig. 1.
Enclosing hood

immediately adjacent to (Fig. 4). Hoods with three sides are relatively immune to effects of room cross draft, two, one, or no closed sides are more subject to these effects and require proportionately higher control velocities.

The most common objection to enclosing hoods is that they impede access to the tank. This objection sometimes also applies to canopy hoods. In addition, canopy hoods may require the worker to breathe contaminated air rising from the tank to the hood and are most extravagant in their ventilation requirements.

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