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ATTN: STEDP-C
Dugway, UT 84022-5000

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13. ABSTRACT *(Maximum 200 words)*

This Test Operations Procedure (TOP) is intended to furnish basic testing information to facilitate test planning, conducting and reporting, and to achieve standardization testing of protective masks. It describes test facilities, equipment, and procedures to be used for testing of protective masks. It describes test facilities, equipment, and procedures, to be used for testing and evaluating protective mask technical performance and safety aspects.

14. SUBJECT TERMS

Protective mask, NBC survivability, physical properties, biological & nuclear simulant, chemical agents, adverse environments, logistics supportability, contamination, surface transportation, sanitization, rough handling, reliability, decontamination

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HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005-5055

REPLY TO
ATTENTION OF

AMSTE-TM-T (70) 27 Aug 97

MEMORANDUM FOR Administrator, Defense Technical Information Center, 8725 John J. Kingman Rd., STE 0944 Ft Belvoir, VA 22060-6218

SUBJECT: Test Operations Procedure (TOP) 8-2-110, Masks, Protective, 1 Aug 97

1. Enclosed are DTIC Form 50 (Encl 1) and two copies of subject test operations procedure (Encl 2) for assignment of accession number.

2. This TOP supersedes TOP 8-2-110, AD No. A091737, 1 Oct 80, which should be removed from your library and discarded.

3. The TECOM point of contact is Mr. Wolfgang HR. Schmidt, AMSTE-TM-T, amstetmt@apg-9.apg.army.mil, DSN 298-1486.

FOR THE COMMANDER:

2 Encls

C. DAVID BROWN, Ph.D.
Chief, Simulation & Technology Div
Directorate for Technical Mission

DTIC QUALITY INSPECTED 4

U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

*Test Operations Procedure 8-2-110 1 August 1997
AD No.

MASKS, PROTECTIVE

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*This TOP supersedes TOP 8-2-110, October 1980.

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1. SCOPE.

a. This test operations procedure (TOP) provides the current standard for planning and conducting tests to evaluate and/or estimate the technical performance of nuclear, biological, and chemical (NBC) masks, as defined in the Operational Requirement Document (ORD), Independent Assessment Plan (IAP), the Independent Evaluation Plan (IEP), the Test Design Plan (TDP), or other publications that pertain to the test item.

b. This TOP describes standard procedures for testing NBC protective masks and accessories. Cold weather testing is excluded from this TOP, as it is covered in TOP 8-4-006[a].

c. The test procedures described herein may be required in a detailed test plan (DTP). The procedure may require modification for unique items or materials or to satisfy specific testing requirements as specified in an IAP or an IEP/TDP. However, alteration of this procedure shall be made only after full consideration of the possible effect the changes may have upon the reliability and validity of the data to be obtained and will be coordinated with all concerned organizations in advance. Appendix A contains a background discussion of various test equipment and challenge agents that have been used in previous protective mask tests. Appendix B contains miscellaneous test information including sample data sheets.

2. FACILITIES AND INSTRUMENTATION

2.1 Facilities.

Facility	Requirement
Medical Clinic	The clinic shall have medical authorities and equipment required to treat exposure to chemical agent or overexposure to simulant, or an adverse reaction to physiological stress. The staff shall include emergency medical technicians (EMTs) qualified in advanced life support. These EMTs shall be present during all chemical agent trials to observe possible adverse physiological responses in participants and to provide appropriate medical aid whenever necessary.
Quantitative Man/Fit Test System	Shall include test booth, simulant vapor and aerosol generators, and all instrumentation necessary to perform quantitative man/fit testing, including sampling systems and recorders.

[a]Reference letters/numbers correspond to those in Appendix D, References.

Facility	Requirement
Chemical laboratory and chemical agent storage facility	Constructed to ensure safe and secure storage, handling, analysis, and decontamination of research, development, test, and evaluation (RDT&E) quantities of chemical agents. The chemical agent laboratory and personnel assignments must meet all requirements of U.S. Army Regulation (AR) 50-6[1], AR 190-59[2], and the safety requirements of U.S. Army Materiel Command Regulation (AMCR) 385-100[3] and Department of the Army Pamphlet (DA PAM) 385-61[4].
Biological laboratory and test chamber	Required to store and prepare test quantities of biological simulant materials, to charge disseminating devices and prepare samplers, and to analyze all biological simulants. Must be equipped with an air intake and an exhaust system. The exhaust system will include high-efficiency particulate filters. The chamber should allow free air circulation around the test item.
Personnel change room and shower facility	To allow personnel to shower and change into clean test clothing before and after tests to reduce cross-contamination and contamination of facilities and non-test personnel.
Engineering control system	Test areas in laboratories and chambers must be equipped with climatic controls that allow air temperatures and air exchange rates to be maintained at prescribed levels throughout the testing period.
Rough handling equipment:	
a. Shock	As specified in Military Standard (MIL-STD-) 810E[5], Method 516.4, Procedure II.
b. Vibration	As specified in MIL-STD-810E[5], Category I, Method 514.4, Procedure I.
c. Low pressure (Altitude)	As specified in MIL-STD-810E[5], Method 500.3, Procedure I.
Climatic chambers	Control temperature and relative humidity (RH) as required.
a. Solar Radiation (Sunshine)	As specified in MIL-STD-810E[5], Method 505.3, Procedure I.

Facility	Requirement
b. Rain	As specified in MIL-STD-810E[5], Method 506.3, Procedure I.
c. Humidity	As specified in MIL-STD-810E[5], Method 507.3, Procedure II.
d. Fungus	As specified in MIL-STD-810E[5], Method 508.4, Procedure I.
e. Salt Fog	As specified in MIL-STD-810E[5], Method 509.3, Procedure I.
f. Sand and Dust	As specified in MIL-STD-810E[5], Method 510.3, Procedures I and II.

2.2 Instrumentation.

Devices for Measuring	Permissible Error of Measurement
Weighing scales	±1.0 percent of item weight
Still color camera	Adequate to document typical test procedures, details of techniques, and any discrepancies from planned procedures as necessitated by operational conditions.
Video camera and/or motion picture camera	Adequate to monitor the test, document, and time test events and procedures.
Metric scale and tape measure	±1.0 mm
Chronometer	±1.0 s
Air temperature	±0.5°C
RH	±5 percent
Airflow	±0.1 m/s
Graduated cylinder	Standard for commercial items
Charcoal properties	As specified in Military Specification (MIL-SPEC) MIL-C-0013724D[6].
Tensile strength, tensile set, and elongation	As specified in American Society for Testing and Materials (ASTM) Method D412[7].

Devices for Measuring	Permissible Error of Measurement
Tear resistance	As specified in ASTM Method D624[8].
Haze	As specified in ASTM Method D1003[9] and MIL-SPEC MIL-L-0050064F[10], Amendment 2.
Lens Protection	As specified in MIL-STD-662E[11] lens capability against fragments.
Hardness	As specified in ASTM Method D2240[12].
Ozone concentration	As specified in ASTM Method D1149[13].
Mask airflow resistance tester	As specified in Q213 Inhalation/Exhalation Airflow Resistance Tester manual, Edgewood Arsenal (EA) Manual No. 136-300-296[14].
Canister/filter airflow resistance	As specified in the Q127 dioctyl phthalate (DOP) Penetrometer Filter Tester manual, EA Manual No. 136-300-138[15].
DOP penetration	As specified in the Q127 DOP Penetrometer Filter Tester manual, EA Manual No. 136-300-138[15].
Microphone tester	As specified in Q12A2 Microphone Functional Tester source control drawing no. 136-30-180[16].
Mask leakage tester	As specified in M14 Protective Mask Leakage Tester manual, EA Manual No. 136-300-18[17].
Physical optics characteristics	As specified in ASTM Method D1044[18], MIL-SPEC MIL-V-43511C[19], ASTM Method D1003[9], or other specified test method.
Outlet valve leakage tester	As specified in M4A1 Outlet Valve Tester manual, EA Manual No. 136-300-284[20].
Respirator (mechanical breather)	±0.5 L of air per minute.
Accelerometer	±0.1 percent (m/s^2)
Aerosol and vapor generators	Adjustable to meet challenge concentration requirements.

Devices for Measuring	Permissible Error of Measurement
Devices to measure viscosity and concentration, and penetration by chemical and biological agents and simulants.	As specified in TOP 8-2-111[21] and TOP 8-2-501[22].
Drinking device airflow resistance	As specified in Q179 Airflow Resistance Tester manual, EA Manual No. 136-300-262[23].
Drinking device leakage	As specified in M14 Protective Mask Leakage Tester manual, EA Manual No. 136-300-18[17].
Canister/Filter gas life	As specified in Q224 Tester manual, EA Manual No. 136-300-299[24] or Q95 Tester manual, EA Manual No. 136-300-198[25].
Rough handling equipment	As specified in the Q113 Rough Handling Tester manual, EA Manual No. 136-300-63[26].

3. REQUIRED TEST CONDITIONS.

3.1 Test Planning.

3.1.1 Experimental design. The statistical design of the test will be developed based on the requirements documents. The project officer will design the order and sequence of testing to ensure that the testing is performed in a balanced design to support the structure specified in the requirements documents, that is, not in a sequential or biased order. This is essential for obtaining data adequate to support the intended analysis and assessments.

3.1.2 Documentation. The project officer shall have available all pertinent documentation. These include the following: Human Use Committee Approval, government and manufacturers' publications, requirements document, IAP or IEP/TDP, Safety Assessment Report (SAR) including the Surgeon General toxicological approval of rubber formulation having dermal contact, test planning directive, system support package (SSP) list, Environmental Impact Assessment for Life Cycle (EIALC), Environmental Impact Statement (EIS), Record of Environmental Consideration (REC), and other documentation as necessary [e.g., TOPs and standing operating procedures (SOPs)]. These documents will contain test criteria, equipment or item specifications, and specific directions about the tests to be performed.

3.1.3 Familiarization. The test planning phase includes identifying potential problem areas by reviewing previous records and the results of similar tests. Relevant SOPs and other procedures to be used shall be reviewed for applicability, completeness, and adequacy. The development of DTPs requires review of the applicable IAP or the IEP/TDP and other test guidance, familiarization with preceding development and test phases, study of test criteria, and selection of appropriate samples, methods, sequences, facilities, and test equipment. Data from previous similar tests shall be considered in order to avoid duplication and to reduce the scope of further testing.

3.1.4 Environmental Assessment. In compliance with the National Environmental Policy Act (NEPA), the Department of the Army (DA) requires that an EIALC be prepared and that potential environmental impacts be assessed at the earliest practicable stage in the planning process of any new equipment. Testing at U.S. Army Test

and Evaluation Command (TECOM) facilities must also be assessed for environmental impact. When a proposed action may significantly affect the quality of the environment, is highly environmentally controversial, or is expected to evoke litigation based on environmental issues, a detailed EIS shall be prepared and evaluated in accordance with (IAW) NEPA processes. Before the test begins, the project officer shall ensure that EIALC, EIS, REC, or other appropriate documentation has been prepared IAW AR 200-2[27], is received, approved, and understood.

3.1.5 Human Use Protocol. Subtests that involve test participants (personnel engaged in or directly supporting, on site, the testing of a materiel system, methodology investigation, or instrumentation program) will address the safety aspects and procedures outlined in TECOM Regulation 385-7[28] and AR 70-25[29].

3.2 Preparations for Test.

Test preparations include selecting and readying the test chamber, instruments, samplers, and equipment needed for exercise scenarios, and the selection and preparation of NBC mask components to be tested. Preparation may require certain preliminary activities to be included in the DTP. The project officer shall ensure that new equipment training (NET) is provided by the developer whenever necessary.

4. TEST PROCEDURES.

A sample flow of a protective mask test is provided in Figures 1 and 2.

4.1 Receipt Inspection.

4.1.1 Method.

4.1.1.1 General. All packaging and test items will be inspected IAW the applicable portions of TOP 8-2-500[30].

a. The developer's SARs and the SSP lists will be on hand before testing starts.

b. If basic issue item lists (BIILs) are not contained in the draft technical manuals (TMs), separate draft BIILs will be on hand.

c. Test item identification numbers (TIINs) will be assigned, and the test items will be marked IAW TOP 8-2-500[30].

d. A logbook will be maintained.

4.1.1.2 Shipping Containers And Intermediate Packaging. Shipping containers and intermediate packaging will be visually inspected for damage, deterioration, loose closures, and correctness and legibility of markings. Markings will be examined for conformance to the requirements of MIL-STD-129[31]. All defects will be photographed (with metric scale) and documented. Representative photographs (with metric scale) of the shipping containers and intermediate packaging will be made. The physical characteristics of the shipping boxes and intermediate packaging will be measured and recorded IAW TOP 8-2-500[30].

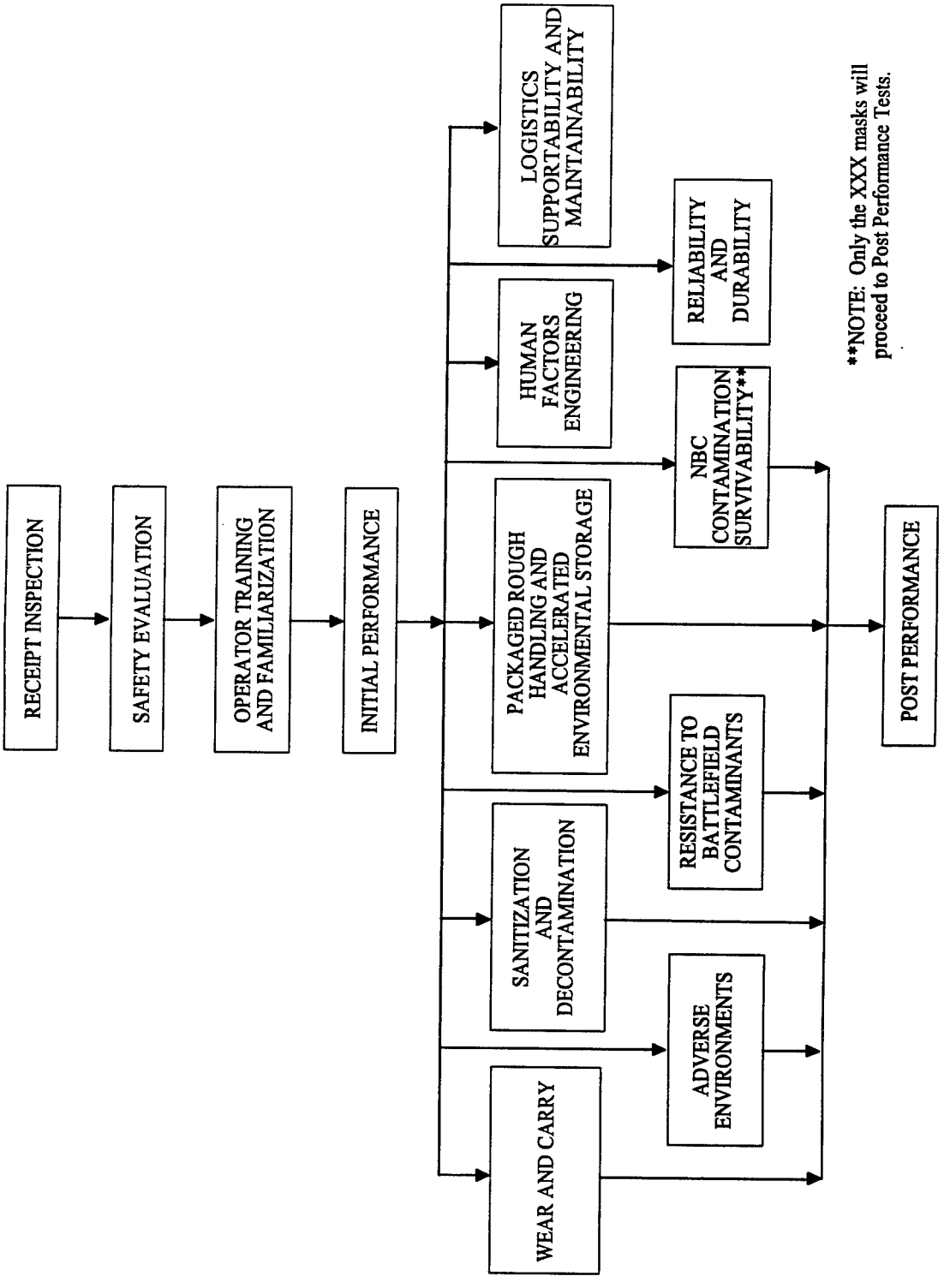


Figure 1. Sample Flow Diagram for Protective Mask Testing.

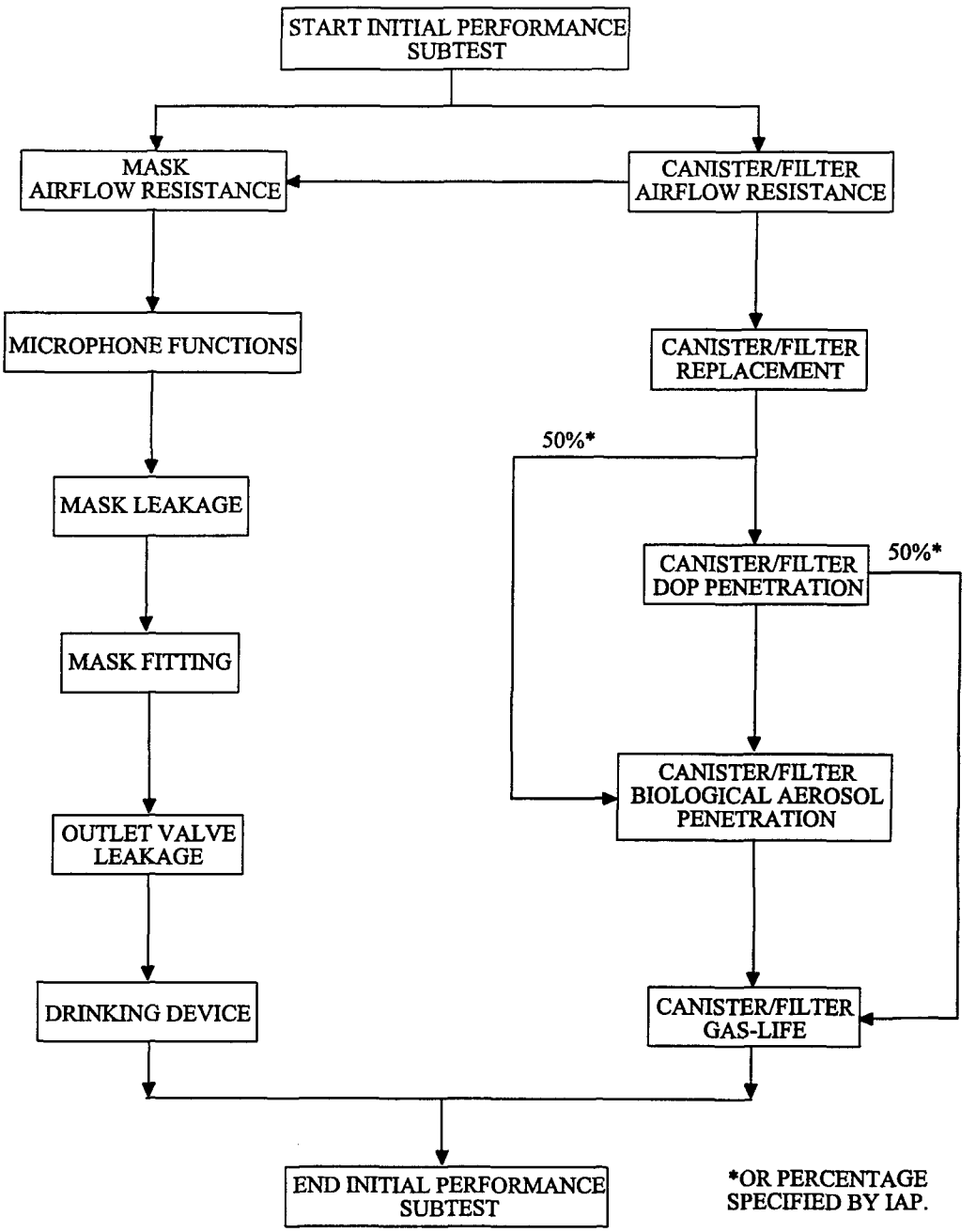


Figure 2. Testing Conducted During the Initial Performance Subtest.

4.1.1.3 Test Items.

a. The test items will be compared with the BIIL and the SSP for completeness. Any discrepancies will be recorded.

b. All components of the selected test items will be inspected for damage, deterioration, and defects. Damage will be photographed (with metric scale) and documented. The physical characteristics of the test items will be measured and recorded.

NOTES:
1. Individual canister/filter containers will only be removed from their hermetically sealed containers immediately before use in the specific subtests.
2. Any test item with an obvious defect that will cause a protection failure will be removed from further testing and replaced if possible.

4.1.2 Data Required.

4.1.2.1 Shipping Containers And Intermediate Packaging.

a. Observational and physical characteristics data.

b. Photographs (with metric scale) of all defects such as damage, deterioration, and illegible markings.

c. Photographs (with metric scale) of representative shipping containers and intermediate packaging.

d. A list of identification markings differing from MIL-STD-129[31].

4.1.2.2 Test Item Inventory And Inspection.

a. A list of items found on the BIIL and/or SSP but not present upon receipt or excess items will be reported.

b. Documentation and photographs (with metric scale) of any damage, deterioration, or defects.

c. Photographs (with metric scale) of representative test items.

d. Documentation of the physical characteristics of the test items, including TIIN if applicable.

4.2 Safety Evaluation.

4.2.1 Method.

a. The protective masks and accessories will be inspected in all configurations to ensure that they comply with the provisions contained in the developer's SAR.

b. The protective mask and accessories will be examined for any defect, omission, or condition that could be detrimental to the safety of the wearer. A sample checklist is presented in Appendix B. Imperfect items will be repaired, if feasible, or removed from further testing.

c. A recommendation for a safety release will be submitted to TECOM IAW TECOM Supplement 1 to AR 385-16[32] at the completion of the operator training and familiarization subtest.

4.2.1.1 Data Required.

a. A recommendation for safety release, based on the compliance of the received protective masks and accessories with the developer's SAR.

b. Data on any safety-related defect, omission, or condition found in the protective masks or accessories.

c. Record of hazards, observed during any phase of testing, that can be attributed to the protective mask or accessories.

4.3 Operator Training and Familiarization.

A statistically adequate number of test personnel having corrective lenses will be included in all testing requiring masks to be worn by test personnel.

4.3.1 Method. Test personnel will receive training and familiarization IAW the applicable procedures of TOP 10-2-501[33] and the following:

a. The NET will be provided by the developer. Training will include safety instructions, assembly and disassembly, donning and doffing, use of drinking devices, care (maintenance, sanitization, and decontamination), and storage.

(1) All potential test participants will be processed through sizing and fitting. Protective mask size will be selected for each individual IAW the draft TM or other governing documents.

(2) Each test participant will be instructed on how to don the protective mask. The times required for donning will be recorded for comparison in the wear and carry subtest (paragraph 4.10). The donning procedure will be performed a minimum of three times by each test participant.

(3) Each test participant will be instructed on how to set up and use the drinking device and the microphone/communication subsystem (where applicable) IAW the instruction given in the draft TM. The times required for the drinking device set up will be recorded for comparison in the drinking device subtest (paragraph 4.4.4).

(4) Test personnel will be trained in the method of mask sanitization and decontamination given in the draft TM.

b. A copy of the draft TM and the written safety instructions will be issued to each test participant.

c. The fact that each test participant understands the requirement and use for each specific test item component will be verified.

d. Test personnel will become familiar with unique terminologies not otherwise defined in the supplied instructional material.

4.3.2 Data Required.

a. Number of personnel trained.

b. Name and military occupational specialty (MOS) (MOS required only for military personnel) of each person trained.

c. Hours of training:

(1) Lectures (±0.1 hour).

(2) Hands-on (±0.1 hour).

(3) Maintenance (±0.1 hour).

d. Interview and questionnaire data.

e. Description and photographs of difficulties encountered during training.

f. TIIN and number of hours each test item is used during training (±1 hour).

g. Copy of NET lesson plan, if available.

h. Description of training aids required.

4.4 Initial Performance Test.

4.4.1 Mask Airflow Resistance Test. This test will be conducted to determine whether the protective mask meets the airflow resistance requirements specified in the criteria.

4.4.1.1 Method. The airflow resistance of each mask will be determined under ambient conditions using the Q213 Inhalation/Exhalation Airflow Resistance Tester or an approved equivalent tester as specified in the IAP. The Q213 Tester will be operated IAW the EA Manual No. 136-300-296[14].

4.4.1.2 Data Required.

a. Mask TIIN.

b. Canister/filter airflow resistance (paragraph 4.9.1).

c. Mask inhalation airflow resistance (±0.1 mm H_2O).

d. Mask exhalation airflow resistance (±0.1 mm H_2O).

4.4.2 Mask Leakage Test. This test will be conducted to determine if any leak paths, such as cuts or voids in the material, exist in the faceblank material and to determine whether the interfaces between the molded facepiece and internal components are properly sealed.

4.4.2.1 Method. The mask leakage test will be determined using the M14 Protective Mask Leakage Tester or approved equivalent tester. The M14 Tester will be operated IAW EA Manual No. 136-300-18[17]. During the leakage test, the air inlet(s) of the canister/filters will be sealed to prevent exposure to the challenge aerosol.

4.4.2.2 Data Required.

a. Mask TIINs.

b. Penetration of challenge aerosol (percent).

c. Area(s) of aerosol penetration.

4.4.3 Outlet Valve Leakage Test. This test will be conducted to determine whether the outlet valve of the protective mask meets the requirements specified in the criteria.

4.4.3.1 Method. The outlet valve of each mask will be tested for leakage using the M4A1 Outlet Valve Leakage Tester or an approved equivalent tester as specified in the IAP. The M4A1 Tester will be operated IAW EA Manual No. 136-300-284[20].

4.4.3.2 Data Required.

a. Mask TIIN.

b. Leakage rates (L/min).

4.4.4 Drinking System Flow Capability. The purposes of this test are to determine whether the drinking device has the required flow capability, whether it can be used satisfactorily in an NBC-contaminated environment without loss of protection for the user, and what the airflow resistances of the various components are.

4.4.4.1 Method. A statistically adequate number of tests will be performed to satisfy the reliability requirements of the criteria. This test will consist of a drinking device usage test and a drinking device leakage test.

a. Drinking Device Usage Test. While wearing the protective mask, test participants will prepare the drinking device IAW the instructions given in the draft TM. Once the drinking device is in place, the participants will attempt to drink 0.5 L of water within a 10-minute period. The time required to prepare the drinking device, the time required to receive water after initiating the drinking process, and the time it takes to drink the 0.5 L of water or the amount of water left after 10 minutes will be recorded.

b. Drinking Device Leakage Test. A leakage test will be performed while the drinking device is connected and disconnected from the water source. The challenge simulant aerosol will be performed with the M14 Protective Mask Leakage Tester. The tester will be operated IAW the instruction manual[17]. The challenge simulant will be confined to the area where the canteen connects to the drinking device. The canteen will be modified to permit uncontaminated airflow through the canteen and drinking device immediately after connection. Airflow will be regulated to provide an air pressure equivalent to the average value required to withdraw 0.5 L of water in a 10-minute period.

c. Airflow Resistance Test. The airflow resistance of the drinking tube, the quick disconnect coupling assembly, and the canteen cap will be measured using the Q179 Airflow Resistance Tester. The tester will be operated IAW the instruction manual[23].

4.4.4.2 Data Required.

a. Mask TIIN.

b. The time required to prepare drinking device for use (±5 seconds).

c. The time required to receive water after initiating the drinking process (±5 seconds).

d. The time required to drink 0.5 L of water (±5 seconds) or the amount of water left (mL) after 10 minutes.

e. Leakage penetration data obtained while connecting and disconnecting the drinking device.

f. Airflow resistance of components (±0.1 mm H_2O).

g. Comments and observations concerning the use of the drinking device.

4.4.5 Microphone Functioning Test.

4.4.5.1 Method. The microphones will be tested with the Q12A2 Microphone Functional Tester. The tester will be operated IAW the specification control drawing no. 136-30-180[16].

4.4.5.2 Data Required.

a. Microphone TIIN.

b. For each microphone tested, the result will be reported as a success (continuity present) or a failure (continuity not present).

4.5 Mask Fitting Test.

These tests will be conducted to provide data concerning the adequacy of the sizing and fitting procedures given in the draft TM and to determine whether the mask provides the required protection to the wearer against field concentrations of chemical and biological agents in vapor and aerosol form. Challenges will be performed only with isoamyl acetate (approved for usage with human subjects by the Office of the U.S. Army Surgeon General).

4.5.1 Method.

4.5.1.1 General.

a. Preliminary sizing and fitting are to be performed IAW procedures outlined in the draft TM.

b. All masks designated for the fitting test will first be subjected to the mask leakage test as described in paragraph 4.4.2. Any mask that does not pass the mask leakage test will not be used in the fitting test.

c. After preliminary sizing and fitting is performed, a leakage test will be performed on masks worn by test participants. The leakage test will use isoamyl acetate, or stannic chloride, or M41 Protective Mask Fit Validation System (PMFVS).

4.5.1.2 Sizing Procedure. Face length and face width will be measured IAW MIL-STD-1472D[34] for each potential test participant. These measurements will be compared with the 5th percentile (female) and the 95th percentile (male) given in MIL-STD-1472D or to the standard stated in the IAP. Any potential test participant with a face length or width outside the range given in MIL-STD-1472D will not be used in the mask leakage test.

4.5.1.3 Fitting Procedure.

a. A statistically adequate number of test subjects will be used to evaluate the fit of the mask. The test participants are to meet the conditions stated in the sizing procedure (paragraph 4.5.1.2). For each mask size there will be an approximately equal number (6 or more) of male and female test participants. The masks will then be leak tested in a simulated chemical/biological atmosphere under the following conditions:

(1) Masks only on clean shaven subjects.

(2) Masks with combat spectacles/inserts on clean-shaven subjects.

(3) Masks with hoods, helmets, and combat spectacles/inserts on clean-shaven subjects.

(4) Masks with hoods, helmets, and combat spectacles/inserts on subjects with 1-, 2-, and 3-day beard growth.

b. Each test participant will don and adjust his/her mask IAW the procedures given in the draft TM. A preliminary qualitative check will be performed with isoamyl acetate used IAW the procedures given in DA PAM 385-61[4]. If the odor of isoamyl acetate is detected by the test participant, the mask will be readjusted and retested. If leakage is again detected, the test participant will don different size masks until a proper fit has been obtained (as indicated by the isoamyl acetate test) or until it has been determined that the test participant cannot be properly fitted.

4.5.1.4 Fit Validation Test. This test will be performed for each of the test conditions stated in paragraph 4.5.1.3. Isoamyl acetate will be used to obtain a preliminary qualitative mask fit check.

a. Before the test participant enters the aerosol test chamber, a sampling tube will be attached to the mask to provide means for continuously monitoring for the presence of the challenge simulant inside the mask. Other sampling devices, such as sampling patches, may be used in conjunction with the sampling tube.

b. The challenge chemical and biological agent simulants used in this test will be the simulants currently approved for use with human test participants.

c. The following activities will be performed by each test participant while in the test chamber for the time designated by test criteria:

(1) Normal breathing upon entry until a baseline percent penetration of the challenge simulant is established.

(2) Deep breathing.

(3) Rapid head movement, looking side to side.

(4) Rapid head movement, looking up and down.

(5) Talking [recite rainbow passage or Pledge of Allegiance, Appendix B].

(6) Touching knees and reaching for ceiling.

(7) On knees, looking up to left then up to right.

(8) Facial movements (yawning, smiling, frowning, rotating chin).

(9) Normal breathing.

d. If the average leakage percent exceeds the value that has been (or is being) agreed upon by the Joint Services Committee (JSC) for protective factor testing of masks, the participant will immediately discontinue the exercise and exit the chamber. After mask cleaning and adjustment, the participant will return to the chamber and continue the exercise. If the leakage recurs, the participant will exit the chamber, and the cause of the leakage will be determined.

4.5.2 Data Required.

a. Participant pulmonary function data.

b. Participant head and face measurements.

c. Mask leakage test (paragraph 4.4.2) results for each mask used in fitting test.

d. Size and TIIN for mask assigned to each test participant.

e. Name and gender of each test participant and notation concerning the presence or absence of facial hair (days growth) or combat spectacles/lenses.

f. Challenge aerosol/vapor time-concentration data.

g. Penetration aerosol/vapor time-concentration data for each activity performed by the test participant.

h. Description of site(s) and cause(s) of mask leakage.

i. Comments concerning the sizing and fitting procedures given in the draft TM.

j. Evidence of discomfort during or after the fit validation test will be noted as a remark on data sheets.

4.6 Physical Properties.

4.6.1 Tensile Test.

4.6.1.1 Method.

a. The tensile tests will be performed on test specimens of the various mask and accessory materials. A statistically adequate number of samples of each material will be tested to meet the requirements for the reliability estimation. Tests will be performed IAW the procedures given in ASTM Method D412[7]. Selection of conditioning and test temperature conduct shall be determined by coordination with the materiel developer.

b. No test specimen can be obtained from a mask component that would meet all the test specimen requirements. However, nonstandard specimens may be tested, but the results may not agree with tests carried out on standard specimens.

c. Tensile Strength/Elongation. One tensile test sample ("dumbbell") will be cut from each mask designated for the tensile strength test. The samples will be cut from the same location on each mask due to the varying thickness of the faceblank. Tensile strength will be measured at 100 and 200 percent elongation and at breakpoint.

(1) All specimens will be cut using ASTM D412-75 Die "C" in a manually operated press with masonite backup. Each specimen will be cut from the forehead of the mask, immediately above the eyes, laterally centered so that the mold parting line bisects the reduced section (middle) of the "dumbbell" specimen. All specimens will be 0.25 in (0.64 cm) wide.

(2) Specimens will be measured for thickness. The thinnest measurement on each specimen will be recorded and used to calculate the cross-sectional area and the stress. The specimens should be thickest at the parting line, in the middle of the "dumbbell" specimen.

(3) Specimens will be tested on an Instron® 1125 mechanical testing machine using self-tightening rubber grips and a pogo stick extensometer that marks the load/elongation curve at every 10 percent of elongation.

(4) Data will be passed to the machine's dedicated Microcon II data processor, which provides calculations for breaking load, breaking stress, load and stress at 100 percent elongation, and load and stress at 200 percent elongation.

(5) Statistical data will be calculated for each group of specimens (mean, standard deviation, coefficient of variance, and minimum/maximum values for the parameter in each group).

d. Pull Test. All headharnesses' rubber tabs (with straps/metal buckles) will be cut from each mask. Pull testing refers to measuring the tensile strength of the headharness attachment to the mask rubber. It is the maximum tensile stress applied during stretching the headharness tabs. The "pull-to-failure" (until it ruptures) test will be conducted on samples from the mask's strap/vulcanized rubber portions of the tabs.

(1) The pull test will be conducted using the same Instron® 1125 machine and data processor cited above (without the extensometer) and using hydropneumatic flat-faced grips to load and hold the specimens. After removing the siding, metal portion of the buckle, the wire portion of the buckle will be gripped in the upper grip of the tester, and the mask rubber gripped in the lower grip of the machine.

(2) The only data required for the pull test will be the breaking load and location of break.

4.6.1.2 Data Required.

a. Mask TIIN.

b. Description of specimen.

c. Temperature and RH of test chamber.

d. Sample dimensions (cm).

e. Type and manufacturer of the test instrument.

f. Method used for mounting the specimens.

g. Tensile strength (MPa).

h. Tensile set (percent).

i. Elongation (percent).

4.6.2 Tear-Resistance Test.

4.6.2.1 Method. The tear resistance test will be performed on statistically adequate numbers of test specimens of facepiece and other designated materials to meet the requirements for reliability estimation. Tests will be performed IAW the procedures given in ASTM Method D624[8]. Selection of the proper die cut shall be determined by coordination with the materiel developer.

4.6.2.2 Data Required.

a. Mask TIIN.

b. Tear resistance (g/cm) of each sample of the various materials.

4.6.3 Durometer Test.

4.6.3.1 Method. Duurometer tests will be performed on statistically adequate numbers of test specimens of the facepiece and other component materials. Tests will be performed IAW the procedures given in ASTM Method D2240[12]. Because there is no area of a faceblank as thick as 6 mm (0.25 in), the test will be performed on a stack of samples having a combined thickness of at least 66 mm (0.25 in). The results may not agree with those obtained on standard specimens (single pieces with a minimum thickness of 6 mm).

4.6.3.2 Data Required.

a. Mask TIIN.

b. Sample dimension (cm).

c. Complete identification of the test material.

d. Temperature and RH of the test chamber.

e. Type and manufacturer of durometer.

f. The time (sec) that pressure foot is in firm contact with the specimen.

g. Method used for mounting the specimens.

h. Number of pieces combined to form the specimen.

i. Hardness reading of the various materials.

4.6.4 Ozone Resistance Test.

4.6.4.1 Method.

a. Ozone resistance tests of the elastomers used in the construction of the protective masks and accessories will be performed IAW ASTM Method D1149[13]. A statistically adequate number of test specimens of each type of material will be used.

b. Specimens under tensile strain are exposed in a chamber containing an ozone-air-atmosphere at a controllable prescribed temperature. The concentration of the ozone can be varied and is measured with a spray-jet device or a counter-current absorption column. The specimens are examined at intervals and their condition recorded.

4.6.4.2 Data Required.

a. Mask TIIN.

b. Identification of the test material.

c. Temperature of test chamber (±1.0°C).

d. Ozone concentration (±5.0 ppm by volume).

e. Airflow rate (L/min).

f. Time at which cracking first appears (min), and a description of the character of the ozone cracks at various periods of exposure.

g. Photographs of cracking.

h. Method used for mounting the specimen.

4.6.5 Lens/Faceblank Integrity Test.

4.6.5.1 Method. This test will be performed on a statistically adequate number of test specimens. The test will be performed IAW the procedures specified in ERDEC Internal Operating Procedure MAIOP-3.

4.6.5.2 Data Required.

a. Mask TIIN.

b. Mask leakage data (±0.0001 percent).

4.7 Optical Properties.

These tests will be conducted to determine whether the optical and durability properties of the lenses and outserts meet the requirements specified in the criteria.

a. Refractive power (±0.01 diopter).

b. Distortion (±0.01 diopter).

c. Defects (magnitude, number, and proximity).

d. Ultraviolet (UV) transmittance.

e. Durability

(1) Impact resistance.

(2) Abrasion resistance.

(3) Separation resistance.

(4) Adhesion.

(5) Leakage.

4.7.1 Luminous Transmittance.

4.7.1.1 Method. Photo Research Photometer Model 1980 and Photo Research Light Source (Gamma Lamp) Model PR 2301 are required to measure the luminous transmittance. Test should be conducted in accordance with paragraph 4.5.3, Military Specification MIL-V-43511C[19], Visor, Flyer's Helmet, Polycarbonate. Luminous transmittance should be determined for each lens, each lens-clear outsert combination, and each lens-tinted outserts combination in accordance with ASTM Method D1003[9].

4.7.1.2 Data Required.

a. TIIN.

b. Defects (magnitude, numbers, proximity).

c. Luminous transmittance (±0.1 percent).

4.7.2 Haze.

4.7.2.1 Method. Gardner Hazemeter Model UX10 and Gardner Digital Photometric Unit Model PG-5500 are required to conduct the haze measurements. Measurements should be conducted IAW the procedures in ASTM Method D1003[9], Test for Haze and Luminous Transmittance of Transparent Plastics, and should be performed at the center point of each lens and each clear outserts.

4.7.2.2 Data Required.

a. TIIN

b. Haze (±0.1 percent)

4.7.3 Lens Distortion.

4.7.3.1 Method. Lens distortion should be measured with an Ann Arbor Optical Tester using a 50-line grating. Distortion measurements of lens and lens outsert combinations should be made IAW Military Specification MIL-V-43511C[19], Visor, Flyer's Helmet, Polycarbonate.

4.7.3.2 Data Required.

a. TIIN

b. Vertical deviation (±0.01 diopter)

c. Horizontal deviation (±0.01 diopter).

4.7.4 Abrasion Resistance.

4.7.4.1 Method. Abrasion resistance should be determined IAW the procedures for curved surfaces described in paragraph 3.9.5, Military Specification MIL-L-0050064F[10], Lens, Ophthalmic, Simple.

4.7.4.2 Data Required.

a. TIIN.

b. Luminous transmittance before and after abrasion.

c. Haze before and after abrasion.

4.7.5 Shatter Resistance.

4.7.5.1 Method. The shatter resistance of the mask lens will be tested IAW MIL-L-0050064F, Lens, Ophthalmic, Simple, using the Q39 Lens Impact Tester.

4.7.5.2 Data Required.

a. TIIN.

b. Shatter resistance.

4.7.6 Prismatic Deviations.

4.7.6.1 Method. Prismatic Deviations (vertical and horizontal) will be measured with an American Optical Focimeter that is calibrated for prismatic deviation units of 0.01 prism diopter and has a maximum range of 0.50 prism diopter for measurements of vertical and horizontal deviations made at the center points.

4.7.6.2 Data Required.

a. TIIN.

b. Prismatic deviations (±0.01 diopter).

4.7.7 Refractive Power.

4.7.7.1 Method. Refractive power will be measured with an American Optical Company Focimeter that is calibrated in units of 0.01 diopter and has a maximum range of 0.25 diopter. The mask will be positioned in the focimeter approximately as worn. Measurements will be made at the right and left center points.

4.7.7.2 Data Required.

a. TIIN.

b. Refractive power (±0.01 diopter).

4.7.8 Visual Field.

4.7.8.1 Method. A Haag-Streit perimeter will be used for visual field testing. The perimeter may require some modifications to accommodate the unusual positioning requirements of the mask and the test subject interpupillary distance. The target stimulus will be a high-contrast, 2-mm white-light circle that is projected onto the center of a hemisphere at a distance of 33 cm from the test subject's eye.

4.7.8.2 Data Required.

a. TIIN.

b. Mapping of the peripheral field-of-view.

4.8 Chemical Agent Vapor Permeation.

These tests will be performed to determine the resistance properties of the mask component materials to vapor permeation of various chemical agents, such as mustard (HD), thickened soman (TGD), and V-agent (VX).

4.8.1 Method. This test will be conducted IAW TOP 8-2-501[22], Permeation and Penetration Testing of Air-permeable, Semipermeable, and Impermeable Materials with Chemical Agents or Simulants (Swatch Testing). Because protective masks are made of nonporous materials, the procedures described in paragraph 4.4.a of TOP 8-2-501 will be used.

4.8.2 Data Required.

a. TIIN and complete description of the swatch.

b. Thickness of swatch.

c. Exposed area of each swatch.

d. Challenge agent.

e. Challenge agent concentration (g/m^2).

f. Purity of agent (percent).

g. Viscosity of agent (centistokes), if thickened.

h. Agent thickener, if applicable.

i. Permeation time (min).

j. Precision obtained on the analytical controls.

4.9 Canister/Filter Test.

4.9.1 Canister/Filter Airflow Resistance Test.

a. The purpose of this test is to determine whether the canister/filter meets the airflow resistance requirements. This test is not required if a standard item accepted by a military specification is used. The canisters/filters tested may also be subjected to a DOP penetration test (paragraph 4.9.3) or a biological aerosol penetration test (paragraph 4.9.4) and/or one of the six gas-life tests (paragraph 4.9.5).

b. This test will be run prior to the mask airflow resistance test (paragraph 4.4.1).

4.9.1.1 Method.

a. The weight and record of manufacturer data for each canister/filter to be tested will be recorded.

b. The airflow resistance of the canister/filter will be measured with the Q127 Penetrometer, Filter Tester, DOP, or equivalent tester as specified in the IAP. The Q127 Tester will be operated IAW EA Manual No. 136-300-138[15].

c. After completion of the airflow resistance test, each canister/filter will be sequentially subjected to a DOP penetration test (paragraph 4.9.3) using a Q127 Penetrometer, Filter Tester, DOP, or biological aerosol penetration test (paragraph 4.9.4) and then a chemical agent gas-life test (paragraph 4.9.5).

4.9.1.2 Data Required. The following data will be obtained and recorded for each canister/filter:

a. Lot number and canister/filter TIIN.

b. Manufacturer data.

c. Weight at the time of airflow resistance test (g).

d. Airflow resistance (mm H_2O).

4.9.2 Canister/Filter Replacement Test. The purpose of this test is to determine whether the canister/filter can be replaced easily in the uncontaminated field environment with and without NBC survivable handwear and environmental handwear (excluding arctic handwear).

4.9.2.1 Method.

a. Canister/filter replacement will be performed IAW the instructions given in the draft TM. The canister/filter replacement times, comments, and observations will be recorded for replacement tests performed under six different conditions.

(1) Replacement performed using environmental handwear (leather gloves with cotton inserts) at a temperature of -32°C.

(2) Replacement performed with NBC handwear at a temperature of -32°C.

(3) Replacement performed without handwear in a temperature range of 10 to 32°C.

(4) Replacement performed using NBC handwear in a temperature range of 10 to 32°C.

(5) Replacement performed without handwear at a temperature of 52°C.

(6) Replacement performed using NBC handwear at a temperature of 52°C.

b. A statistically adequate number of tests will be performed under each condition to satisfy the reliability requirements for the criteria. All equipment used in the tests will be temperature-conditioned to the testing temperature.

c. The success or failure of each canister/filter replacement will be determined by leak testing with the M14 Protective Mask Leakage Tester. The leak tester will be operated IAW EA Manual No. 136-300-18[17].

d. The statistical design of the canister/filter replacement test requires that each individual performing the test will perform the canister/filter replacement under each of the six test conditions. The order of performance will be randomized.

4.9.2.2 Data Required. The following data will be collected for each of the six conditions.

a. Canister/filter TIIN.

b. Climatic data.

c. Canister/filter replacement time (±5 seconds).

d. Name of individual performing the test.

e. Leakage data for each canister/filter replaced.

f. Comments and observations concerning ease of replacement.

g. A list of any special tools and/or materials required for canister/filter replacement.

h. A description of any special training required for canister/filter replacement.

i. Comments and observations concerning the adequacy of instructions given in the draft TM.

4.9.2.3 Canister/Filter Carbon Properties Test. This test will be conducted to determine whether the impregnated charcoal used in the canister/filter for the protective mask meets the physical characteristics requirements for the test item. This test is not required if charcoal is purchased to a military specification.

4.9.2.4 Method. The charcoal used in the canister/filter will be tested IAW the procedures given in MIL-SPEC MIL-C-0013724D[6].

4.9.2.5 Data Required.

a. Canister/filter TIIN.

b. Particle size (given in percent by weight) of sample material passing through selected sieves as specified in MIL-C-0013724D[6].

c. Physical properties of hardness, loss in weight, bulk density, and ammonia content.

d. Gas sorption for hydrogen cyanide (AC), phosgene (CG), cyanogen chloride (CK), arsine (SA), and sarin (GB).

4.9.3 Canister/Filter DOP Penetration Test. The purpose of this test is to determine whether the canister/filter resistance to DOP smoke penetration (or other appropriate challenge substance) meets the requirements specified in the criteria.

4.9.3.1 Method. One-half (or the number specified in the IAP) of the canister/filters tested for airflow resistance (paragraph 4.9.1) will be tested for resistance to DOP penetration. Testing will be performed using Q127 Penetrometer, Filter Tester, DOP, or an equivalent tester as specified in the IAP and operated IAW the instruction manual.

4.9.3.2 Data Required.

a. Lot number and canister/filter TIIN.

b. Manufacturer data.

c. Weight of canister/filter before and after DOP penetration test (g).

d. DOP penetration (percent).

4.9.4 Canister/Filter Biological Aerosol Penetration Test. The purpose of this test is to determine whether the biological aerosol filtration capability of the canister/filters meets the requirements specified in the criteria.

4.9.4.1 Method.

a. One-half (or the number specified in the IAP) of the canister/filters tested for airflow resistance (paragraph 4.9.1) will be tested for resistance to biological aerosol penetration. Testing will be performed using the tester indicated in the IAP and operated IAW the instruction manual.

b. Each canister/filter will be weighed and the manufacturer data recorded before starting the biological aerosol penetration test.

c. The biological protection capabilities of the canister/filter will be determined using the agent or simulant specified in the IAP. An adapter will be designed to hold the canister/filter when placed in the test chamber. A mechanical breather will be attached to the adapter and will pump air through the canister/filter to simulate breathing at a sedentary work rate (minute volume of 8.3 L, or as specified in the criteria). The biological aerosol concentration and particle size will be specified by the criteria.

d. A suitable sampling device (e.g., cotton collector or millipore filter) will be placed between the adapter and the respirator to collect the simulant penetrating the canister/filter. The canister and adaptor will be placed into the test chamber with the specified challenge concentration. The length of time the unit is tested in the chamber will be specified by the criteria.

4.9.4.2 Data Required.

a. Manufacturer data for each canister/filter.

b. Lot number and canister/filter TIIN number.

c. Weight of each canister/filter before and after challenge test (g).

d. Biological aerosol challenge concentration (colony forming units (CFU)/L of air).

e. Challenge time (±5 seconds).

f. Amount of biological agent/simulant that penetrated the canister/filter (CFU).

g. Background control data.

4.9.5 Canister/Filter Gas-Life Test. The purpose of this test is to determine whether the canister/filter meets the chemical agent vapor filtration requirements specified in the criteria. The criteria should specify the minimum number of chemical agent attacks the canister/filter system must withstand, including sequential attacks with different types of agent. A chemical attack is defined as an exposure of 20,000 mg×min/m^3 (equivalent to a 20-minute exposure at an agent concentration of 1,000 mg/m^3).

4.9.5.1 Method. A sufficient number of canister/filters will be challenged by each chemical agent to satisfy the reliability requirements of the criteria. The testing apparatus will be the Q224 Gas Sorption Tester for agents GB and GD, the Q95 All Purpose Apparatus, Gas Life Testing for agents AC, CG, CK, and SA, or as specified in the IAP. The Q224 Tester will be operated IAW EA Manual No. 136-300-299[24]; the Q95 All Purpose Apparatus, Gas Life Testing will be operated IAW EA Manual No. 136-300-198[25]. The canister/filters will be challenged by six chemical agents (GB, GD, AC, CG, CK, SA) and the simulant dimethyl methylphosphonate (DMMP). The specific test conditions for each agent challenge are listed below[a].

a. Sarin (GB).

(1) Challenge concentration: 4000±200 mg/m^3.

(2) Flow rate: 30.0±1 L/min.

(3) Temperature: 24±3°C

(4) RH of challenge vapor: 50±5 percent.

(5) End point: 0.04 mg/m^3.

(6) Pretest conditioning: None.

b. Soman (GD).

(1) Challenge concentration: 700±50 mg/m^3.

(2) Flow rate: 30.0±1 L/min.

(3) Temperature: 23.9±2.8°C.

(4) RH of challenge vapor: £ 15 percent

(5) End point: 0.04 mg/m^3.

[a]These test conditions are based on the Quadripartite Standardization Agreement 838, dated 10 Mar 92.

(6) Pretest conditioning: None.

c. Hydrogen cyanide (AC).

(1) Challenge concentration: 4000±200 mg/m^3.

(2) Flow rate: 30.0±1.0 L/min.

(3) Temperature: 24±3°C.

(4) RH of challenge vapor: 80±5 percent.

(5) End point: 1.0 mg/m^3 breakthrough of either AC or cyanogen (a chemical generated by reaction of AC with the carbon impregnants).

(6) Pretest conditioning: None.

d. Phosgene (CG).

(1) Challenge concentration: 20,000±1000 mg/m^3.

(2) Flow rate: 30.0±1.0 L/min.

(3) Temperature: 24±3°C.

(4) RH of challenge vapor: dry condition, 20±5 percent; and wet condition, 80±5 percent.

(5) End point: 8.0 mg/m^3.

(6) Pretest conditioning: None

e. Cyanogen chloride (CK).

(1) Challenge concentration: 4000±200 mg/m^3.

(2) Flow rate: 30.0 ±1.0 L/min.

(3) Temperature: 24±3°C.

(4) RH of challenge vapor: 80±5 percent.

(5) End point: 2.5 mg/m^3.

(6) Pretest conditioning: 80 percent RH at 26.7±5.6°C for 24 hours.

f. Arsine (SA).

(1) Challenge concentration: 10,000±500 mg/m^3.

(2) Flow rate: 30.0±1.0 L/min.

(3) Temperature: 24±3°C.

(4) RH of challenge vapor: 80±3 percent.

(5) End point: 10 mg cumulative.

(6) Pretest conditioning: 80 percent RH at 26.7±5.6°C for 24 hours.

g. Dimethyl methylphosphonate (DMMP).

(1) Challenge level: 3000±200 mg/m^3.

(2) Flow rate: 30.0±1 L/min.

(3) Temperature: 24±3°C.

(4) RH: less than 20 percent.

(5) End point: 0.04 mg/m^3.

(6) Pretest conditioning: None.

4.9.5.2 Data Required. The following data will be recorded for each canister/filter challenged with a chemical agent:

a. Canister/filter lot number, TIIN, and manufacturer data.

b. Type of agent.

c. Challenge concentration (mg/m^3).

d. Flow rate (L/min).

e. Chamber temperature (°C) and RH (percent).

f. Effective agent removal time (time from start of agent challenge to the time when the "end point" amount of agent is detected on the downstream side of the canister).

g. Gas-life for agent challenge (mg×min/m^3) (multiply challenge concentration by effective agent removal time).

4.10 Wear and Carry.

a. Tests to collect quantitative data pertaining to the suitability and durability of protective masks for projected field use will be conducted at appropriate environmental test sites. Tests will measure the design and accelerated use characteristics of the protective mask and will provide basic comparison data that complement laboratory analysis. The operational usage of the masks and accessories will resemble, as closely as possible, the operational mode summary/mission profile (OMS/MP). The protective masks and accessories will be tested against one or more (as appropriate) of the four use modes listed below. Normal and high activity tasks will be performed in each use mode to test the areas listed with each mode.

(1) Infantry mode: communications; vision; compatibility with individual clothing items, load-carrying equipment, body armor, helmets, individual and crew-serviced weapons, and towed artillery.

(2) Armor mode: compatibility with individual clothing items, sighting devices, communications equipment, fire-control devices, and other specified systems of armored vehicles and self-propelled weapons.

(3) Aviation mode: compatibility with aircraft cockpits and aviation life support equipment (ALSE).

(4) Special-purpose mode: compatibility with the clothing and equipment used in special-purpose operations, including demilitarization.

b. After the time period specified in the IAP, all test items will be returned to an appropriate laboratory to determine protective and optical durability characteristics.

c. Reliability, durability, maintainability and human factors tests may be integrated with wear and carry tests for cost effectiveness as specified in the Test and Evaluation Master Plan (TEMP). However, when the scope or number of wear and carry hours planned is less than that desired, wear and carry tests may be supplemented by other types of hardware reliability and durability tests (e.g., simulated mask use, repeated part actuations, rough handling tests, component pull tests, and flight simulator tests).

4.10.1 Method. This TOP provides detailed guidance for the special-purpose mode. Additional guidance for designing the wear and carry test for infantry, armor, and aviation modes is provided in TOPs 1-2-610[37] and 1-2-502[38]. Once the protective mask and accessories are tested in the appropriate mode(s), post-test examinations will be performed.

4.10.1.1 Infantry Mode. A wear and carry test will be designed IAW Appendix B of TOP 10-2-021[39]. The test will be designed to provide data concerning the areas described in paragraph 4.10.a.(1).

4.10.1.2 Armor Mode. A wear and carry test will be designed IAW TOP 10-2-205[40]. The test will be designed to provide data concerning the areas described in paragraph 4.10.a(2).

4.10.1.3 Aviation Mode. A wear and carry test will be designed IAW TOP 7-3-086[41]. The test will be designed to provide data concerning the areas described in paragraph 4.10.a.(3).

4.10.1.4 Special-Purpose Mode. Mask carrying will be accomplished by individuals performing one or more (as specified in the IAP) of the simulated duties. The types of individuals will include explosive ordnance disposal (EOD) personnel, decontamination equipment operators, munitions handlers, test equipment operators, maintenance personnel, test officers, safety officers, fireman, and security guards. Each mask will be worn by one or more

individuals for the OMS/MP required total time while the individual(s) is (are) performing simulated demilitarization or chemical-accident-incident response and assistance (CAIRA) tasks.

a. Simulated demilitarization tasks.

(1) Detect and monitor chemical agent simulants using the detector kit and alarm system indicated in the IAP.

(2) Identify munitions and agents.

(3) Use a field X-ray machine to determine fuze status of munitions.

(4) Defuse munitions and perform rendering-safe procedures.

(5) Decontaminate munitions, areas, and operational equipment.

(6) Excavate a burial pit using crane and "clam shells". The crane operator will be masked.

(7) Operate the armored personnel carrier (APC) specified in the IAP and simulate evacuation caused by breakdown of the APC's collective protection equipment.

b. CAIRA test exercises.

(1) Neutralize intruders and/or secure area of an accident/incident.

(2) Extinguish fire located in a chemically contaminated area.

(3) Perform EOD rendering-safe procedures.

(4) Provide first aid treatment to casualties, including simulated injections with the Mark I Nerve Agent Antidote Kit.

(5) Remove casualties to medical station located at the decontamination line.

(6) Perform decontamination of personnel and equipment.

c. After completion of each simulated demilitarization test and each CAIRA test exercise, participants will be questioned concerning various aspects of the mask system's performance.

4.10.1.5 Post-test Examinations. After completion of all performance testing, protective masks and accessories will be transported to the appropriate laboratories for determination of protective and optical durability characteristics. All of the masks tested in the special-purpose mode will be used in the post-test examinations. A statistically adequate number of masks tested in the infantry, armor, and/or aviation mode(s) will be chosen from those used in each of the arctic, desert, temperate, and tropic environments. Selection will be made IAW the "probability of employment" given in the OMS/MP.

a. Inspection. All protective masks and accessories will be inspected for the following:

(1) Tears, breaks, cracks, distortions, punctures, and evidence of dry rot.

(2) Permanent distortion affecting the fitting.

(3) Warped, cracked, and damaged outlet valves.

(4) Discoloration and mold.

(5) Cracked, broken, scratched, and distorted facepieces.

(6) Corrosion of hardware.

b. Mask airflow resistance test. The mask airflow resistance test will be performed using the procedures described in paragraph 4.4.1.

c. Mask leakage test. The mask leakage test will be performed using the procedures described in paragraph 4.4.2.

d. Outlet valve leakage test. The outlet valve leakage test will be performed using the procedures described in paragraph 4.4.3.

e. Drinking system flow capability. The drinking system flow capability will be assessed using procedures described in paragraph 4.4.4.

f. Microphone functioning test. The microphone functioning test will be performed using the procedures described in paragraph 4.4.5.

4.10.2 Data Required.

a. History of mask usage.

b. Performance test data for each of the modes tested, to include the following data:

(1) Description of scenario for each test exercise.

(2) Record of meteorological conditions during each test exercise, including ambient air temperature, RH, and weather observations.

(3) Record of the lot number and TIIN of each mask used, name and gender of wearer, and the number of hours each mask was worn.

(4) Record of significant findings concerning safety, operational effectiveness, compatibility with protective clothing and operational equipment, communications effectiveness, and operator's vision and comfort while wearing the mask.

(5) Record of number of sanitizations for each mask.

(6) Observations concerning the maintenance of the mask system, including ease of maintenance; need for special tools, skills, or test equipment; interchangeability of parts; adequacy and accuracy of maintenance instructions provided in the draft TM; and time required to perform maintenance tasks.

(7) Observations concerning the durability of test item components, including identification of failures and description of incidents.

(8) Questionnaire data.

(9) Weights of canister/filters at beginning and end of the wear and carry subtest.

(10) Results of the mask airflow resistance test.

(11) Results of mask leakage test.

(12) Outlet valve leakage test.

(13) Drinking system flow capability.

(14) Results of microphone functioning tests performed at the beginning and end of the wear and carry subtest.

4.11 Adverse Environments.

These tests will be performed to determine whether the protective masks and accessories remain functional after exposure to the adverse climatic conditions of low pressure (altitude), solar radiation (sunshine), rain, humidity, fungus, salt fog, sand and dust, and immersion. These tests will be conducted IAW MIL-STD-810E[5]. An unpackaged rough handling test will also be conducted as described in paragraph 4.11.1.9.

4.11.1 Method.

4.11.1.1 Pretest Procedures.

a. A statistically adequate number of test items will be allocated for exposure to each adverse environment to satisfy the reliability estimation given in the criteria. Before testing in adverse environments, each mask with accessories will be subjected to the following inspection tests performed IAW the methods outlined in the referenced paragraph.

(1) Mask airflow resistance test (paragraph 4.4.1).

(2) Mask leakage test (paragraph 4.4.2).

(3) Outlet valve leakage test (paragraph 4.4.3).

(4) Drinking system flow capability (paragraph 4.4.4).

(5) Microphone functioning test (paragraph 4.4.5).

b. After completion of the inspection tests, one-half of the designated masks and accessories will be stowed in carriers. Each mask and its accessories will then be tested in the designated adverse environment condition.

4.11.1.2 Low pressure (altitude). Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 500.3, Procedure I.

4.11.1.3 Solar radiation (sunshine). Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 505.3, Procedure I.

4.11.1.4 Rain. Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 506.3, Procedure II.

4.11.1.5 Humidity. Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 507.3, Procedure II.

4.11.1.6 Fungus. Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 508.4, Procedure I.

4.11.1.7 Salt Fog. Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 509.3, Procedure I.

4.11.1.8 Sand and Dust. Assembled masks and accessories will be tested IAW MIL-STD-810E[5], Method 510.3, Procedure I, if possible. If no sand and dust chambers exist that will meet the requirements of MIL-STD-810E, tests may be conducted according to MIL-STD-810D[42].

4.11.1.9 Unpackaged Rough Handling. This test will be conducted with the items conditioned at elevated and sub-zero temperatures.

a. Each mask without carrier will be dropped from a height of 1.8 m (6.0 feet) onto a 0.5-inch plywood board. Mask will be divided into four groups. Group one will be dropped to land front (lens area) down; group two will be dropped to land bottom (chin area) down; group three will be dropped to land right side (canister) down; group four will be dropped at a 45 degree angle (leaning forward) to land bottom (chin area) down. After the drop test, all masks will be inspected for physical damage.

b. Each mask will then be placed in a carrier and tumbled in the Q113 Rough Handling Machine or equivalent tester designated by the IAP for 25 complete revolutions. The Q113 will be operated IAW EA Manual No. 136-300-63[26]. After completion of the test, the masks will be inspected for physical damage.

4.11.1.10 Post-test Inspection. After completion of each adverse environment test, the masks and accessories will be inspected for breaks, tears, abrasions, corrosion, mildew, or other fungal growth, and functioning of the accessories. Canister/filters will be weighed and inspected for loose charcoal by gently shaking each canister/filter above a white surface. All masks subjected to the fungus, salt fog, and dust tests will be sanitized IAW the procedures given in the draft TM. After completion of visual inspection and sanitization (as applicable), the following tests will be performed:

a. Mask airflow resistance test. The mask airflow resistance test will be performed using the procedures described in paragraph 4.4.1.

b. Mask leakage test. The mask leakage test will be performed using the procedures described in paragraph 4.4.2.

c. Outlet valve leakage test. The outlet valve leakage test will be performed using the procedures described in paragraph 4.4.3.

d. Drinking system flow capability. The drinking system flow capability will be assessed using procedures described in paragraph 4.4.4.

e. Microphone functioning test. The microphone functioning test will be performed using the procedures described in paragraph 4.4.5.

4.11.2 Data Required.

a. Mask and accessory TIINs.

b. Canister/filter manufacturer data.

c. Test history of each mask and accessory.

d. Canister/filter weight before and after adverse environment test.

e. Results of visual inspection of masks and accessories before and after adverse environment test.

f. Mask airflow resistance before and after adverse environment test.

g. Results of the mask leakage test before and after adverse environment test.

h. Results of the outlet valve leakage test before and after adverse environment test.

i. Results of the drinking system flow capability before and after adverse environment test.

j. Results of microphone functioning test before and after adverse environment test.

4.12 Sanitization.

The purpose of this test is to determine whether the protective mask and accessories can be sanitized without damage or deterioration.

4.12.1 Method.

a. The mask and the accessories specified in the IAP will be subjected to the sanitization test. A statistically adequate number of items will be tested to satisfy the reliability estimation given in the criteria.

b. Before conducting the sanitization test, the weight of each canister/filter and the TIIN for each mask and accessories will be recorded.

c. The masks and accessories will be subjected to the following tests performed IAW the referenced paragraph:

(1) Mask airflow resistance test (paragraph 4.4.1).

(2) Mask leakage test (paragraph 4.4.2).

(3) Outlet valve test (paragraph 4.4.3).

(4) Drinking system flow capability (paragraph 4.4.4).

(5) Microphone functioning test (paragraph 4.4.5).

d. After completion of the tests, the masks will be sanitized IAW the procedures given in the draft TM. Following sanitization, the tests listed in paragraph 4.12.1.c will be repeated. Operators will be interviewed concerning the clarity, completeness, and accuracy of the instructional material and the adequacy of the sanitization procedure.

4.12.2 Data Required.

a. TIIN of masks and accessories.

b. Canister/filter weight before and after sanitization test.

c. Mask airflow resistance before and after sanitization.

d. Mask leakage before and after sanitization.

e. Outlet valve leakage test before and after sanitization.

f. Drinking system flow capability before and after sanitization.

g. Microphone functioning test results before and after sanitization.

h. Comments and observations concerning the adequacy of instructions and effectiveness of the sanitization procedures given in the draft TM.

4.13 Nuclear, Biological, and Chemical (NBC) Contamination Survivability.

4.13.1 Method. This test will be conducted IAW TOP 8-2-111[21], NBC Contamination Survivability, Small Items of Equipment.

4.13.2 General.

a. This test will have three separate categories: chemical, biological, and radiological. The mask will be tested for decontaminability and hardness in each of the three categories. Compatibility will also be tested.

b. The masks will undergo five contamination/decontamination cycles (C/D). It is further recommended that the masks be subjected to one cycle of chemical agents C/D (HD, TGD and VX), one cycle of biological simulant C/D (BG), and one cycle of radiological C/D (FP).

c. After the contamination-decontamination procedure is complete, all test items will be subjected to the following tests:

(1) Mask airflow resistance test. The mask airflow resistance test will be performed using the procedures described in paragraph 4.4.1.

(2) Mask leakage test. The mask leakage test will be performed using the procedures described in paragraph 4.4.2.

(3) Outlet valve leakage test. The outlet valve leakage test will be performed using the procedures described in paragraph 4.4.3.

(4) Drinking system flow capability. The drinking system flow capability test will be performed using the procedures described in paragraph 4.4.4.1.b.

(5) Microphone functioning test. The microphone functioning test will be performed using the procedures described in paragraph 4.4.5.

4.13.2.1 Chemical. This test will be conducted using HD, TGD, and VX as the challenge agents. The contamination procedures and sampling will be done IAW TOP 8-2-111[21]. Decontamination will be performed IAW the decontamination procedures outlined in Field Manual (FM) 3-5[43], the draft TM, or other governing documents.

4.13.2.2 Biological Agents. This test will be conducted using biological simulant Bacillus subtilis var. niger (BG). The contamination procedures and sampling will be done IAW TOP 8-2-111[21]. Decontamination will be performed IAW the decontamination procedures outlined in FM 3-5[43], the draft TM, or other governing documents.

4.13.2.3 Radiological. This test will be conducted using fluorescent particles (FP) as the radiological simulant. The contamination procedures and sampling will be done IAW TOP 8-2-111[21]. Decontamination will be performed IAW the decontamination procedures outlined in FM 3-5[43], the draft TM, or other governing documents.

4.13.2.4 Compatibility. Conduct test using the procedures specified in paragraph 4.4 of TOP 8-2-111[21]. The test should be designed to simulate the scenario in which the test item will be used.

4.13.3 Data Required. The following data must be collected for each test.

4.13.3.1 Chemical.

a. TIIN of masks and accessories.

b. Description and photographs of the test-item surface condition (pretest), including construction material and surface cleanliness.

c. Description and photographs of test-item cracks, crevices, and other features that may allow contaminants or decontaminants to penetrate below the surface and may be difficult to decontaminate.

d. Chamber temperature (±3°C), RH (±5 percent), and calculated airflow (±1 m/sec).

e. Agent: name and control number, purity (percent), viscosity after adding thickener (as applicable) (centistokes), quantity of dye and thickener (as applicable)(g/L), quantity of agent dispensed (g), agent contamination concentration (g/m^2), and drop size (mg). Data will be gathered in the smallest increment that the instrumentation/procedure is designed to achieve and can be easily read.

f. Description of dissemination procedure.

g. Results of each post-decontamination vapor and contact sample collected during each sampling period (mg/sample).

h. Results of the sampling and analysis controls.

i. Sample history including elapsed time to analysis.

j. Name and title of principal test participants.

k. Description of the decontamination solution, methods, equipment, and item-specific procedures.

l. Test-item pretest and post-test performance data (mask airflow resistance test, mask leakage test, outlet valve leakage test, drinking system flow capability, and microphone functioning test).

4.13.3.2 Biological.

a. TIIN of masks and accessories.

b. Description and photographs of the test-item surface condition (pretest), including construction material and surface cleanliness.

c. Description and photographs of test-item cracks, crevices, and other features that may allow contaminants or decontaminants to penetrate below the surface and may be difficult to decontaminate.

d. Chamber temperature (±3°C), RH (±5 percent), and calculated airflow (±1 m/sec.).

e. Agent simulant BG: Name and control number, diluent used, viscosity, percent solids, date harvested and/or reconstituted, date used, and CFU per mL.

f. Disseminator used, quantity of BG suspension disseminated (mL), air pressure (psi), and dissemination time (second).

g. Photograph and written description of each area sampled.

h. Simulant contamination level of the chamber air immediately after dissemination (CFU/L of air).

i. Simulant contamination levels for each sample location area before and after decontamination (CFU/cm^2).

j. Results of sampling and analysis controls (CFU/control).

k. Description of the decontamination solution, methods, equipment, and item-specific procedures.

l. Test-item pretest and post-test performance data (mask airflow resistance test, mask leakage test, outlet valve leakage test, drinking system flow capability, and microphone functioning test).

4.13.3.3 Radiological.

a. TIIN of masks and accessories.

b. Description and photographs of the test-item surface condition (pretest), including construction material and surface cleanliness.

c. Description and photographs of test-item cracks, crevices, and other features that may allow contaminants or decontaminants to penetrate below the surface and may be difficult to decontaminate.

d. Chamber temperature (±3°C), RH (±5 percent), and calculated airflow (±1 m/sec.).

e. Simulant FP data: FP lot or control number, color, particle count per gram, and particle size range (mm).

f. FP disseminator used, air pressure (psi), dissemination time (sec), and quantity of FP disseminated (g).

g. Results of sampling and counting control.

h. Time to complete test-item contamination (fall-out), chamber airwash time, decontamination time, and time of each sample (min).

i. Description of the decontamination solution, methods, equipment, and item-specific procedures.

j. Test-item pretest and post-test performance data (mask airflow resistance test, mask leakage test, outlet valve leakage test, drinking system flow capability, and microphone functioning test).

4.13.3.4 Compatibility.

a. A listing of mission essential tasks identified by the combat developer for the equipment undergoing NBC compatibility testing. Include all pretest task performance estimates for the mission-essential tasks.

b. Soldier/equipment performance measurements made with operators wearing standard battle-dress and NBC protective clothing.

c. Temperature, wind speed, RH, light conditions, cloud cover, and heat-stress level recorded throughout testing.

d. A training record, MOS qualification score, experience, medical or physical profile, and anthropomorphic data for each operator-participant.

e. Copies of operator and supervisor questionnaires.

f. Description and photographs of all clothing and protective ensembles, including pretest and post-test inspection information of the protective ensemble.

4.14 Resistance to Battlefield Contaminants.

The purpose of this test is to determine whether the protective mask and selected accessories (as specified in the IAP) remain functional after exposure to the adverse effects of various battlefield contaminants.

4.14.1 Method. A statistically adequate number of test items will be exposed to each battlefield contaminant to satisfy the reliability requirements of the criteria.

4.14.1.1 Pretest Performance. Before testing begins, the following data will be collected for the masks and accessories (as applicable):

a. Mask airflow resistance test (paragraph 4.4.1).

b. Mask leakage test (paragraph 4.4.2).

c. Outlet valve leakage test (paragraph 4.4.3).

d. Drinking system flow capability (paragraph 4.4.4).

e. Microphone functioning test (paragraph 4.4.5).

4.14.1.2 Battlefield Contaminant Test.

a. The challenge battlefield contaminants will include JP4 fuel, small arms lubricant (LSA), decontaminating solution No. 2 (DS2), gasoline, skin decontamination materials, insect repellent, six percent aqueous film-forming foam (AFFF), and diesel fuel, or as specified in the criteria.

b. Contaminants will be applied directly to each test item surface (without carriers) using the methods described below or as specified in the IAP. Contact with the interior surfaces of the mask will be avoided. Only one type of contaminant will be used per test item.

(1) JP4 fuel, gasoline, skin decontamination solution, insect repellent, AFFF, and diesel fuel. Each contaminant will be applied to the exterior surfaces of each selected mask and accessory using gauze pads.

(2) LSA and DS2. Each liquid contaminant will be sprayed on selected masks and accessories using a hand-held sprayer. Coverage of the test item will be verified visually. Masks and accessories will be positioned to allow maximum coverage of exterior surfaces and to prevent contact with the interior surfaces.

c. After exposure to the contaminant for the time specified in the appropriate requirements document, the masks and accessories will be cleaned and sanitized using the methods described in the draft TM.

4.14.1.3 Post-test Inspection. After completion of cleaning and sanitization, all masks and accessories will be inspected for softening of materials, peeling, discoloration, abrasions, corrosion, and other evidence of deterioration. Each test item will then be subjected to each of the following tests:

a. Mask airflow resistance test. The mask airflow resistance test will be performed using the procedures described in paragraph 4.4.1.

b. Mask leakage test. The mask leakage test will be performed using the procedures described in paragraph 4.4.2.

c. Outlet valve leakage test. The outlet valve leakage test will be performed using the procedures described in paragraph 4.4.3.

d. Drinking system flow capability. The drinking system flow capability test will be performed using the procedures described in paragraph 4.4.4.

e. Microphone functioning test. The microphone functioning test will be performed using the procedures described in paragraph 4.4.5.

4.14.2 Data Required.

a. Contaminant used.

b. TIIN of masks and accessories.

c. Canister/filter weight before and after test.

d. Test item pretest and post-test performance data (mask airflow resistance test, mask leakage test, outlet valve test, drinking system flow capability, and microphone functioning test).

4.15 Packaged Rough Handling and Environmental Storage.

The purpose of this test is to determine if degradation or malfunctions for the protective mask and accessories are produced by shock stresses expected in the handling, transporting, and environmental storage of the packaged items. The packaged rough handling and environmental storage tests will be performed as specified by MIL-STD-810E[5]. Accelerated environmental storage testing may be conducted if it is necessary to generate data for comparison with previous testing programs. Accelerated environmental storage testing is conducted IAW CBR Agency Test Manual 70-1[44]. The total number of shipping boxes of masks and accessories will depend on the number of test items per shipping box and the number of test items required for the reliability estimation of performance characteristics given in the criteria.

4.15.1 Method.

4.15.1.1 Pretest Procedures.

a. All items will be tested in "overseas" shipping boxes. The shipping boxes, intermediate packages, and test items will be inspected for evidence of damage IAW the procedures given in the receipt inspection subtest (paragraph 4.1) and repacked in the original manner.

NOTE: Individual canister/filter containers will not be opened until after the completion of the packaged rough handling or environmental storage tests.

b. Packaged test items will be sequentially subjected to shock, vibration, low pressure (altitude), and accelerated environmental storage tests. After each test, the items will be inspected and repackaged. New vapor barrier bags will be used each time the items are repackaged. Air will be evacuated from the vapor barrier bags to the same degree as accomplished in the original vapor barrier bag.

4.15.1.2 Sequential Rough Handling Test. All packaged test items will be sequentially subjected to shock, vibration, and low pressure and performed IAW the referenced procedure. The sequence of the tests will be indicated in the IAP or by the criteria.

a. Shock test. All packaged items allocated to this subtest will be subjected to the shock test described in Method 516.4, Procedure II of MIL-STD-810E[5].

b. Vibration test. All packaged items allocated to this subtest will be subjected to the vibration test described in Method 514.4, Procedure I of MIL-STD-810E[5].

c. Low pressure (altitude) test. All packaged items allocated to this subtest will be subjected to the low pressure test described in Method 500.3, Procedure I of MIL-STD-810E[5].

4.15.1.3 Environmental Storage Test. All packaged test items will be sequentially subjected to hot, humid, and cold conditions and tested IAW the referenced procedure. The sequence of the tests will be indicated in the IAP or by the criteria.

a. Hot storage. All packaged items allocated to this subtest will be subjected to a minimum of seven diurnal cycles at induced conditions according to Table 501.3-I and Procedure I, Method 501.3, MIL-STD-810E[5].

b. Humid storage. All packaged items allocated to this subtest will be subjected to a minimum of 60 diurnal cycles according to Cycle 3, Table 507.3-I and Procedure I, Method 507.3, MIL-STD-810E[5].

c. Cold storage. All packaged items allocated to this subtest will be subjected to a minimum of 72 hours following temperature stabilization at basic cold conditions according to Table 502.3-I and Procedure I, Method 502.3, MIL-STD-810E[5].

4.15.1.4 Accelerated Environmental Storage Test.

a. The packaged test items in shipping containers will be separated into four groups. Each group will contain at least one box of the following test-items:

(1) Masks and accessories that have been sequentially subjected to shock, vibration, and low pressure tests, where the vibration test was performed in cold temperatures.

(2) Masks and accessories that have been sequentially subjected to shock, vibration, and low pressure tests, where the vibration test was performed in hot temperatures.

(3) Replacement canister/filters that have been sequentially subjected to shock, vibration, and low pressure tests, where the vibration test was performed in cold temperatures.

(4) Replacement canisters/filters that have been sequentially subjected to shock, vibration, and low pressure tests, where the vibration test was performed in hot temperatures.

b. One group of the packaged test items will be subjected to accelerated arctic storage, one group to accelerated desert storage, one group to accelerated tropic storage, and one group to cyclic storage. The length of storage time for each condition will be 12 weeks. Storage conditions will be as follows:

(1) -46.0°C with RH uncontrolled.

(2) High temperature-low humidity (63°C with less than 5 to 10 percent RH).

(3) High temperature-high humidity (45°C with a RH of 85 percent).

(4) Packaged test items will be stored for 1 week in each of the above conditions and the cycle repeated four times (total test time of 12 weeks).

4.15.1.5 Post-test Inspection. After completion of the packaged rough handling and environmental storage (accelerated or otherwise) testing, the shipping boxes, intermediate packages, and test items will be inspected for evidence of damage IAW the procedures given in the receipt inspection subtest (paragraph 4.1). Masks and canister/filters will then be subjected to the following tests:

a. Mask airflow resistance test. The mask airflow resistance test will be performed using the procedures described in paragraph 4.4.1.

b. Mask leakage test. The mask leakage test will be performed using the procedures described in paragraph 4.4.2.

c. Outlet valve leakage test. The outlet valve leakage test will be performed using the procedures described in paragraph 4.4.3.

d. Drinking system flow capability. The drinking system flow capability test will be performed using the procedures described in paragraph 4.4.4.

e. Microphone functioning test. The microphone functioning test will be performed using the procedures described in paragraph 4.4.5.

4.15.2 Data Required.

a. TIIN of each shipping container, mask, and accessory.

b. Test history.

c. Visual inspection results before and after test.

d. Canister/filter weight before and after test.

e. Post-test inspection results (mask airflow resistance test, mask leakage test, outlet valve test, drinking system flow capability, and microphone functioning test).

4.16 Human Factors Engineering (HFE).

The purpose of this subtest is to determine if the protective mask and accessories are satisfactorily designed and fabricated with respect to HFE principals. Guidance for conducting this test is provided in TOP 1-2-610[37] and TOP 10-2-021[39].

4.16.1 Method. A test-wide HFE evaluation will be made based on the comments and observations of the test subjects, the observers, and project officers, and on the test results obtained throughout the test program. Receipt inspection (paragraph 4.1), safety (paragraph 4.2), and operator training and familiarization subtests (paragraph 4.3) will form the basis for preliminary critiques on HFE aspects. Subtests performed after receipt inspection, safety, and operator training and familiarization will provide data that will serve to verify, modify, and/or augment the earlier results. Throughout the test program, comprehensive questionnaire forms will be issued to test subjects, observers, and project officers to record comments, observations, and recommendations. Additional information may also be gained by interviewing the test personnel. Guidance for designing the questionnaires and interview forms are given in Appendix A and B of TOP 1-2-610[37]. A speech intelligibility test will be conducted with and without the mask to evaluate ease of communications. Particular attention will be given to the recording of the following information:

a. All observations concerning donning, doffing, wearing, and operating the protective masks and accessories under all circumstances.

b. Ease of communication and hearing and compatibility with receiving and transmitting communication devices.

c. Test subjects' ratings on visual aspects of job-related field activities and tasks including overall acceptability of the mask, visual acuity, depth perception, distortion, fogging, and night vision.

d. Test subjects' ratings on wear and comfort including fit, ease of inhalation and exhalation, seating, interference with activities, use of drinking device, and overall acceptability.

e. Compatibility with clothing and equipment.

f. Any auxiliary tools, devices, and/or procedures required for mask usage that were not specified in the draft TM.

g. Any deviations from recommended procedures that might contribute to improved HFE aspects related to the protective masks and accessories.

4.16.2 Data Required.

a. Collect the following data from all applicable subtests:

(1) Accessibility.

(2) Climatic considerations.

(3) Compatibility.

(4) Donning and doffing.

(5) Drinking.

(6) Durability.

(7) Ease of inhalation and exhalation.

(8) Filter replacement.

(9) Fit.

(10) Protection.

(11) Sanitization and decontamination.

(12) Speed of communications and speech intelligibility scores.

(13) Wearability and comfort.

(14) Vision.

b. Questionnaire(s), interview comments, and observation data.

4.17 Reliability and Durability.

The purpose of this test is to determine if the protective mask and accessories meet the quantitative reliability characteristics specified in the criteria.

4.17.1 Method.

a. A test-wide investigation will be made to determine the reliability and durability of the protective mask and accessories. Tests will be conducted IAW the OMS/MP. Histories of individual mask systems will be kept with respect to storage, wear and carry times, and conditions of usage. Indications or evidence of deterioration will be noted. At or near the end of the test program, studies will be made to determine the durability of the test items.

b. Reliability of the mask system and that of separate components will be determined in terms of mean time between failure and in terms of the proportion of items that meet stated performance requirements. In some cases, it may be appropriate to evaluate the durability of certain components in terms of mean cycles between failure. Mean time or cycles between failure is an indicator of durability if the operating time or use cycles per item is sufficiently long. The proportion of items that meet stated performance requirements may or may not be an indicator of durability. Performance test data may be analyzed in terms of variables or attributes (pass/fail). The proportion of items that meet stated performance criteria and requirements document is one type of reliability that should be evaluated.

(1) Examples of performance tests on mask components for which reliability may be assigned includes:

(a) Canister/filter leakage.

(b) Permeability of mask components to chemical agents.

(c) Drink tube leakage and airflow resistance related to canister and valves.

(d) Exhalation resistance related to canister and valves.

(e) Exhalation resistance related to outlet valve.

(f) Resistance to separation during pull test of drink tube, microphone cable, hose and other movable parts.

(2) Examples of such performance tests for mask systems for which reliability may be assigned include:

(a) Mask leakage.

(b) Protection or fit factor.

(3) When no component reliability requirement is found, a system requirement may be allocated to various components to generate a reliability criterion and assist in the evaluation.

4.17.2 Data Required. The reliability and durability evaluation will be performed using the data obtained in subtests 4.3 through 4.10. These data will include the following:

a. The number of test items.

b. The number of successful performances.

c. The number of failures and malfunctions.

d. Agent and challenge concentrations.

e. Life times of the test item at the time of failure or incident/malfunctions.

4.18 Logistic Supportability and Maintainability.

a. The objectives of this subtest are:

(1) To acquire data on all maintenance actions performed on the protective mask and accessories.

(2) To determine whether the TM contains all the essential operation and maintenance information.

(3) To determine whether the SSP is adequate to maintain the protective mask and accessories.

(4) To verify that all maintenance procedures and materials are safe.

b. Guidance for conducting this test is provided in TOP 10-2-507[45].

4.18.1 Method.

a. Throughout the course of the test program, a complete record will be kept of each mask system's scheduled and unscheduled maintenance operation, and each incident reported in a test incident report (TIR) IAW AMCR 70-13[46]. Each maintenance action will be recorded in a logbook. The logbook will indicate what maintenance tasks were performed and the total downtime in clock-hours. A determination of whether or not each maintenance action was caused by a protection failure will be made. For each failure, the failed component will be identified along with the accumulated history (e.g., storing, wearing, and carrying times). Failures that do not result in loss of protection to the operator will be recorded, but will not be chargeable against mask system reliability.

b. All maintenance actions will be performed IAW the instructions given in the TM using the tools; test, measurement, and diagnostic equipment (TMDE); field test equipment; and facilities specified. Simulated maintenance actions may be required to evaluate all of the aspects of maintainability. The following subjects will be included in maintenance testing:

(1) Servicing. Servicing data will be obtained throughout the test program on such factors as sanitization, decontamination, canister/filter replacement, and replacement of parts. The SSP will be evaluated for adequacy of contents and ease of use.

(2) Safety. Safety aspects of the mask system will be continuously monitored. Warning and instruction plates will be checked for adequacy of content and conspicuous location. Particular attention will be given to the adequacy of instructions and methods for mask sanitization and decontamination with respect to operator safety.

(3) Publications. Supplied TMs and other manuals will be examined to determine if they contain all essential operation and maintenance information. The documents will be evaluated for simplicity, clarity, consistency, and completeness. All errors or omissions will be reported.

(4) HFE. All maintenance actions will be continuously monitored for HFE implications. Prepared questionnaires will be issued to test participants to obtain comments, observations, and recommendations concerning HFE aspects of maintenance.

c. Information concerning the logistic supportability (e.g., availability of replacement parts, tools) will also be recorded throughout the test.

4.18.2 Data Required.

a. Record of MOS and skill level.

b. A complete logbook with all scheduled and unscheduled maintenance made during the test program. Each entry will contain the following information:

(1) A list of all maintenance tasks performed for each scheduled and unscheduled maintenance action, the total man-hours expended, the number of personnel used, and the total downtime in clock-hours.

(2) Level of maintenance and parts consumption.

(3) At the time of each failure, the failed component will be identified and the history of the test item usage will be recorded.

(4) The time in man-hours and clock-hours to diagnose the problem and to correct the failure excluding Administrative Logistic Downtime (ALDT).

(5) Operator recommended changes to TM and/or SSP.

(6) Comments and observations concerning any problems encountered during the maintenance action.

c. A list of maintenance actions that would be hazardous to the operator.

d. Comments on the adequacy of publications and a list of recommended changes.

e. HFE data consisting of the following information:

(1) Ease of maintenance operation.

(2) Physical effort required to perform maintenance duties.

(3) Adequacy of working space.

(4) Any considerations that would improve test item maintenance/ maintainability characteristics.

5. DATA REQUIRED.

The data requirements for each of the specific tests are identified along with each of the tests described in paragraph 4.

6. PRESENTATION OF DATA.

6.1 Receipt Inspection.

Present results of the receipt inspection subtest in a manner that is appropriate to the item and test criteria; use narrative, tables, diagrams, photographs, and radiographs. Where appropriate, statistical analysis may be included.

6.2 Safety Evaluation.

a. Forward a Safety Release Recommendation to TECOM after completion of the operator training and familiarization subtest.

b. Provide descriptions and data on any safety-related defects, omissions, and/or conditions found in the protective mask and accessories.

c. Present records of all hazards observed during testing that could be attributed to the protective mask and accessories.

d. Perform a test-wide safety evaluation based on the comments and observations of the test participants, the observers, and project officers, and on the test results obtained throughout the evaluation. Describe and classify any accident or hazard found during any subtest IAW TOP 1-1-012[47].

NOTE: All accidents, hazards, or equipment failures will be reported in a TIR IAW AMCR 70-13[46].

6.3 Operator Training and Familiarization.

a. Tabulate and present NET information (number of sessions, length of training time, and number of personnel trained per session).

b. Present a table that includes measurement data for mask sizing and the serial number (SN) or TIIN of the assigned protective masks and accessories.

c. Present tabulated results of the times required for donning the protective mask.

d. Provide data obtained in sanitization and decontamination subtest (paragraph 4.12) concerning the adequacy of the sanitization and decontamination training and methods.

e. Present the tabulated results obtained from interviews and questionnaires concerning the adequacy of NET.

f. Present comments, observations, and questionnaire response data concerning mask comfort and overall ease of use.

g. Provide photographs and videos documenting any difficulties encountered in familiarization, donning, wearing, and operating the protective mask and accessories.

6.4 Initial Performance Test.

6.4.1 Mask Airflow Resistance Test. Present inhalation and exhalation airflow resistance test results. Reduce and analyze each set of data IAW the statistical methods given in the IAP.

6.4.2 Mask Leakage Test. Present mask leakage test results. Include mask TIIN and description of area(s) of leakage, if applicable. Reduce and analyze data IAW the methods given in the IAP.

6.4.3 Outlet Valve Leakage Test. Reduce and analyze data IAW the statistical methods given in the IAP.

6.4.4 Drinking System Flow Capability.

a. Present the drinking device test results (preparation time, water intake initiation time, water intake time or amount of water left at 10 minutes, and leakage test data). Reduce and analyze each set of data using the statistical methods outlined in the IAP.

b. Present a summary of comments and observations concerning the use of the drinking device.

6.4.5 Microphone Functioning Test. Present the microphone test results in tabular form. Summarize the success/failure data by utilizing a lower binomial confidence interval.

6.5 Mask Fitting Test.

a. Present mask fitting results. Presentation will include the physical dimension data, name, gender, presence or absence of combat spectacles/lenses, and presence or absence of facial hair for each test participant; mask leakage test results, mask size, and TIIN for each mask used in the mask fitting test; and the average challenge aerosol/vapor concentration in the test chamber and corresponding average penetration concentration in the mask for each activity performed by the test participant and the percent penetration.

b. Reduce and analyze percent penetration data IAW the statistical methods outlined in the IAP.

c. Determine the relationship between physical dimension variables and mask leakage test results IAW the statistical methods outlined in the IAP.

d. Present a summary of comments concerning the adequacy of the sizing and fitting procedures.

6.6 Physical Properties.

6.6.1 Tensile Test. Present tensile test results (tensile strength, tensile set, and elongation data) for each type of material tested. Reduce and analyze each set of data IAW the procedure given in ASTM Method D412[7] and the statistical methods given in the IAP.

6.6.2 Tear Resistance Test. Present tear test results for each type of material tested. Reduce and analyze data IAW the procedures given in ASTM Method D624[8] and the statistical methods given in the IAP.

6.6.3 Hardness Test. Present the hardness test results. Reduce and analyze data IAW the procedures given in ASTM Method D2240[12] and statistical methods given in the IAP.

6.6.4 Ozone Resistance Test. Present ozone resistance test results for each type of material tested. Reduce and analyze data IAW the procedures given in ASTM Method D1149[13].

6.6.5 Lens/Faceblank Integrity Test. Present mask leakage test results. Reduce and analyze data IAW the test standards and the statistical methods given in the Internal Operating Procedure MAIOP-3[36].

6.7 Optical Properties.

Present optical properties and durability results. Reduce and analyze data IAW the test standards and the statistical methods given in the IAP.

6.8 Chemical Agent Vapor Permeation.

Present chemical agent permeation test results for each material-agent challenge combination investigated. Reduce and analyze each set of data IAW the statistical methods given in the IAP.

6.9 Canister/Filter Test.

6.9.1 Canister/Filter Replacement Test.

a. Present the replacement time and leakage results for each of the canister/filters tested under the various conditions. Reduce and analyze data IAW the statistical methods outlined in the IAP.

b. Present a summary of the comments and observations concerning the ease of canister/filter replacement, the adequacy of the instructions given in the TM, and the need for special tools and materials. Include recommendations for improvement, if applicable.

6.9.2 Canister/Filter DOP Penetration Test.

a. Present a table providing the following information:

(1) Lot number and canister/filter TIIN.

(2) Manufacturer data.

(3) Weight before DOP penetration test (g).

(4) DOP penetration (percent).

b. Reduce and analyze the DOP penetration data IAW the statistical methods outlined in the IAP.

6.9.3 Canister/Filter Biological Aerosol Penetration Test. Present a table providing the following information:

a. Manufacturer data for each canister/filter.

b. Lot number and canister/filter TIIN number.

c. Weight of each canister/filter at the time of the test (g).

d. Biological agent challenge concentration (CFU/L of air).

e. Challenge time (min).

f. Effective agent removal time (min).

g. Amount of biological agent that penetrated the canister/filter (CFU).

6.9.4 Canister/Filter Gas-Life Test.

a. Present gas-life test data, for each chemical agent used, in tabular format. In each table, provide the following information for each canister/filter subjected to the gas-life test:

(1) Canister/filter lot number, TIIN, and manufacturer data.

(2) Type of agent and challenge concentration (mg/m^3).

(3) Canister/filter flow rate (L/min).

(4) Effective agent removal time (min).

(5) Chemical agent gas-life ($mg \times min/m^3$).

b. Reduce and analyze each set of gas-life data using the statistical methods outlined in the IAP.

6.10 Wear and Carry.

a. Present a table providing a history of each mask system used in the wear and carry subtest. Each mask system history will include data indicating the length of time each mask was in storage, carried, and worn, and a brief description of each usage condition. Notations will also be made of all significant occurrences concerning safety, operability, compatibility, maintainability, and reliability.

b. Provide a table summarizing the information obtained in each operational mode test exercises.

c. The numbers in the mask history summary table will be consistent with individual data sheets. Detailed operating time data will be recorded on data sheets (See Sample Data Sheet, Sample Wear and Carry Operating Time in Appendix B.) and be available if requested. Other reliability, availability, and maintainability (RAM) data will be described in TIRs.

d. Provide a table summarizing test participant opinions, preferences, comments, and recommendations concerning the adequacy of the protective mask and accessories.

e. Present tables of the protective and optical durability characteristics obtained at the end of the subtest. Reduce and analyze each set of data IAW the statistical methods outlined in the IAP.

6.11 Adverse Environments Test.

a. For each adverse environment, present a table of the protective and optical durability characteristics obtained at the end of the test. For those tests requiring sanitization, present the comments concerning the adequacy of the sanitization procedures given in the draft TM.

b. Reduce and analyze data IAW the statistical methods outlined in the IAP.

c. Use photographs, narrative comments, or other suitable means of presentation to report evidence of damage resulting from adverse environmental stress.

6.12 Sanitization.

a. Present tables providing the following information for each item used in the sanitization test.

(1) TIIN of masks and accessories.

(2) Canister/filter weight before and after sanitization test.

(3) Canister/filter airflow resistance before and after sanitization.

(4) Mask airflow resistance before and after sanitization.

(5) Mask leakage before and after sanitization.

(6) Outlet valve leakage before and after each sanitization.

(7) Drinking system flow capability before and after each sanitization.

(8) Microphone functioning test results before and after sanitization.

b. Reduce and analyze data IAW the statistical methods outlined in the IAP.

c. Provide a summary of the comments and observations concerning the adequacy of instructions and effectiveness of the sanitization procedures given in the draft TM. Use photographs, narrative comments, or other suitable means of presentation to report inadequacies.

6.13 NBC Survivability.

a. Present tables providing the following information for each item used in the survivability testing:

(1) TIIN of masks and accessories.

(2) Chemical agent or biological simulant physical characteristics.

(3) Chemical agent or biological simulant contamination density.

(4) Chemical agent droplet size.

(5) Biological simulant aerosol concentration.

(6) Post-decontamination swab and/or contact sampling data.

(7) Canister/filter weight before and after test.

(8) Post-test performance data (mask airflow resistance, mask leakage, outlet valve leakage, drinking system flow capability, and microphone functioning).

(9) Chemical agent permeation test results.

(10) Chemical agent outgassing results.

(11) Canister/filter DOP penetration test results.

(12) Canister/filter biological aerosol penetration test results.

b. Reduce and analyze data IAW the statistical methods outlined in TOP 8-2-111[21].

c. Provide a summary of the comments and observations concerning the adequacy of instructions and effectiveness of the decontamination procedures given in the draft TM. Use photographs, narrative comments, or other suitable means of presentation to report inadequacies.

6.14 Resistance to Battlefield Contaminants.

a. For each battlefield contaminant, present a table of the protective and optical durability characteristics obtained at the end of the test.

b. Reduce and analyze each set of data using the statistical methods outlined in the IAP.

c. Use photographs, narrative comments, or other suitable means of presentation to report evidence of damage resulting from exposure to battlefield contaminants.

6.15 Packaged Rough Handling and Environmental Storage.

a. For each combination of stress conditions, present a table of the protective and optical durability characteristics data obtained at the end of the test. These data will be statistically compared with the corresponding data obtained in the initial performance subtest (paragraph 4.4). Reduce and analyze each set of data IAW statistical methods outlined in the IAP.

b. Use photographs, narrative comments, or other suitable means of presentation to report evidence of damage to shipping boxes, intermediate packages, and test items resulting from rough handling and environmental storage.

6.16 Human Factors Engineering.

a. A table will be presented summarizing the specific ratings and subjective opinions of evaluators for the following mask and accessory performance characteristics:

(1) Accessibility.

(2) Climatic considerations.

(3) Compatibility.

(4) Donning and doffing.

(5) Drinking.

(6) Durability.

(7) Ease of inhalation and exhalation.

(8) Filter replacement.

(9) Fit.

(10) Protection.

(11) Resuscitation.

(12) Sanitization and decontamination.

(13) Speed/communications and speech intelligibility scores.

(14) Wearability and comfort.

(15) Vision.

b. A summary of comments and observations will be presented regarding shortcomings and recommendations.

6.17 Reliability and Durability.

a. Data collected throughout the test program will be submitted to a qualified reliability analyst for evaluation. The evaluated data will be presented in tables, or as otherwise appropriate, supplemented by graphs and other illustrations. Detailed descriptions of the method of analysis will be presented, including definitions of failures for the various components.

b. A complete description of failures and types of incidents/malfunctions will be presented for each component or mask system, as appropriate. A discussion of pattern failures and suggestions for improvements where reliability can be significantly improved will be provided.

c. Reliability and durability data will be reported in terms of one or more of the following parameters:

(1) Mean Time Between Operational Failure (MTBOF) for various types of pre-defined failures using wear and carry test data and scoring conference decisions.

(2) MTBOF estimates from simulated use test data. Simulated use data may focus on such areas as use cycles, wear time, and blower-on time (if applicable) to estimate MTBOF (wear and carry).

(3) The proportion of test items that pass various performance tests on mask systems and its components.

6.18 Logistic Supportability and Maintainability.

a. The maintenance and logistic supportability data will be presented in an appropriate manner (e.g., tables and narrative). Maintenance data will be reduced IAW TECOM Supplement 1 to AMCR 700-15[48]. The following maintenance parameters will be computed and discussed:

(1) Mean time to repair (MTTR).

(2) Mean time between operational failures (MTBOF).

(3) Maintenance ratio (MR).

(4) Mean down time (MDT).

(5) Mean active maintenance down time ($\bar{M}$).

(6) Mean time between maintenance (MTBM).

(7) Inherent availability (A_i).

(8) Operational availability (A_o).

APPENDIX A. BACKGROUND INFORMATION

This appendix provides background information about several of the tests contained in this TOP. This information includes types of testing equipment and challenging agents that have been used in previous tests of protective masks.

Test	Equipment and/or Challenge Agent
Mask Airflow Resistance Test	Q213 Inhalation/Exhalation Airflow Resistance Tester
Mask Leakage Test and Drinking Device Leakage Test	M14 Protective Mask Leakage Tester with mineral oil and Emmery 3004 as challenging agent
Outlet Valve Leakage Test	M4A1 Outlet Valve Leakage Tester
Microphone Functioning Test	Q12A2 Microphone Functional Tester
Mask Fitting Test	Corn oil, mineral oil, isoamyl acetate, stannic chloride (smoke tube), and/or biological aerosol
Luminous Transmittance Test	Photo Research Photometer, Model 1980 and Photo Research Light Source (Gamma Lamp) Model PR 2301
Haze Test	Gardner Hazemeter, Model UX10 and Gardner Digital Photometric Unit, Model PG-5500
Lens Distortion Test	Ann Arbor Optical Test
Shatter Resistance Test	Q39 Lens Impact Tester
Prismatic Deviations Test	American Optical Focimeter
Refractive Power Test	American Optical Focimeter
Visual Field Test	Haag-Streit Perimeter
Canister/Filter Airflow Resistance	Q127 Penetrometer, Filter Tester, DOP
Canister/Filter Replacement Test	M14 Protective Mask Leakage Tester with mineral oil as challenge agent
Canister/Filter Gas-life Test	Q224 Gas Sorption Tester with agents GB and GD; Q95 All Purpose Apparatus, Gas Life Testing
Rough Handling Test (Adverse Environments)	Q113 Rough Handling Machine
Drinking Device Components Airflow Resistance Test	Q179 Airflow Resistance Tester

APPENDIX B. SAMPLE DATA SHEETS AND QUESTIONNAIRES.

DESCRIPTION	PAGE
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Physical Properties Test - Tensile Test	B-20
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Resistance to Battlefield Contaminants Test	B-63
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LOGISTIC SUPPORTABILITY ANALYSIS CHART	B-69
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Human Factors Engineering (HFE) Data	B-72

TEST PLANNING QUESTIONNAIRE FOR TEST SPONSOR

Please circle the appropriate subtest for which Test Sponsor will be responsible.

	TEST TITLE	SUBTEST
1.	Receipt Inspection (REQUIRED)	4.1
2.	Safety Evaluation (REQUIRED)	4.2
3.	Operator Training and Familiarization (REQUIRED)	4.3
4.	Initial Performance Test	4.4
	a. Mask airflow resistance	4.4.1
	b. Mask leakage	4.4.2
	c. Outlet valve leakage	4.4.3
	d. Drinking system flow capability	4.4.4
	e. Microphone functioning	4.4.5
5.	Mask Fitting Test	4.5
6.	Physical Properties Test	4.6
	a. Tensile	4.6.1
	b. Tear resistance	4.6.2
	c. Hardness	4.6.3
	d. Ozone resistance	4.6.4
	e. Lens/faceblank integrity	4.6.5
7.	Optical Properties Test	4.7
	a. Luminous transmittance	4.7.1
	b. Haze	4.7.2
	c. Lens distortion	4.7.3
	d. Abrasion resistance	4.7.4
	e. Shatter resistance	4.7.5
	f. Prismatic deviation	4.7.6
	g. Refractive power	4.7.7
	h. Visual field	4.7.8
8.	Chemical Agent Vapor Permeation	4.8
9.	Canister/Filter Test	4.9
	a. Canister/filter airflow resistance	4.9.1
	b. Canister/filter replacement	4.9.2
	c. Canister/filter DOP penetration	4.9.3
	d. Canister/filter biological aerosol penetration	4.9.4
	e. Canister/Filter Gas-Life	4.9.5
10.	Wear and Carry Test	4.10
11.	Adverse Environments Test	4.11
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15.	Packaged Rough Handling and Accelerated Environmental Storage	4.15
16.	Human Factors Engineering	4.16
17.	Reliability and Durability	4.17
18.	Logistic Supportability and Maintainability	4.18

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. The colors take the shape of a long round arch, with its path high above, and its ends apparently beyond the horizon. There is according to legend, a boiling pot of gold at one end. People look, buth no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

Pledge of Allegiance

I pledge allegiance to the flag of the United States of America, and to the republic for which it stands, one nation under God, indivisible, with liberty and justice for all.

SAMPLE TEST DATA SHEET

Operator Training and Familiarization

OPERATOR TRAINING AND FAMILIARIZATION DATA CHART		NO. OF PERSONNEL TRAINED:				
		HOURS OF TRAINING			TEST ITEM	
NAME:	MOS:	LECTURE (±0.1 HR)	HANDS-ON (±0.1 HR)	MAINTE-NANCE (±0.1 HR)	TIIN	HOURS USED (±1 HR)

SAMPLE CHECK LIST FOR SAFETY EVALUATION

Aspect	Yes[a]	No	NA[b]
1. Are any components of the protective mask missing?			
2. Are there any rips, tears, or holes in any of the components?			
3. Are all lenses/outserts fully sealed?			
4. Are there any scratches or other defects on any of the components?			
5. Are any of the straps or latches broken?			

[a]Describe the defect completely and include photographs if applicable.
[b]Not applicable.

Comments

SAMPLE DATA SHEET
TEST INCIDENT REPORT (TIR)

RECORD#_____ PAGE ____OF____

1. TEST TITLE:_____ 2. TIR#:_____
3. MODEL:_____ 4. TEST PROJ#:_____
5. SERIAL#:_____ 6. MFR:_____
7. USA#: _____ 8. CONTRACT#: _____
9. TEST SPONSOR:_____ 10. TEST AGENCY:_____
11. TEST LIFE:_____ 12. LIFE UNITS:_____

II INCIDENT-DATA

13. DATE: MONTH_____ DAY_____ YEAR_____
14. TIME _____ ZONE:_____
15. INC TITLE: _____
16. SUBSYSTEM:_____

17. INCIDENT CLASS: [ ] CRITICAL [ ] MAJOR [ ] MINOR
[ ] INFORMATION [ ] INFO-GOOD NEWS

18. OBSERVED DURING: [ ] OPERATION [ ] MAINTENANCE
[ ] INSPECTION [ ] INIT INSPECTION
[ ] OTHER_____

19. ACTION TAKEN: [ ] CLEARED [ ] MAINTAINED [ ] SUSPEND TEST
[ ] OPERATED [ ] DEFER MAINT [ ] NONE

20.CATEGORY: [ ] PHYSICAL [ ] SAFETY [ ] PERFORMANCE
[ ] RAM [ ] HUMAN FACTORS [ ] TRAINING
[ ] OTHER_____

21. TEST ENVIRONMENT:_____
22. DEFECTIVE MATERIEL:_____

III INCIDENT SUBJECT DATA

23. NAME: _____
24. QUANTITY: _____
25. FSN/NSN: _____
26. MFR PART#: _____
27. SERIAL#: _____
28. FGC: _____
29. MFR: _____
30. LSA#: _____
31. DRAWING#: _____

32. ACTION: [ ] REPLACE [ ] REPAIR [ ] ADJUST [ ] REMOVE
[ ] INSTALL [ ] DIAGNOSE [ ] SERVICE [ ] NONE
[ ] OTHER _____

33. NEXT ASSY: _____
34. NEXT ASSY SN: _____
35. PART LIFE: _____
36. PART UNITS: _____

IV MAINTENANCE DATA

37. TYPE: [ ] UNSCHEDULED [ ] WEEKLY [ ] MONTHLY
[ ] ANNUAL [ ] SEMI-ANNUAL [ ] QUARTERLY
[ ] INTERVAL

38. MAINTENANCE LEVEL AND TIME DATA:

LEVEL PRESC	LEVEL RECMD	LEVEL USED	DIAGNOSTIC	ACTIVE
[ ] CREW	[ ] CREW	[ ] CREW	CLOCK HOURS	
[ ] ORG	[ ] ORG	[ ] ORG	_____:_____	_____:_____
[ ] DS/GS	[ ] DS/GS	[ ] DS/GS	MAN HOURS	
[ ] DEPOT	[ ] DEPOT	[ ] DEPOT	_____:_____	_____:_____
	[ ] CONTR/TEST			

V INCIDENT DESCRIPTION

39. DESCRIBE INCIDENT FULLY: _____

VI SCORING & CORRECTIVE ACTION DATA

40. FD/SC STEP:_____

41. FD/SC CLASS:_____

42. CHARGEABILITY:_____

43. ASGD RESP:_____

44. CA STATUS:_____

45. RELEASE DATE:_____

SIGNATURE DATA

46. PREPARER:_____

47. RELEASER:_____

48. PREP-TITLE:_____

49. REL-TITLE:_____

50. PREP-PHONE:_____

51. REL-PHONE:_____

OPERATOR TRAINING AND FAMILIARIZATION SAMPLE QUESTIONNAIRE

NAME:_____

MILITARY PERSONNEL:

RANK:_____ MOS:_____ ARMY SERVICE NO._____

EXPERIENCE IN MOS:_____

CIVILIAN/GOVERNMENT EMPLOYEE:

RATING:_____ JOB TITLE:_____

JOB DESCRIPTION:_____

1. Have you had any previous experience with the test item?_____

2. Please rate the adequacy of the information supplied in the TM and other instructional material in the following categories, with 1 being poor and 5 being very adequate.

a.	safety instructions	1	2	3	4	5
b.	sizing and fitting procedures	1	2	3	4	5
c.	assembly and disassembly	1	2	3	4	5
d.	donning and doffing	1	2	3	4	5
e.	use of drinking device	1	2	3	4	5
f.	maintenance	1	2	3	4	5
g.	sanitation and decontamination	1	2	3	4	5
h.	storage	1	2	3	4	5

3. Please comment and/or make recommendations for change in the TM on any category above which failed to achieve a rating of 4 or 5.

OPERATOR TRAINING AND FAMILIARIZATION SAMPLE QUESTIONNAIRE (Cont'd)

4. Did you receive enough hours of hands-on experience?_____

5. Did the lectures adequately cover the TM and other instructional materials as well as answer any questions or discrepancies?_____

6. Comments or recommendations on the NET lesson plan.

7. Did you experience any difficulties during the sizing and fitting procedures?_____

8. Time required to don protective mask:_____

9. Time required to prepare drinking device:_____

10. Observations on the ease of assembly and disassembly, donning and doffing, operation of the drinking device, care, and storage.

SAMPLE TEST DATA SHEET

Initial Performance Test - Mask Airflow Resistance

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

1. Canister/Filter Airflow Resistance: _____ (mm H_20)
2. Mask Inhalation Airflow Resistance: _____ (±1 mm H_2O)
3. Mask Exhalation Airflow Resistance: _____ (±1 mm H_2O)

SAMPLE TEST DATA SHEET

Initial Performance Test - Mask Leakage

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

1. Penetration of Challenge Aerosol:_____ (%)

2. Area(s) of Aerosol Penetration: _____
_____
_____

SAMPLE TEST DATA SHEET

Initial Performance Test - Outlet Valve Leakage

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Leakage Rates(L/min)

SAMPLE TEST DATA SHEET

Initial Performance Test - Drinking System Flow Capability

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

1. Time Required to Prepare Drinking Device: _____ (±5 seconds)
2. Time Required to Receive Water After Initiating Drinking Process:

   _____ (±5 seconds)
3. Time Required to Drink 0.5 L of Water: _____ (±5 seconds)
4. Amount of Water Left After 10 Minutes: _____ mL

Initial Performance Test - Drinking System Flow Capability (Cont'd)

Leakage Penetration Data (obtained while connecting and disconnecting the drinking device)

Comments and observations concerning the use of the drinking device

Results of Airflow Resistance Test

SAMPLE TEST DATA SHEET

Initial Performance Test - Microphone Functioning

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Results (continuity present/continuity not present):

SAMPLE TEST DATA SHEET

Mask Fitting Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Test History/Mask Leakage Test Results

Description of Fitting Procedures

Description of Test Events

Mask Fitting Test (Cont'd)

Participant Information

1. Name_____ Gender_____

2. Mask Size_____

3. Face Width_____ Face Length_____

4. Absence/Presence of Facial Hair_____ Days Growth_____

5. Absence/Presence Combat Spectacles/Lenses_____

6. Participant Pulmonary Function Data:

Test Data

1. Challenge Aerosol/Vapor Time-Concentration Data:_____

_____

2. Penetration Aerosol/Vapor Time-Concentration for Participant Tasks:
   a. Normal Breathing (upon entry until a baseline percent penetration of challenge simulant is established) _____
   b. Deep Breathing _____
   c. Rapid Head Movement, side to side _____
   d. Rapid Head Movement, up and down _____
   e. Reciting (Appendix B) _____
   f. Touching Knees/Reaching for ceiling _____
   g. On Knees, looking up to left, then up to right _____
   h. Facial Movements _____
   i. Normal Breathing _____

Mask Fitting Test (Cont'd)

Description of site(s) and cause(s) of mask leakage

Comments concerning sizing and fitting procedures

SAMPLE TEST DATA SHEET

Physical Properties Test - Tensile Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

1. Tensile Strength: _____ MPa
2. Tensile Set: _____ (%)
3. Elongation: _____ (%)

SAMPLE TEST DATA SHEET

Physical Properties Test - Tear Resistance

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Materials	Tear Resistance (g/cm)

SAMPLE TEST DATA SHEET

Physical Properties Test - Hardness

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Hardness Readings

Material	Hardness Reading

SAMPLE TEST DATA SHEET

Physical Properties Test - Ozone Resistance

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

1. Temperature of Test Chamber: _____ (±1.0°C)
2. Ozone Concentration: _____ ppm (±5%)
3. Airflow Rate: _____ L/min
4. Time Until Cracking: _____ min

Physical Properties Test - Ozone Resistance (Cont'd)

Description of the character of the ozone cracks at various periods of exposure

SAMPLE TEST DATA SHEET

Physical Properties Test - Lens/Faceblank Integrity

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Mask Leakage Data (±0.0001 percent)

SAMPLE TEST DATA SHEET

Optical Properties Test - Luminous Transmittance

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number proximity)

1. Luminous transmittance: _____ (±0.1%)

SAMPLE TEST DATA SHEET

Optical Properties Test - Haze

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number proximity)

1. Haze: _____ (±0.1%)

2. Prismatic Deviations: _____

SAMPLE TEST DATA SHEET

Optical Properties Test - Lens Distortion

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number proximity)

1. Vertical deviation: _____ (±0.01 diopter)

2. Horizontal deviation: _____ (±0.01 diopter)

SAMPLE TEST DATA SHEET

Optical Properties Test - Abrasion Resistance

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number proximity)

1. Luminous Transmittance after abrasion: _____ (diopter)

2. Haze after abrasion: _____

SAMPLE TEST DATA SHEET

Optical Properties Test - Shatter Resistance

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number, proximity)

1. Impact Resistance: _____

SAMPLE TEST DATA SHEET

Optical Properties Test - Prismatic Deviation

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number, proximity)

1. Distortion: _____ (diopter)

2. Prismatic Deviation: _____ (diopter)

SAMPLE TEST DATA SHEET

Optical Properties Test - Refractive Power

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number proximity)

1. Refractive Power: _____ (diopter)

SAMPLE TEST DATA SHEET

Optical Properties Test - Visual Field

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

Description of Defects (magnitude, number, proximity)

Visual Field: _____

SAMPLE TEST DATA SHEET

Chemical Agent Vapor Permeation Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Description of Swatch

Thickness of swatch: Exposed area of swatch:

Chemical Agent Vapor Permeation Test (Cont'd)

Test Data

1. Material: _____

2. Challenge Agent: _____

3. Challenge Agent Concentration:

   a. Vapor _____ mg/L

   b. Liquid _____ mg/m^2

4. Purity of Agent: _____ (%)

5. Viscosity of Agent (if thickened): _____ centistokes

6. Agent Thickener (if applicable): _____

7. Permeation Time: _____ min

8. Precision Obtained on Analytical Controls

SAMPLE TEST DATA SHEET

Canister/Filter Airflow Resistance Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Manufacturer Data

Description of Test Events

Test Data

1. Canister/Filter Weight: _____ g

2. Airflow Resistance: _____ (mm H_20)

SAMPLE TEST DATA SHEET

Canister/Filter Replacement Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Environmental Conditions

Description of Test Events

Test Data

1. Name of Test Participant: _____
2. Canister/Filter Replacement Time: _____ (±5 seconds)
3. Leakage data: _____

Comments and observations concerning ease of replacement

Canister/Filter Replacement Test (Cont'd)

List of special tools and/or materials required for Canister/Filter replacement (if applicable)

Description of special training (if applicable)

Comments and observations concerning the adequacy of instructions given in the draft TM

SAMPLE TEST DATA SHEET

Canister/Filter Carbon Properties Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of Test Events

Test Data

1. Particle Size: _____

2. Physical Properties:
   - Hardness _____
   - Loss in weight _____
   - Bulk density _____
   - Ammonia content _____

3. Gas Sorption:
   - Hydrocyanic Acid (AC) _____
   - Phosgene (CG) _____
   - Cyanogen chloride (CK) _____
   - Arsine (SA) _____
   - Sarin (GB) _____

SAMPLE TEST DATA SHEET

Canister/Filter DOP Penetration Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Manufacturer data

Description of Test Events

Test Data

1. Canister/Filter Weight
   Before: _____ g

   After: _____ g

2. DOP Penetration: _____ (%)

SAMPLE TEST DATA SHEET

Canister/Filter Biological Aerosol Penetration Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Manufacturer Data

Test History

Description of Test Events

Canister/Filter Biological Aerosol Penetration Test (Cont'd)

Test Data

1. Canister/Filter Weight
   Before: _____ g

   After: _____ g

2. Biological Aerosol Challenge Concentration:
   _____ CFU/L

3. Challenge Time: _____ ±5 seconds

4. Amount of Biological Agent/Simulant Penetration:
   _____ CFU

Background Control Data

SAMPLE TEST DATA SHEET

Canister/Filter Gas-Life Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Manufacturer Data

Type of Agent: _____

Description of Test Conditions

Description of Test Events

Canister/Filter Gas-Life Test (Cont'd)

Test Data

1. Challenge Concentration: _____ mg/m^3

2. Flow Rate: _____ L/min

3. Chamber Temperature: _____ °C

4. Relative Humidity _____ %

4. Effective Agent Removal Time: _____ min

5. Challenge Agent Gas-Life (multiply challenge concentration by effective agent removal time): _____ $mg \cdot min/m^3$

SAMPLE TEST DATA SHEET

Daily Wear and Carry Operating Time

Test/Phase No._____ Date_____

Project Officer_____

Mask Type _____ Mask ID No._____

Mask User _____ Suit_____ Hood_____

Use Mode Code:

I - Infantry
AR - Armor
AVI - Aviation, use in the air
AVG - Aviation, use on ground
SP - Special purpose

Activity Code:

H - High
L - Low

Use No.	Wear Time			Carry Time			Use Code	Activity Code	Comments
	Start	End	Diff	Start	End	Diff			
1									
2									
3									
4									
Daily Totals									

Description of Test Scenario or Exercises:

_____
_____

Environmental Conditions (temperature, wind, rain, dust, etc.):

_____
_____

How many PMCS checks were completed during the day? _____ Pre-use
_____ Post-use

How many sanitizations were completed during the day? _____

Wear and Carry Test (Cont'd)

Description of Test Events

Participant Information

1. Name_____ Gender_____

2. Number of hours mask was worn: _____

3. Summary of interview and/or questionnaire comments

Wear and Carry Test (Cont'd)

Test Data

1. Number of Sanitations: _____

2. Canister/Filter Weights:
   Before _____ g
   After Test _____ g

3. Canister/Filter Airflow Resistance:
   _____ (mm H_2O)

4. Mask Airflow Resistance:
   Inhalation _____ (±0.1 mm H_2O)
   Exhalation _____ (±0.1 mm H_2O)

5. Mask Leakage:
   Penetration of aerosol _____ %
   Area(s) of Penetration _____

6. Outlet Valve Leakage Rates: _____ (L/min)

7. Drinking System Flow Capability:
   Time to prepare device: _____ (±5 seconds)
   Time to receive water: _____ (±5 seconds)
   Time to drink 0.5 L of water: _____ (±5 seconds)
   Water left after 10 minutes: _____ mL
   Leakage penetration data: _____
   Airflow resistance test: _____

8. Microphone Functioning:
   Before Test _____
   After Test _____

Wear and Carry Test (Cont'd)

9. Chemical Agent Permeation:

Material Tested	_____	
Challenge Agent	_____	
Agent Concentration	_____	
Purity of Agent	_____	(%)
Viscosity of Agent	_____	centistokes
Agent Thickener	_____	
Permeation Time	_____	min

10. Canister/Filter DOP Penetration:

_____ (%)

11. Canister/Filter Biological Aerosol Penetration:

Aerosol Concentration	_____	CFU/L
Challenge Time	_____	min
Amount of Penetration	_____	CFU

Observations concerning safety, operational effectiveness, compatibility with protective clothing and equipment, communications effectiveness, and operator's vision and comfort

Wear and Carry Test (Cont'd)

Observations concerning maintenance

Observations concerning durability of test item components

Test Incident Report (TIR) numbers that pertain to this test

SAMPLE TEST DATA SHEET

Adverse Environment Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Canister/Filter Manufacturer Data

Test History

Challenge Environment: _____

Description of Test Events

Adverse Environment Test (Cont'd)

Test Data

1. Canister/Filter Weight:
   Before Test _____ g
   After Test _____ g
2. Mask Airflow Resistance:
   Before Test _____ (mm H_2O)
   After Test _____ (mm H_2O)
3. Mask Leakage:
   Before Test _____
   After Test _____
4. Outlet Valve Leakage
   Before Test _____
   After Test _____
5. Drinking System Airflow Resistance:
   Before Test _____
   After Test _____
6. Drinking System Leakage:
   Before Test _____
   After Test _____
7. Microphone Functioning:
   Before Test _____
   After Test _____

Adverse Environment Test (Cont'd)

Observations concerning post and pretest visual inspections of masks and accessories

SAMPLE TEST DATA SHEET

Sanitization Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Test History

Description of Sanitization Procedure

Description of Test Events

Sanitization Test (Cont'd)

Test Data

1. Canister/Filter Weight:
   Before Test _____ g
   After Test _____ g
2. Mask Airflow Resistance:
   Before Test _____ (mm H_2O)
   After Test _____ (mm H_2O)
3. Mask Leakage:
   Before Test _____ (%)
   After Test _____ (%)
4. Outlet Valve Leakage:
   Before Test _____
   After Test _____
5. Drinking System Airflow Resistance:
   Before Test _____
   After Test _____
6. Drinking System Leakage:
   Before Test _____
   After Test _____
7. Microphone Functioning:
   Before Test _____
   After Test _____

Sanitization Test (Cont'd)

Test Incident Report (TIR) numbers that pertain to this test

Summary of interview and/or questionnaire comments

SAMPLE TEST DATA SHEET

Nuclear, Biological, Chemical (NBC) Survivability Chemical

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of test item surface condition

Description of test item features (i.e., cracks, crevices)

Description of test procedures (contamination, decontamination)

NBC Survivability Chemical (Cont'd)

Chamber Conditions:

Temperature _____ RH_____ %

Calculated airflow _____ m/sec

Agent Information:

Type:_____ Control No._____

Viscosity _____ centistokes

Purity _____ percent

Amount of Dye _____ g/L

Type of Thickener _____

Amount of Thickener _____ g/L

Amount of Agent Used _____ g

Contamination Concentration _____ g/m^2

Drop Size _____ mg

Decontamination Solution _____

Results of post-contamination vapor and contact samples

Post-test Performance:

1. Mask Airflow Resistance _____ g
2. Mask Leakage _____ %
3. Outlet Valve Leakage _____ %
4. Drinking System Airflow Resistance _____
5. Drinking System Leakage _____
6. Microphone Functioning _____

SAMPLE TEST DATA SHEET

Nuclear, Biological, Chemical (NBC) Survivability Biological

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of test item surface condition

Description of test item features (i.e., cracks, crevices)

Description of test procedures (contamination, decontamination)

NBC Survivability Biological (Cont'd)

Chamber Conditions:

Temperature_____ RH_____ %

Calculated airflow_____ m/sec

Biological Simulant Information:

Name _____ Control No._____

Diluent_____ Viscosity_____

Percent Solids_____ Date Harvested/
Reconstituted_____

Date Used_____ CFU/mL_____

Contamination Level of Chamber_____CFU/L of air

Contamination Level of Each Sample Location:

1. _____ CFU/cm^2

2. _____ CFU/cm^2

3. _____ CFU/cm^2

Decontamination Solution_____

Post Test Performance:

1. Mask Airflow Resistance _____ g
2. Mask Leakage _____ %
3. Outlet Valve Leakage _____ %
4. Drinking System Airflow Resistance _____
5. Drinking System Leakage _____
6. Microphone Functioning _____

SAMPLE TEST DATA SHEET

Nuclear, Biological, Chemical (NBC) Survivability Radiological

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Description of test item surface condition

Description of test item features (i.e., cracks, crevices)

Description of test procedures (contamination, decontamination)

NBC Survivability Radiological (Cont'd)

Chamber Conditions:

Temperature_____ RH_____ %

Calculated airflow_____m/sec

Radiological Simulant (FP) Information:

Lot or Control No._____ Color_____

Particle Count/Gram_____

Particle Size Range_____ mm to_____ mm

Quantity of FP Disseminated _____ g

Fall Out Time _____ min

Airwash Time _____ min

Sampler Time _____ min

Post-test Performance:

1. Mask Airflow Resistance _____ g
2. Mask Leakage _____ %
3. Outlet Valve Leakage _____ %
4. Drinking System Airflow Resistance _____
5. Drinking System Leakage _____
6. Microphone Functioning _____

SAMPLE TEST DATA SHEET

Nuclear, Biological, Chemical (NBC) Survivability Compatibility

SAMPLE TEST DATA SHEET

Resistance to Battlefield Contaminants Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Contaminant Used:_____

Method of Application:_____

Description of Test Events

Resistance to Battlefield Contaminants Test (Cont'd)

Test Data

1. Canister/Filter Weight:
   Before _____ g
   After _____ g
2. Mask Airflow Resistance:
   Before _____ (mm H_2O)
   After _____ (mm H_2O)
3. Mask Leakage:
   Before _____ (%)
   After _____ (%)
4. Outlet Valve Leakage:
   Before Test _____
   After Test _____
5. Drinking System Airflow Resistance:
   Before Test _____
   After Test _____
6. Drinking System Leakage:
   Before Test _____
   After Test _____
7. Microphone Functioning:
   Before Test _____
   After Test _____

Comments and observations concerning the adequacy of instructions and effectiveness of the decontamination procedures given in the draft TM

SAMPLE TEST DATA SHEET

Packaged Rough Handling and Environmental Storage Test

Test/Phase No._____ Date_____
Project Officer_____ Time(Begin/End)_____/_____

Test Personnel_____
_____
_____

Test Item_____ TIIN_____

Test History

Results of Pretest Visual Inspection

Description of Test Events

Packaged Rough Handling and Environmental Storage Test (Cont'd)

Test Data

1. Canister/Filter Weight:
   Before Test _____ g
   After Test _____ g

2. Mask Airflow Resistance:
   Before Test _____ (mm H_2O)
   After Test _____ (mm H_2O)

3. Mask Leakage:
   Before Test _____ (%)
   After Test _____ (%)

4. Outlet Valve Leakage:
   Before Test _____
   After Test _____

5. Drinking System Airflow Resistance:
   Before Test _____
   After Test _____

6. Drinking System Leakage:
   Before Test _____
   After Test _____

7. Microphone Functioning:
   Before Test _____
   After Test _____

Packaged Rough Handling and Environmental Storage Test (Cont'd)

Results of Post-test Visual Inspection

Comments and Observations Concerning Physical Properties Test

SAMPLE TEST DATA SHEET

Reliability and Durability

RELIABILITY AND DURABILITY ANALYSIS CHART					
SUBTEST:	NO. OF TEST ITEMS	SUCCESSES	FAILURES	AGENT AND CHALLENGE CONCENTRATIONS	LIFE TIME OF TEST ITEM

LOGISTIC SUPPORTABILITY ANALYSIS CHART

Column	Instructions
1	Test phase/no. Enter the test phase/no. or subtest as indicated in the TOP or on the test data sheet.
2	Item/Component TIIN and test history. Enter item/component TIIN and related test history.
3/4	Maintenance category, scheduled. Indicate the maintenance category prescribed by the MAC using the following codes: C - Operator/crew; O - Organizational; F - Direct support; H - General support; N - None prescribed. Indicate whether the maintenance action taken was a scheduled or unscheduled activity.
5	TM instructions, adequate. Place an "X" in this column to indicate that the TM instructions covering this maintenance task or action are adequate.
6	TM instructions, inadequate. When the TM instructions are considered inadequate, insert the test center TIR number, if appropriate, which transmitted the inadequacies.
7	Active maintenance time. Enter clock hours and man-hours required for the maintenance operation to the nearest tenth of an hour. If the operation was not actually performed but was reviewed, indicate the estimated active maintenance time by using the prefix E. (Explain unusual differences in maintenance times for the same operation in the body of the test report.)
8	Parts consumption. Record the part name and number (as appropriate) of any parts used to perform maintenance.
9	Remarks. When a maintenance task is related to a specific incident, enter the TIR number. Also, use the remarks column to identify maintenance functions that are considered failures for reliability computations. Enter the time in man-hours prescribed by the MAC to perform each function (or locally devised forms may require entry of the information in a separate column).

NOTE: For the test report, include the serial number of the test item in the remarks column or include separate charts for each test item.

SUPPORTABILITY ANALYSIS CHART	PROJECT NO.	NOMENCLATURE	IDENTIFICATION NO.

TEST PHASE/ NO	ITEM/COMPONENT TIIN AND TEST HISTORY	MAINT CAT C-OP CREW O-ORG F-DIRECT H-GENERAL N-NONE SCHEDULED		TM INSTRUCTIONS		ACTIVE MAINTENANCE TIME		PARTS CONSUMPTION	REMARKS
		YES	NO	ADQT	INADQT	CLOCK HOURS	MAN-HOURS		
1	2	3	4	5	6	7		8	9

LOGISTIC SUPPORTABILITY ANALYSIS CHART - HFE ANALYSIS

HFE MAINTENANCE ANALYSIS CHART				
TEST PHASE/NO	EASE OF MAINTENANCE OPERATION	PHYSICAL EFFORT REQUIRED	ADEQUACY OF WORKING SPACE	RECOMMENDED IMPROVEMENTS
1	2	3	4	5

SAMPLE TEST DATA SHEET

Human Factors Engineering (HFE) Data

HFE DATA ANALYSIS CHART	PROJECT OFFICER:		TEST PERSONNEL:	
SUBTEST	ACCESSIBILITY	CLIMATIC CONSIDERATIONS	COMPATIBILITY	DONNING AND DOFFING

HFE DATA ANALYSIS CHART (Cont'd)				
SUBTEST	DRINKING	DURABILITY	EASE OF INHALATION AND EXHALATION	FILTER REPLACEMENT

HFE DATA ANALYSIS CHART (Cont'd)				
SUBTEST	FIT	PROTECTION	SANITATION	SPEED OF COMMUNICATION

HFE DATA ANALYSIS CHART (Cont'd)			
SUBTEST	SPEECH INTELLIGIBILITY SCORES	WEARABILITY AND COMFORT	VISION

APPENDIX C. ABBREVIATIONS.

A_i - Inherent availability

A_o - Operational availability

AC - hydrogen cyanide

AFFF - aqueous film-forming foam

ALDT - Administrative Logistic Downtime

ALSE - aviation life support equipment

AMCR - U.S. Army Materiel Command Regulation

APC - armored personnel carrier

AR - Army Regulation

ASTM - American Society for Testing and Materials

BG - Bacillus subtilis var. niger (B. globigii)

BIIL - basic issue item list

CAIRA - chemical-accident-incident response and assistance

CFU - colony forming units

CG - phosgene

CK - cyanogen chloride

DA - Department of the Army

DMMP - dimethyl methylphosphonate

DOP - dioctyl phthalate

DS2 - decontaminating solution No. 2

DTP - detailed test plan

EA - Edgewood Arsenal

EIALC - environmental impact assessment for life cycle

EIS - environmental impact statement

EMT - emergency medical technician

EOD - explosive ordnance disposal

FM - field manual

FP - fluorescent particle

GB - sarin

GD - soman

HD - mustard

HFE - human factors engineering

IAP - Independent Assessment Plan

IAW - in accordance with

IEP - Independent Evaluation Plan

JSC - Joint Services Committee

LSA - small arms lubricant

$\underline{M}$ - mean active maintenance down time

MDT - mean down time

MIL-SPEC - military specification

MIL-STD - military standard

MOS - military occupational specialty

MR - maintenance ratio

MTBOF - mean time between operational failures

MTBM - mean time between maintenance

MTTR - mean time to repair

NATO - North Atlantic Treaty Organization

NBC - nuclear, biological, and chemical

NEPA - National Environmental Policy Act

NET - new equipment training

OMS/MP - operational mode summary/mission profile

ORD - operational requirements document

PAM - pamphlet

PMFVS - Protective Mask Fit Validation System

RDT&E - research, development, test, and evaluation

REC - record of environmental consideration

RH - relative humidity

SA - arsine

SAR - safety assessment report

SN - serial number

SOP - standing operating procedure

SSP - system support package

TDP - test design plan

TECOM - U.S. Army Test and Evaluation Command

TEMP - Test and Evaluation Master Plan

TGD - thickened soman

TIIN - test item identification number

TIR - test incident report

TM - technical manual

TMDE - test, measurement, and diagnostic equipment

TOP - test operations procedure

UV - ultraviolet

VX - V-agent

APPENDIX D. REFERENCES.

REQUIRED

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5. Headquarters, Department of Defense, Washington, D.C., Military Standard (MIL-STD-) 810E, Environmental Test Methods and Engineering Guidelines, 14 July 1989.

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