

RESPIRATOR ARTICLE ABSTRACTS

These are the abstracts of papers presented at the recent Technical Advances in Personal Protection Conference—Ed.

"Review of Japanese Conference," presented by M. H. Glynn, Sabre Safety Limited, Matterson House, 225 Ash Road, Aldershot, Hampshire GU12 4DD, United Kingdom

The 1993 Conference in Tokyo was very successful with 192 attendees; 160 from Japan, 16 from USA, and Europe represented by 2 from Sweden and 3 from the UK.

Our newly elected European Board Members are Andy Capon, Per-Gunnar Jönsson and Maureen Willcocks.

A committee was formed to drive for new members whilst Jim Johnson, the new Vice President, started a move to promote the exchange of Respiratory Standards Information around the world, starting with a Glossary of Definitions — a kind of international TC79/ SC1 committee!

The quality of the papers was as high as ever and the two women giving the simultaneous translations were excellent.

"Respiratory Protective Equipment for Medics and Paramedics," presented by Per-Gunnar Jönsson, FOA NBC Defence, National Defence Research Establishment, S-901 82 UMEA, Sweden

The Swedish National Board of Health and Welfare is planning to provide respiratory protective devices to ambulance crews and other medical and paramedical personnel that might have to work in an area contaminated with toxic gases or vapors.

The main requirements for such a respiratory protective device are:

- It shall provide protection against toxic industrial chemicals.
- It shall give protection factor of at least 500 to 95% or more of the users.
- The carbon dioxide content of the inhaled air shall not exceed 1.0%.
- It shall be possible to wear the respiratory protective device for at least six hours without any appreciable decrease in work performance.
- It shall be possible to use whilst wearing ordinary spectacles.
- It shall be possible to use outdoors at temperatures down to -20°C.

Some test results and conclusions gained from the background research on this type of device will be presented.

"Physical/Psychological Effects of Wearing Powered Respirators," presented by G. A. Robins and F. E. Morley, Chemical & Biological Defence Establishment, Porton Down, Salisbury, Wiltshire, SP4 0JG, United Kingdom

Performance characteristics were measured for high efficiency respirators fitted with Power Assisted Breathing Units (PABU) operating at flow rates up to 100 litres/minute. A flow rate of three times the respiratory minute volume was required to maintain positive pressure inside the respirator.

Total Inward Leakage (TIL) of salt aerosol was measured using a continuous sampling method. Maintaining positive pressure eliminated leakage at the face seal and outlet valve but TIL reflected aerosol penetration through the canister. Lowest TIL occurred when the PABU had two parallel canisters. Respiratory characteristics of test subjects performing same routines showed wide variation.

"Protection Factors of Military Respirators," presented by Hein Jager, TNO Prins Maurits Laboratory, Lange Kleiweg 137, PO Box 45, 2280 AA Rijswijk, The Netherlands

In view of the threat of modern warfare agents, a military respirator should ensure a high level of protection. TNO Prins Maurits Laboratory has measured face seal leakage of our types of respirators in the laboratory and compared these with the total leak as measured by the Portacount instrument during a troop trial. SF₆-measurements in the laboratory show that all types, when expertly fitted, can yield a protection factor over 10,000. Measurements in the field were performed using the Portacount and show that the protection obtained by the average (conscript) soldier might be much lower. Comparison of these results with earlier work indicate that these findings seem to be representative for the military population in general. Although a statistical analysis is obscured by the effects of incorrect use, the results were analyzed with regard to the sizing system of the mask, and the face length and breadth of the wearer. Results for measurements with test subjects wearing the mask for 24 hours and in dusty conditions indicate that for every wearer, the actual protection of the mask not only depends on the wearer but also on time and environment.

"Alternatives to Carbon Tetrachloride for Canister Testing," presented by Paul Malloy, The Associated Octel Company Limited, PO Box 17, Oil Sites Road, Ellesmere Port, South Wirrall L65 4HS, United Kingdom

Due to increasing concern on health and environmental grounds regarding the use of carbon tetrachloride, CEN TC 79 SC4 decided that the use of this agent for testing gas filters should be discontinued as soon as possible.

When data from various sources on many potential alternative agents was examined, cyclohexane and 2 butanone emerged as front runners. An inter-laboratory trial of these two compounds was therefore instigated.

The reason for choosing these two compounds, the objectives of the trial, and the details of the program of tests shall be discussed.

"Pulsed Sampling for Contaminants Inside Hoods," presented by T. D. Proctor, J. A. Bolsover, M. P. Clayton, Health & Safety Executive, Research and Laboratory Services Division, Broad Lane, Sheffield S3 7HQ, United Kingdom

Certain tests on RPE required samples to be taken from the wearer's breathing zone during inhalation only. This is achieved by monitoring pressure to detect the change from inhalation to exhalation. In RPE incorporating hoods, such systems face difficulties from pressure fluctuations occurring due to flexing of the hood due to wearer movement.

This paper describes a method for monitoring the levels of re-breathed CO₂ in hooded escape BA sets using a pulsed sampling method, PC controlled, triggered by changes in the air temperature within the breathing zone.

Although primarily developed for monitoring re-breathed CO₂, the method can be extended for use in inward leakage measurements on other types of facepiece.

"Review of Interaction of Respiratory Protection Equipment with Personal Protection Equipment," presented by Julia B. G. Johnstone, Institute of Occupational Medicine, 8 Roxburgh Place, Edinburgh EH8 9SU, Scotland, United Kingdom

In many work situations the wearers of RPE often also have to wear other types of PPE such as safety helmets, protective clothing or hearing protectors which can either reduce the effectiveness of one or other item of PPE or can result in the wearer being exposed to additional health or safety risks created by the PPE. For example, if a full facepiece is worn with a safety helmet, the facepiece visor can interfere with the safety helmet, forcing it to tip backwards on the head. If the helmet was struck by a falling object, the force could be transferred to the visor causing the visor to be displaced and respiratory protection reduced or lost. In addition, the front head-harness buckle on some facepieces almost fills the space between the forehead and the helmet so that any impact on the front of the helmet, e.g., caused by walking into an obstruction, could force the buckle into the forehead.

For some PPE ensembles such as full facepiece respirators worn with chemical protective suits, the ensemble substantially reduces the body's ability to lose the heat generated by metabolic processes and can thus either exacerbate an existing thermal stress risk or can generate risk where the environmental conditions would not otherwise suggest that such a risk exists.

In addition, the interactions between different types of PPE can cause items which individually would not be regarded as being unacceptably uncomfortable to be regarded as unacceptable when combined with the other items of PPE. Given that in some work situations uncomfortable PPE might either not be worn or might be mis-worn in the attempt to reduce discomfort, it is essential that combinations of RPE with the other types of PPE do not cause unacceptable discomfort.

This presentation will review the available information regarding the interactions of RPE with other types of PPE.

"Setting Performance Criteria for Protective Clothing," presented by Robin M. Howie, Institute of Occupational Medicine, 8 Roxburgh Place, Edinburgh EH8 9SU, Scotland, United Kingdom

Protective clothing selection has to take account of a number of factors:

- Protective performance against agent(s) of concern.
- Possible interactions with any other item of PPE.
- Thermal consequences of the total PPE ensemble.
- Comfort and wearability.

In selecting protective clothing able to provide adequate protection and which is matched to the wearers, their jobs and environments, it is essential that all four above aspects of performance are taken fully into account.

Protective clothing thus has to be selected against criteria which ensures the above.

The protective performance of clothing against aerosols or gases can be limited by penetration or permeation of fabrics, seams and fasteners and by leakage at seals between the body and the garment. The user should be aware of the protective performance needed and should require potential suppliers to provide the relevant test data covering all four limiting factors above.

Some types of clothing can interact with other items of PPE, e.g., hoods can interfere with the fit of safety helmets if the fabrics are too thick.

During the selection process the users should clearly define what other items of PPE may require to be worn along with the clothing and should ensure that deleterious interactions are prevented.

Protective clothing can cover significant areas of the body and thus reduce or prevent the loss of heat generated by metabolic processes. This effect can be exacerbated if other items of PPE can cover the remaining areas of the body, e.g., PPE such as gloves or respirator facepieces can result in virtually all of the skin surface being covered.

During the selection process the user should evaluate how much heat will be generated by the wearers and ensure that the protective clothing selected, when worn with the other items of PPE, do not create a thermal stress risk. If such cannot be achieved, the user should determine the maximum safe wear durations and implement the relevant administrative procedures to ensure that such safe wear

durations are not exceeded.

Protective clothing should be selected to ensure that the total protective ensemble does not impose unacceptable discomfort on the wearers. This should be achieved by ensuring that the protective clothing selected provides adequate protection without either generating significant thermal stress or restriction to movement. To achieve this requirement, wearers should be actively involved in the selection process.

"Particle Protection in Protective Clothing: The CEN View," presented by Helmut Eichinger, Du Pont De Nemours Int. SA, 2 Chemin Du Pavillon, CH-1218 Le Grand-Saconnex, Geneva, Switzerland

In line with EEC Directive 89/686/EEC, the CEN Technical Committee TC162 was mandated to establish test methods and performance classification for CE type certification of protective clothing.

Particle hazards occur in the form of chemical powders, biological agents and radioactive contamination. Protective requirements depend upon particle sizes (very fine particle: <1 micron; fine particles 1-20 microns), particle geometry (spherical particles, fibers) and challenge conditions (continuous direct surface contact, particle aerosol).

The new EN standards evaluate protective clothing based on resistance and barrier tests for clothing materials, seams, closures and on dynamic whole suit tests. They are setting minimum performance requirements and a scheme for performance level classification. A technical report is being drafted that shall serve as protective clothing selection guide.

Based on these new EN standards and the protective clothing selection guide report, users, professional associations, and health and safety inspectors shall be able to express their protection needs in European wide harmonized terms.

"Health Protection—An Integrated Approach?" presented by P. G. Evans, Health & Safety Executive, Magdalen House, Stanley Precinct, Bootle, Merseyside L20 3QZ

This open forum session is intended to stimulate debate on the use of an integrated approach to Personal Protective Equipment (PPE) in order to better safeguard the health of the wearer.

Traditionally, and for obvious reasons, ISRP has concerned itself with respiratory protection only. Can this approach be sustained when personal protection requires a coordinated response to health risks? Occupational ill-health does not recognize these boundaries and protective clothing, such as suits and gloves, is an important means of defending a significant route of assault by chemical, physical, and biological agents.

Does ISRP's parochial approach contribute to problems of incompatibility when more than one item of PPE has to be worn? Does it lead to insufficient attention being paid to important subjects such as comfort and heat stress? Should ISRP continue with its insular (purist?) attitude to respiratory protection, or should it acknowledge the importance of its interaction with other protective equipment and stimulate cooperation with groups interested in these areas? The view of delegates will be most welcome.