

SUMMATION

Robert J. Halen, M. D., General Chairman*

I am sure you will join me in expressing appreciation to the program participants. They have brought us up to date on matters under consideration. Your active participation in the Workshops also added substantially to the worth of the Symposium. Our goal was to review that which is known about the effects of Carbon Monoxide on man, and to attempt to relate this to regulation. It has not been an easy task.

In two days of discussion, little or nothing was said about the acute, specific effects of Carbon Monoxide associated with its asphyxial action. The NIOSH Criteria Document has relatively little to say about this, also. The acute asphyxial event has generally, over the years, become an "accident" in industrial considerations. Accidents can and do happen, however. Preventive measure against their occurrence and continued proficiency in rescue and resuscitation measures must receive appropriate attention despite the shift of emphasis to more subtle effects. It is important also to recognize that this shift of emphasis is a progressive step in consideration of a toxic material about which much has been learned, and much has been accomplished. Discussions centered largely around two apparent effects of Carbon Monoxide which received the most attention in the NIOSH Criteria Document, and presumably will be the basis for standard promulgation. These were the effects of certain levels of Carbon Monoxide on the results of selected performance tests, and on the well-being of individuals with coronary artery disease.

Evaluation of the results of various performance tests in the presence of Carbon Monoxide is very difficult. The large number of variables is a major problem. Dr. Stewart's work illustrated this very well. Both he and Dr. Dinman further pointed out the questionable correlation between performance of portions of a task and performance of the total task. In any event, it was generally agreed that significant interference with performance tests has not been demonstrated at 35 ppm of CO in air. Based on available information, a level of 100 ppm, or even higher, was suggested as an appropriate level, if the results of performance tests were to be the determining consideration.

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The effects of Carbon Monoxide on coronary artery disease was discussed at length. This was appropriate in that reports of the adverse effects of 5% COHb on individuals with coronary artery disease, and the association of this level with environmental levels of 35 ppm were the major reasons for the NIOSH recommendation. Questions were raised about the validity of extrapolating conclusions of studies in which 5% COHb levels were achieved by short, high concentrations of CO to situations in which this level is reached by longer, lower levels of exposure. Despite some rather broad conclusions reached by some observers, it was agreed that at present there is no solid evidence that Carbon Monoxide causes coronary artery disease. At issue, and compilers of the Criteria Document apparently agree, is the problem of aggravation of pre-existing disease. The correlation between research biochemical determinations and traditional clinical medical findings such as symptomatology or electrocardiographic abnormalities remains somewhat obscure. This lack of information presents serious socio-economic and medico-legal problems in consideration of the return to certain work of individuals following frank coronary artery events. Embracing the 5% COHb level concept totally also raises questions of the extent of case finding methods which should be utilized in the as yet undiagnosed group working in areas with borderline environmental exposures.

The pathological physiology of Carbon Monoxide exposure was presented in a very lucid manner by Dr. Alarie. Equilibrium and dissociation curves for COHb and factors which influence each are certainly germane to the evaluation of problem areas and to regulatory activities based on biologic findings.

Mr. Lynch informed us of available environmental measurement equipment and techniques. His reservations about the accuracy of determinations at the suggested level bring another significant factor into regulatory considerations.

Dr. Lassister outlined procedures followed by NIOSH in reaching their conclusions. Dr. Van Atta discussed the process of translating information from NIOSH and other sources into an enforceable and meaningful standard. Both gentlemen conveyed the thoroughness with which they and their associates pursue their missions, but pointed out the requirements of the law.

Have we reached any conclusions in this symposium? There has certainly been a free exchange of views which is healthy. We have learned of the difficulties encountered in assigning proper weight to articles in the scientific literature, particularly under conditions imposed by the

Occupational Safety and Health Act of 1970. We have learned of the difficulty inherent in refuting a positive correlation once made. We have learned of the difficulty in defining health. All of these, however, are problems not unique to consideration of Carbon Monoxide.

Carbon Monoxide effects under consideration today are not those with which we were concerned only a few years ago. Neither experience nor recorded observations appear adequate to make specific recommendations for tolerance levels in terms of these more recently considered, and less than specific effects. Maintenance of the status quo for a sufficient period to properly evaluate these possible effects in a sufficient number of employees over a sufficient period of time does not seem an unwise course.