



**Homeland
Security**

Science and Technology

Summary

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts unbiased operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). The SAVER Program mission includes:

- Conducting impartial, practitioner relevant, and operationally oriented assessments and validations of emergency responder equipment;
- Providing information that enables decision makers and responders to better select, procure, use, and maintain emergency responder equipment.

Information provided by the SAVER Program will be shared nationally with the responder community, providing a life-saving and cost-saving asset to DHS, as well as to federal, state, and local responders.

The SAVER Program is established and supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

To contact the SAVER Program Support Office
Telephone: 877-336-2752

E-mail: saver@dhs.gov

Visit the SAVER Web site: <https://www.rkb.us/saver>

Assessment Report on Mask Leak/Fit Testers (MLFTs)

In order to provide emergency responders with information on currently available Mask Leak/Fit Tester (MLFT) technologies, capabilities, and limitations, the U.S. Department of Homeland Security's SAVER Program performed an assessment of comparable MLFT equipment in February 2007 to validate their use and effectiveness in preparedness applications. Findings are provided in the Assessment Report on Mask Leak/Fit Testers, which is available by request at <https://www.rkb.us/saver>.

Background

Emergency responders may work in conditions where they are exposed to harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors. Modern respirator facepieces are capable of a high degree of protection but only if they are fitted correctly and properly donned. MLFTs are necessary in emergency response services including public works, law enforcement, fire, emergency medical services, and health care. Fit tests are commonly categorized as either a qualitative fit test (QLFT) or a quantitative fit test (QNFT). A QLFT uses a test aerosol to determine if a proper mask seal has been achieved. The wearer must determine whether the aerosol can be detected by taste or smell once the respirator is donned. A QNFT measures either the infiltration of air into the facepiece or the infiltration of particles inside the wearer's breathing zone.

Assessment

An MLFT focus group was held prior to the assessment to identify MLFT informational needs and establish assessment criteria. Percentage values were then assigned to each SAVER category. Although you can perform a QLFT and a QNFT with MLFTs, the focus group noted that QLFT relies on voluntary or involuntary responses (taste, smell, or irritation) to a challenge agent and is therefore a more subjective means of fit-testing a responder mask. Based on the recommendation of the MLFT focus group, the assessment focused on the comparative assessment of QNFTs, which follow the testing set forth in Occupational Safety and Health Administration (OSHA) 1920.134.

Two MLFTs were assessed:

- Thermo-Systems Incorporated (TSI) PortaCount® Plus
- Occupational Health Dynamics (OHD) FitTester 3000®.

Six emergency response subject matter experts (SMEs) were selected to serve as evaluators. Evaluators were divided into two three-member teams, and each team member and data recorder was assigned an air-purifying respirator (APR) or self-contained breathing apparatus (SCBA) facepiece to use during the assessment. Two APR and two SCBA facepiece models representing a cross section of available masks were selected for use in the assessment. Each team member was assigned a different model mask to expose the evaluators to the different types of adapters and setup requirements required by both fit tester models. Each team used one of each of the following mask models:

- Scott® SCBA AV2000® SCBA facepiece
- MSA FireHawk™ Air Mask (SCBA) facepiece
- North Safety Products 54501 Series APR
- 3M™ 7800 Series Full Facepiece APR.

During each assessment rotation, evaluator teams installed the computer software, set up the fit tester, and completed a successful fit test on each team member as well as the team's data recorder. The teams then rotated to allow evaluators to use both MLFT models. Each MLFT model was evaluated in the same manner, and the assessment conditions were controlled to make the evaluation of each system as similar as possible.

Assessment Results

Evaluators scored the MLFT models based on the evaluation criteria that were established by the MLFT focus group and prioritized within the five SAVER categories (capability, usability, affordability, deployability, and maintainability). The scoring system was based on a 100-point scale. The evaluator category and composite scores are shown in table 1. Higher scores indicate better MLFT performance.



The following sections provide a brief summary of the evaluator comments and feedback on each assessed MLFT. The evaluator comments have been grouped by five topics that received the most evaluator feedback. The full report contains a criterion-by-criterion breakdown of evaluator comments.

PortaCount Plus

The PortaCount Plus received the highest overall evaluator score, and scored highest in the capability, usability, and maintainability categories. The PortaCount Plus and FitTester 3000 received the same deployability category score.

Fit-Testing Capabilities. Evaluators reported that the fit tester is capable of fit testing APR as well as powered air-purifying respirator (PAPR) and SCBA facepieces. They noted that the assessed PortaCount Plus system is capable of fit testing N95 particulate respirators, and P2 and P1 disposable respirators. These mask types, however, were not used in the assessment. They added that TSI for the PortaCount offers adapters for a broad range of respirators, and the company Web site provides a detailed adapter compatibility chart for the APR, PAPR, and SCBA facepieces. Evaluators noted that a large number of APR require the same TSI

Table 1. MLFT Assessment Results

| MLFT | Composite Score | Affordability (.10 Overall Weighting) | Capability (.30 Overall Weighting) | Deployability (.10 Overall Weighting) | Maintainability (.20 Overall Weighting) | Usability (.30 Overall Weighting) |
|---|-----------------|---------------------------------------|------------------------------------|---------------------------------------|---|-----------------------------------|
|  PortaCount® Plus | 71 | 59 | 70 | 77 | 68 | 74 |
|  FitTester 3000® | 65 | 61 | 59 | 77 | 63 | 70 |

40 millimeter (mm) adapter kit while the PAPR and SCBA facepieces required model-specific adapters. Evaluators also noted that the PortaCount Plus requires several consumable items such as alcohol, alcohol wicks, salt tablets, zero check filters, and mask filters for operation.

Stand-Alone or Computer Software Operation. The PortaCount Plus is capable of fit testing as a stand-alone unit or in conjunction with a computer. Evaluators reported that the stand-alone unit is easy to set up and operate. They noted that the display screen and controls are functionally labeled. They also noted, however, that the stand-alone unit does not store fit-testing results for future printing or reference but requires the results to be printed following each test. Evaluators pointed out that the stand-alone unit is only compatible with two TSI portable printers, which they considered expensive. Evaluators reported that the computer software included with the PortaCount Plus makes the system even easier to operate but it is only compatible with Microsoft Windows® 2000 and Windows® XP operating systems. They commented that the software was easy to

install and operate. Evaluators stated that the software’s large screen prompts make it easy for the operator and the user to follow the protocol steps. Most evaluators noted that the user-friendly software made it possible for the user to conduct the test without an operator. They stated that the computer software also allows fit-testing results to be stored in a database in Microsoft Access™ format and/or printed from any printer.

Adapters. Evaluators noted that the PortaCount adapter kits required by the assessed fit testers were reasonably priced, but also were the greatest source of evaluator frustration. Evaluators reported that the PortaCount adapters require a sample tube to be placed in the mask’s breathing zone. They discovered that the method for inserting the tube is slightly different for each adapter and mask. Evaluators noted that the user manual provided no specific adapter instructions, and the instructions included with the adapters did not have mask-specific pictures or diagrams to help with installation. They pointed out that the instructions included with the generic 40mm adapter kit used with the 3M and North APR were much easier to follow than the

instructions for the Scott and MSA SCBA facepiece adapter kits.

Fit-Testing Time. Evaluators reported that an OSHA CFR 1910.134 protocol fit test can be completed in approximately 15 minutes. Evaluators stated that the tests were quickly completed, but they pointed out that the user must don the mask for 5 minutes prior to beginning the eight-step protocol. They agreed that following the completion of a fit test, the fit tester can be ready to fit test another mask of the same model almost immediately. Evaluators noted that the FitPlus software can eliminate unnecessary testing time by allowing the operator to program the software to immediately terminate the test when the fit factor for any exercise fails or to continue through all eight steps before failing the test.

Warranty and Maintenance. The PortaCount Plus has a 2-year parts and labor warranty. Evaluators reported that TSI recommends annual manufacturer maintenance, which includes cleaning, calibration, and worn parts replacement (if necessary). They noted that the TSI Web site lists a \$695 fee for annual maintenance.

FitTester 3000

The FitTester 3000 received the highest evaluator score in the affordability category. The FitTester 3000 and the PortaCount Plus received the same deployability category score.

Fit-Testing Capabilities. Evaluators reported that the FitTester 3000 is capable of fit testing APR and SCBA facepieces. They noted that most APR models use the same 40mm adapter kit but model-specific adapters were needed for most PAPR and SCBA facepieces. Evaluators noted that the FitTester 3000 requires no consumable items for operation.

Stand-Alone or Computer Software Operation. The FitTester 3000 is capable of fit testing as a stand-alone unit or in conjunction with a computer. Evaluators reported that the stand-alone unit was quick and easy to set up but a little more complicated to operate as a stand-alone unit due to the multiple function arrow keys. They noted that the stand-alone FitTester 3000 can connect directly to any IBM[®]-compatible printer. Evaluators reported that the computer software included with the FitTester 3000 was simpler and more intuitive to operate than the stand-alone unit, but the software is only compatible with Microsoft Windows 2000 and Windows XP operating systems. The computer software can import personnel data from Microsoft Excel[®] or American Standard Code for Information Interchange (ASCII) files and can only export ASCII text files.

Adapters. Evaluators reported that the FitTester 3000 adapter kits were somewhat expensive and especially troublesome. Unlike the PortaCount Plus adapters, which insert a tube into the mask's breathing zone, the FitTester adapters require the inhalation valve diaphragms of the APR (and the SCBA adapters) to be propped open or removed. Evaluators experienced several failed fit tests before discovering how to adequately prop open the diaphragms on the APR, and they encountered even more difficulty removing the diaphragms from the MSA 1/4 turn mask-mounted regulator (MMR) adapter that was required to fit test the MSA FireHawk SCBA facepiece. Evaluators commented that no clear directions were provided on how to safely and effectively prop open or remove the diaphragms.

Fit-Testing Time. Evaluators reported that an OSHA protocol fit test can be completed in less than 15 minutes, unless the user is required to repeat several exercises. Each time a user fails any step, evaluators stated that the

FitTester 3000 allows the operator to choose whether to retest the step, move to the next step, or abort the test. They pointed out that the computer software immediately retests the step when the retest option is clicked while the stand-alone unit requires operator response to a second prompt before it retests the step. Due to the level of coordination required between the operator and the user, evaluators noted that the more familiar the user was with the 17-step protocol prior to the test, the more quickly the test was completed.

Warranty and Maintenance. The FitTester 3000 has a 2-year parts and labor warranty. Evaluators reported that OHD recommends annual manufacturer maintenance and calibration, but they were unable to find cost information in the provided materials or on the OHD Web site. They did find that OHD offers free upgrades to the unit with yearly calibration.

Conclusion

Table 2 shows evaluator-identified MLFT advantages and disadvantages of both assessed fit testers. Even though the evaluators were able to successfully fit test the masks used in the assessment, they agreed that emergency responders will need additional respiratory protection and fit-testing training in order to proficiently operate the fit testers. The evaluators' consensus was that the provided instructional materials were only adequate to train potential operators with a clear understanding of respiratory protection, respirators, and fit testing prior to instruction on these fit tester models.

All reports in the MLFT series, as well as reports on other technologies, are available on the SAVER Web site (<https://www.rkb.us/saver>).

Table 2. Evaluator-Identified MLFT Advantages and Disadvantages



| MLFT | Advantages | Disadvantages |
|---|---|---|
|  <p data-bbox="295 1545 467 1570">PortaCount® Plus</p> | <ul style="list-style-type: none"> • Software is easy to install and user-friendly^a • Software instructions are detailed • Large screen prompts are easy to follow • Test times are short • 40mm APR adapter fits a large number of respirators^a • 40mm APR adapter instructions are clear and easy to follow • N95 Companion allows fit testing of N95 particulate respirators, P2 and P1 disposable respirators • Software database stores files in Microsoft Access format • Protective storage/transit case is rugged and well organized | <ul style="list-style-type: none"> • Stand-alone mode requires special printer • User manual does not provide step-by-step operating instructions • Software manual comes on a CD • Fit tester requires consumables • MSA and Scott SCBA adapter instructions lack details |

Table 2. Evaluator-Identified MLFT Advantages and Disadvantages (Continued)

| MLFT | Advantages | Disadvantages |
|--|--|--|
|  <p>FitTester 3000®</p> | <ul style="list-style-type: none"> • Software is easy to install and user-friendly^a • Fit tester is quick and easy to set up • Helpful quick-start guide • Daily checks are quick and simple to conduct • 40mm APR adapter fits a large number of respirators^a • Software and stand-alone modes have retest option • Stand-alone mode can print results with most IBM-compatible printers | <ul style="list-style-type: none"> • Adapters require removing or propping open diaphragms • Adapter instructions are lacking details or not included • Correct squeeze bulb operation requires user familiarity • Movement following exercises can affect test results • Multi-function arrow keys are not intuitive • Protective storage/transit case is an optional accessory • Software database files must be converted from ASCII format • Operator must watch user for step confirmation • User manual does not provide step-by-step instructions • Does not fit test N95 particulate or P2 and P1 disposable respirators |

Note:

^a Evaluator-identified advantages or disadvantages common to both fit testers.