

SPEECH TO INTERNATIONAL WORKSHOP
ON RESPIRATOR RESEARCH - MORGANTOWN, WEST VIRGINIA

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Good Morning. First let me thank Dr. Oppold for accepting a segment of Industry's request to be represented on this panel. I want to review with you some of our respirator needs, and areas where we feel additional research is required. I am here today as Chairman of the Organization Resources Counselors Task Force on Respiratory Protection.

ORC is composed of 60 member companies, which range in size from medium to very large, all of whom have a strong interest in improving the rulemaking process, a commitment to a safe and healthful workplace and a willingness to work together with the Federal Government to achieve these ends.

ORC works with its members and the government to facilitate cooperation between them, believing that standards which address problems in the workplace cannot and should not be written without extensive contact and input from the affected industries. Toward that end, ORC through its task force system, attempts to make the information and expertise that is present in industry available to government.

Galileo, who lived in the first half of the 17th Century (1564 - 1642) and who was a contemporary of Bernardo Ramazzini, recognized that great ideas often spring from simple phenomena. He praised William Gilbert, who in 1600 treated the earth as a magnet while trying to explain gravitational phenomena, with these words "I do not doubt that in the course of time this new science will be inspired with still further observations and even more by true and conclusive demonstrations." Like the apple dropping out of the tree which Newton observed, some 40 years after Galileo died, the phenomenon which we in industry are observing is the steady dropping of acceptable exposure levels for materials based on new and sometimes more sensitive toxicological and epidemiologic methods and data. Chemicals like vinyl chloride and normal hexane that ten years ago were thought to be of relatively low toxicity have had their ACGIH-TLVs dropped from 500 to 1 ppm for VCM and tentatively 50 ppm for n-Hexane. As the levels to which industry must control chemical exposure drop, the feasibility of engineering controls diminish, and fully utilized work practice and administrative controls still fail to reduce work room exposures to these lower and lower levels, there will undoubtedly be a greater reliance on the use of respirators to protect employee health. Where respirators must be used to mitigate exposures, the respirator program must be considered a surrogate for the engineering, work practice or administrative control. Accepting this premise forces the employer to apply the same high level of effort to the use of respirators as that which is normally afforded primary control strategies. Keep in mind, that when respirators are used properly in conjunction with these primary control programs, extremely effective exposure control can be achieved.

My objective here today, is to help those of you doing the research set objectives based on current and developing industrial needs. Innovation and improvement in respirators, fitting techniques, and program methodology will continue to assure that a high level of protection is supplied to employees as exposures change and the utilization of personal protective devices becomes more critical. Additionally, for the employee and employer to fully appreciate and accept the use of respirators in the work environment, they must be reliable, comfortable, easy to use and have a minimal effect on productivity.

AIR-PURIFYING RESPIRATORS

First I will review some research needs related to air purifying equipment. In the last year, my company has lowered its permissible exposure levels of two major commodity chemicals based on the outcome of animal toxicity studies which we sponsored. The two chemicals are formaldehyde and ethylene oxide. The formaldehyde exposure guide was set at 1 ppm for an eight hour time weighted **average--the** current OSHA-PEL is 3 ppm; for EO we lowered the exposure guide to 3 ppm for an 8 hour **TWA--the** OSHA-PEL is 50 ppm. We and our customers were faced with a dilemma when we felt it necessary to take the initiative in lowering exposure **levels--there** were **no** air-purifying respirators available that would effectively help control exposures. As you may **know**, carbon is a poor sorbent for both of these chemicals. The use of airline or self-contained equipment is not feasible for many operations encountered in the chemical industry. In addition to starting the design of engineering and work practices to limit **exposure**, we also initiated research projects to find effective sorbents for both of these important chemical building blocks. Sulfuric acid impregnated carbon worked for EO, but the search for the ideal formaldehyde sorbent continues.

The problem that my company faced with respect to finding sorbents for specific needs will be the same problem faced by many other companies for many important chemicals over the next decade. For the last four decades, we have relied on a handful of stock sorbents to deal with all of our problems. Well, life has gotten much more complicated and I am afraid we can no longer solve all of our respirator problems with sorbents such as soda lime, carbon, silica gel and an assortment of impregnated carbons and silica gels. A major research effort must be undertaken to find new and more effective sorbent systems with which to respond to changing occupational health knowledge and developing industrial technologies such as those in the energy field.

Let me quickly outline a few more research needs: Performance of air-purifying equipment as tested by silica dust, lead oxide fume and carbon tetrachloride may not accurately determine the performance of a respirator used for protection against other materials. Performance criteria and subsequently approvals of air-purifying respirator should be based on tests against a broad range of challenge media, as well as the specific challenges of interest.

Research on test methods and procedures is needed to better quantify the degree of protection afforded a respirator wearer when using the equipment to protect against specific air contaminants such as EO or **formaldehyde**. Obviously, carbon tetrachloride tests alone give little hint as to the **effectiveness** of a sorbent in a production environment.

More work is needed to assess the effect of multiple air contaminants on the service life of sorbent systems, on breathing resistance parameters for air purifying equipment based on physiological data, on defining optimum conditions for packaging, shipment and storage of respirators, and on end of service-life indicators. More research is needed by a broader segment of the manufacturers in the area of disposable single and multiple use respirators. Such equipment has had a positive impact on employee and management acceptance of respirator use. Competition in this area will help further innovate and help in reducing the cost of such devices.

In the area of powered air purifying respirators, more research and product evaluation is needed to accurately assess the degree of protection provided by these potentially useful and innovative devices. Some companies that have quantitatively fit this type of equipment under real world conditions have achieved fit factors significantly below those assigned by NIOSH and ANSI. With the current emphasis being placed on powered air purifying equipment in the lead standard, these problems must be resolved in the very near future. Powered air purifying equipment has its place in industry but in my opinion it is not fully proven for use in the work environment and more real world testing is required.

SELF-CONTAINED BREATHING APPARATUS

Switching gears to self contained breathing apparatus, it is unfortunate that it took the Lubbock, Texas incident to move the entire testing and approval process to stage center, but even if the equipment had not failed for whatever reason, the current performance characteristics of SCBAs has the potential for adversely affecting the health and safety of the wearer, e.g., the service life of this equipment is too short, warning alarms of low air cannot be heard in some work environments and the equipment operation and integrity can be affected by flame, high temperature, water, and component corrosion. Innovative research to lengthen service time with possibly a guaranteed minimum service time under all conditions is needed, as is the identification of improved construction material and end of service time indicators. Additionally, formal performance criteria should be developed for closed circuit positive pressure SCBCAs.

TRAINING AND MOTIVATION

The most important aspect of using respiratory protection as an exposure control is assuring that the equipment wearer fully understands the nature of the hazard, the reason for respirator use and how to use the equipment properly. Of course anytime we discuss respirator programs, training is considered apple pie and motherhood and all too often we take it for granted. We need new and dynamic approaches to motivate and train.

The most difficult aspects of running a respirator program is motivating employees to properly use required respirators day in and day out. While management support of the program is essential, the format of this support is crucial. Training programs and effective audio-visual aids aimed at the respirator wearer using the most up-to-date pedagogy and psychology are some of the best manifestations of management support. The best minds in education and industrial psychology must be used to identify and develop effective and dynamic approaches to respirator training. Experts in the technical aspect of respirator protection must combine their efforts with social scientists to satisfactorily develop such programs.

QUANTITATIVE FIT TESTING

As you all know, NIOSH, OSHA, manufacturers, and the industrial respirator user continue to be embroiled in both technical and legal arguments over the use of quantitative fitting.

Quantitative fitting as a laboratory technique for evaluating respirator fit was developed in the early 1960's. Until recently, the equipment and technique was so complex that it remained a laboratory tool **only**. Portable equipment and small fixed installations are now available and this has opened the technique to the industrial **user**. **Still**, however, many uncertainties and technical problems exist, making quantitative fitting of questionable value to the average industrial respirator user. Some of these uncertainties and technical problems include:

1. Quantitative fitting equipment now in use and available to the industrial user is not built to a standard **specification**. This can result in a significant variability of test performance on different systems. **ASTM Committee E34.14** is working on this problem, but it is unlikely that a standard can be finalized in the very near future.
2. Quantitative fitting test procedures have not been standardized. There are no ANSI, ASTM or government standards on how to conduct quantitative fitting tests. This would cause a great deal of variability between tests performed by different technicians. **ASTM E34.14** is also trying to develop a standard set of fitting exercises and test **procedures** for quantitative fitting.
3. Based on data from **Dupont/National** Paint and Coating Association Study, fit factors in excess of 250 have been obtained for 95% of the people tested using an innovative qualitative fit program. If these data are confirmed by further research, a serious question of cost-benefit will be raised with respect to quantitative fitting, especially for the small respirator user.
4. There is an extremely high degree of variability when a fit testing is performed on the same individual with the same facepiece at different times. With quantitative fitting, the highly variable numerical results are of little value in the workplace. Research to determine what levels of fit are achieved in the workplace with an innovative qualitative fit test procedure such as the one developed by Dupont is needed. The scientific data developed in this type of research should be used as the basis for assigning fit factors to each type of respirator.
5. Newly available toxicology data indicate that the primary test atmosphere, 2-ethyl hexyl phthalate (also known as di-octyl phthalate - D.O.P.), is a suspected **carcinogen**. Other test media may have to be identified before testing is fully accepted as a safe procedure.
6. If industry is to accept the use of quantitative fitting, we would have to be assured of the improved safety to employees provided by this technology over that provided by rigorous qualitative fitting procedures. Additionally, we must consider the cost of quantitative fitting versus that of qualitative. The entry cost alone for quantitative is between \$8,000 and \$15,000 compared to \$15.00 for qualitative. Based on available data, the **cost-benefit** of quantitative fitting looks poor for the average respirator user.

The bottom line is that much more research and standard development are needed before industry can be convinced that quantitative testing has favorable cost-benefit ratio. I am happy to say that **industry**, Dupont, and the National Paint and Coating Association are conducting extensive research in this area. Some of the Dupont people are here and may want to elaborate on their work.

SUMMARY

Neither the physics nor the politics of respirator research can take place in a vacuum. Industry must be a party to setting research priorities and of the peer review of research growing out of these priorities. After **all**, we know where the utilization of respiratory protection is a necessary part of our manufacturing processes. But more **important**, it is our employees who must wear the fruits of your research and development **efforts**, and it is essential to us as employers, that when respirators are required, that they afford equal protection to that of the best engineering, work practices, and administrative controls. Thank you.