estimates of the physiological requirements of the user, tempered by present and future engineering limitations. (6) When available, breathing machines, rather than human subjects, should be used for the majority of certification testing. (7) A more realistic ergonomics test than that presently proposed is needed. (8) A test for the gas tightness of the complete apparatus is needed. (9) A better test than that currently employed is needed to determine how well the mask fits the wearer.

Respirator certification requirements from the following foreign countries were reviewed: Australia, CEN (European Economic Community), Japan, and Great Britain. A comparison was then made with the US requirements. Certain requirements used by these countries, such as the flame resistance requirements of CEN and the extensive ergonomic tests required in Britain, should be incorporated into revised US regulations.

RESPIRATOR FIELD PERFORMANCE FACTORS

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The use of protection factors (PFs) or fit factors (FFs) to predict the level of protection provided the worker under actual use conditions involves a major uncertainty caused by variations associated with field applications. This concern has been identified and has resulted in the definition of the terms Field Performance Factor (FPF) and Worker Use Factor (WUF)[1] to better represent the protection provided. To quantitate the FPF, a study was jointly sponsored by the Occupational Safety and Health Administration (OSHA) and the Nuclear Regulatory Commission (NRC) that would ultimately involve the measurement of respirator performance under actual use conditions. These tests would relate FPF to the FF measured at the work site by using a portable quantitative fit test system.

OSHA and NRC requested that before the field study, efforts be directed to Task I, a review of the problems associated with sampling aerosols within the respirator facepiece in order to determine FF or FPF, and Task II, an environmental chamber study to determine the effects of temperature and humidity on a respirator wearer. The field study would be Task III.

Task I—Literature Review on Aerosol Sampling Devices for Respirator Field Study. A literature search for information regarding particulate sampling devices was initiated. Literature on field testing of respirators was evaluated for sampling devices utilized and for the rates, flows, and other pertinent data necessary to perform comparisons and recommendations. The review was completed and a draft report was written.

Task II—A Study To Determine the Effects of Temperature and Humidity on Respirator Fit Under Simulated Work Conditions. After a comprehensive evaluation of the many aspects of the environmental chamber study, it was decided to purchase and install an environmental chamber at Los Alamos. Specifications were written and the chamber will be ordered for delivery in 1984.

The study protocol will be presented to the Human Studies Review Committee for approval. Drafts of the necessary forms have been prepared and no problems are expected.

Design of the chamber test program has been completed and approved by OSHA and NRC. Major test program criteria follow:

(1) An anthropometric panel will *not* be used.
(2) The positive-pressure respirator tests would be conducted first. These respirators were identified and criteria set for determining prescreening acceptable fit.
(3) The negative-pressure respirators were selected and prescreening acceptable fit criteria set. The normal head-movement fit exercises would be used.

(4) The work exercises to be performed inside the environmental chamber by each test subject are to
   (a) move sand from one container to another with a shovel,
   (b) pound on a railroad tie with a sledge hammer,
   (c) step up and down a two-step ladder at a moderate rate,
   (d) pick up clay bricks from the floor and lay them in a corner pattern with nonsolidifying mortar, and
   (e) pound nails with claw hammer into a board located above the head of the subject.

Reference

1. A. Hack, C. Fairchild, and B. J. Skaggs, letter to "The Forum," *American Industrial Hygiene Association Journal* 43, A–16 (December 1982).

PENETRATION OF RESPIRATOR FILTERS BY FIBROUS AEROSOLS

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This project will measure the penetration of selected respirator filters by asbestos fibers. These data will assist OSHA in the development of revised asbestos standards for worker protection. This work is designed to test respirator filter media and will not evaluate leakage around the sealing interface between the respirator facepiece and the wearer's face. All respirator media scheduled for testing are filters that are currently approved by OSHA for use against asbestos. These filters will be challenged with well-characterized fibrous aerosols and the resultant penetration measured.

Experimental activities have primarily involved assembly of the test system, measurement of the penetration of several respirator filter models with a fibrous glass aerosol to proof the test system, and preparation for testing with an asbestos aerosol during 1984.

The test system that has been assembled is schematically illustrated in Fig. 6. The generator is a modified Timbrell-type device, which we have shown to be reliable in providing reproducible atmospheres of fibrous aerosols. Dilution air may be added to the generator output to aid in reaching the desired challenge concentration of fibers (5 to 50 fibers/cm^3) in the aerosol containment chamber. The respirator filter is encased in a smaller removable Lucite chamber, which allows the aerosol to be drawn from the main containment chamber through the test respirator by a side port. There is provision to monitor the flow, nominally 64 L/min, through the respirator filter and the pressure drop across the filter. The aerosol upstream of the respirator filter is sampled by a 25-mm membrane filter through a port in the side of the Lucite chamber containing the respirator filter. All of the air that passes through the respirator filter is filtered by a 47-mm membrane filter that is used to determine the concentration of fibers downstream of the respirator filter. Respirator penetration is assessed by microscopic counting of fibers collected upstream compared with those downstream of the test respirator filter media. The membrane filters used for aerosol collection are the standard type recommended by OSHA (Millipore type AAWG, nominal pore size 0.8 μm).

Preliminary penetration measurements have been made using a fine-diameter fibrous glass aerosol. From previous studies at Los Alamos, the mean diameter of this aerosol is known to be 0.45