

PROMISING DIRECTIONS FOR RESPIRATOR RESEARCH

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It is my purpose to discuss selected aspects of respirator usage which could benefit the user **population**. Some questions are major ones which will require mobilization of considerable talent and physical resources to obtain answers and practical apparatus or procedures resulting from these **answers**. Other questions are not as formidable and will not require comparable talent, resources or energy for resolution. Vannevar Bush related the research establishment and its efforts to the building of pyramids. Some pyramid workers build the foundation stones, others **conceptualize** the design and yet others perform the essential but less formidable task of smoothing stone surfaces, shifting stones or even cleaning up debris. The current state of the art of respiratory protection has needs ranging from cleaning up the debris of old practices to initiating new and imaginative research which could change concepts of respiratory protective equipment and its testing. I will discuss research areas that represent great need and are opportune for investigative assault.

1. Matching Wearer Respiratory Impairment to **RPE** resistance.

Who should wear a respirator? Approximately 7×10^6 workers have respiratory impairment. There are no guidelines for a physician to state that a protective device can be worn by a certain individual. It is conceivable that more harm than good is done by a worker with respiratory impairment being assigned a respirator. It remains to sort out what tests of pulmonary function will be used to gather data to answer this question and what values of the parameter(s) will be the basis for either further screening of the potential wearer or denial of the respirator to the worker. The latter is effectively excluding the affected employee from performance of selected jobs.

Testing to **determine** the parameters of interest should be performed under stress, rather than at rest. Stress testing for respirator performance has seldom been reported in the literature.

2. Test Protocols

Many of the traditional tests for respirator performance are highly specific (silica dust, lead fume, for examples). **They** are empirical in the sense that by using certain apparatus and by following very specific procedures, the test dust can be reasonably reproduced. The test result has qualified the device for usage with a wide range of airborne toxic dusts which may differ in size **characteristics**, as well as composition, from the test dust. It is not clear that the performance on a wide array of potentially toxic materials is predictable from performance on one test material. This problem is at its most acute with potentially toxic gases. The predictability of performance of canisters for pollutant gases on the basis of performance testing with one gaseous contaminant is poor, at best. We must investigate the adsorption, and solid state chemical reaction fields with the purpose of improving our predictability of canister performance for **nontested** aerosols and gases.

3. Testing in Place

Perhaps the most controversial subject of current RPE research is whether or not we can now test these units quickly, effectively, and **reproducibly** while

they are worn by the user in the field. I look to this conference to supply the most up-to-date answers to this question. It appears clear that all needed tests for **in-place** testing are not available, because they are not available for utilization in the **laboratory**. Are there any field testing methods capable of usage today? Are they practical and economically feasible? Surely we owe it to the RPE user to offer a test which reveals something about his/her respirator usage, rather than average leakage penetration figures for the device based on testing in a laboratory setting under non-stress conditions.

4. Respirator Design

Several aspects of respirator materials and components appear to be candidates for major improvement. Thus, physical dimensions of **half-mask** and full face respirators are not adaptable to the variety of male and female facial characteristics. **Anthropometric** research projects to designate categories of respirator face fits have been sporadic in the past. We need a systematic approach to this problem.

The incorporation into a respirator of a feature that indicates saturations of cartridge or pressure drop buildup in a visible or audible manner should not be an insurmountable research **task**, even when one recognizes the economic constraints for meeting the market needs and including such a feature.

The valving of many demand respirators has not altered in my professional lifetime. Has the question of low resistance, stable valves been addressed anew recently?

Finally, can we make available half or full mask respiratory protective equipment with provision for removing **multiple** gaseous and particulate contaminants? The usual solution for protection in such atmospheres is to opt for supplied air type units.

5. Behavioral Patterns Associated with RPE Usage.

It is well known that even where the effective RPE unit is available and the need for its usage exists, selected employees refuse to wear it. What are the dimensions of this refusal to protect **one's** self? Do we **have** a good understanding of who will and will not wear RPE and why? I certainly do not. Personal experiences strongly suggest that it is linked to attitudes towards work, to authority and perhaps an image of self. We should attempt to inject some behavioral research into the RPE investigatory framework.