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Symposium on Threshold Limits

Present Trends in MAC's

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THE THINKING today on the concept of threshold limits of injurious materials, designated by whatever term, has passed through an evolution to a gratifying maturity.

Initially the need to know how little of a toxic substance might remain in an industrial atmosphere without injury to those exposed was insistently apparent. Such information began to be supplied through correlation of concentrations of injurious substances with observed effect on the health of the worker for such materials as granite dust¹ and lead compounds.² Results of short-time animal experiments had been available even before the present century from such investigators as K. B. Lehmann³ and later from Yant and others at the U. S. Bureau of Mines,⁴ with the classic combined long-exposure animal experimentation and occupational study on benzene by Greenburg⁵ in the middle twenties.

As these threshold limit values became more numerous and were more widely applied, it is perhaps not surprising that misconceptions and aberrant usages occurred. Some persons erred in considering the levels more precise than the facts justified; others rejected them because the values could not precisely fit all conditions of exposure and physiological response. And the detractors were for a while more vociferous and seemed possibly to be more sound than the protagonists.

With time, there has been a separation of the valuable advantages of the threshold

limits and the improper use of them. Nowhere is the present concept of threshold limits more ably and competently expressed than in the papers and discussions of this Symposium.

That the discussants might not have the very last word, it may be permissible for this prologue to assume in part the prerogative of an epilogue! The following commentaries appear pertinent.

The last publication of the American Standards Association Z-37 Committee on Maximum Acceptable Concentrations of Toxic Dusts and Gases⁶ is reported correctly as 1949 by Sachs who deplored the lack of revision of the 1941 Standard for benzene at the obsolete level of 100 parts per million. It is to be noted that this ASA Committee is now active in the revision and publication of MAC Standards for many of the materials on which information is available.

The term "maximum acceptable concentrations" was adopted by the ASA Committee for a number of reasons. The word "acceptable" does not connote the legal control inherent in the words "allowable" and "limit," but rather a simple acceptability without further implication. Also, the expression, MAC, has been widely used over the years and is now a part of the language. In fact the Germans adopted a wording which gives the abbreviation, MAK, so that this term may be used in international conversation. Their words as used in the title of a paper by Oettel⁷ are "Maximale Arbeitsplatz-Konzentration." It is understood that this same expression is being used in the "MAK" tables of the German Association for Worker Protection.

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However, there can be no really valid objection to the term "Threshold Limits" used by the committee of the American Conference of Governmental Industrial Hygienists or to "Hygienic Guides," the term adopted by the American Industrial Hygiene Association committee. This Symposium would not be complete without reference to the availability of the excellent AIIHA Hygienic Guides to which reference is made elsewhere in this Journal.

One of the most perplexing problems in arriving at threshold limits is posed by the cancerigens. Stokinger's statement in this Symposium is the first publication on this phase of the subject. However, the use of the procedure suggested by Stokinger as applied to nickel carbonyl has already drawn some fire. Quoting in part from a private communication from Oettel whose publications^{7,8} on "MAK's" include a well-considered presentation of the general subject: "We suggest that consideration be given to indicating the suspected cancerigens with an asterisk with reference to a footnote that the hazard exists and consequently especially effective control measures be instituted. No man can say today which concentration of the several industrial substances is actually required to be cancerigenic . . ." This statement follows his objection to the present listing by the ACGIH of nickel carbonyl as 0.001 ppm on the basis of its alleged cancerigenicity, which incidentally Oettel's extensive experience with the substance causes him to doubt, while failing to include any acknowledgement of the

known cancerigenicity of arsenic, chromates and asbestos. Says Oettel "In this I see a great danger. The lists should in any event remain logical."

Waters' discussion of Brandt's paper occupies the final pages of this publication of the Symposium, but it is believed that Waters would not wish his comments to be considered the last word on the subject of threshold limits—rather that his observations are limited essentially to the use of these values in legal codes, rigidly fixed by statute. As the last word in this Symposium, this introductory refers the reader to the concluding paragraphs of the paper by Brandt for his discussion of the philosophy of threshold limits.

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The Need for Threshold Limits

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PROBABLY one of the most basic needs in human endeavor is for man to have an orderliness set to his manner of thinking. Everyone has a need for discipline, for boundaries to be drawn, and for limits to be defined. It does not matter that the only use for some of the limits so defined may be to ignore them; they have still served their

purpose as a point of aim for individual interpretation. If this seems cryptic, an example concerning a common substance may be cited.

Almost everyone is familiar with the threshold limit values for silica—for dust with a free silicon dioxide content above 50%, the limit is given as five million parti-