SYSTEM PERFORMANCE SPECIFICATION (SPS)

FOR THE

Uniform Integrated Protection Ensemble – Increment 1 (UIPE I¹)

Version 1
FEBRUARY 2011
# TABLE OF CONTENTS

1. SCOPE.................................................................................................................................................................1
2. APPLICABLE DOCUMENTS ....................................................................................................................................1
3. REQUIREMENTS ..................................................................................................................................................4
4. VERIFICATION ..................................................................................................................................................10
5. PACKAGING ....................................................................................................................................................18
6. NOTES ...............................................................................................................................................................19

## LIST OF TABLES

1. Table I: Spectral IR Reflectance Requirements, Universal Camouflage ..........................................................8
2. Table II: Spectral IR Reflectance Requirement, OCP (Nyco) ........................................................................9
3. Table III: Colorfastness Requirements ........................................................................................................9
4. Table IV: Verification Matrix .......................................................................................................................10
1. **SCOPE**

1.1. **Identification.** This System Performance Specification (SPS) establishes the initial performance requirement for the Uniform Integrated Protection Ensemble – Increment 1 (UIPE I¹). The UIPE I¹ is a garment that provides percutaneous protection against chemical and biological (CB) warfare agents and continuous protection against CB agent permeation while reducing the thermal burden to the warfighter. UIPE I¹ will provide enhanced individual protection capabilities to meet United States (US) Special Operations Command (SOCOM) and US Navy (USN) requirements.

1.2. **Document Overview.** This specification documents the performance requirements for the UIPE I¹. Threshold (mandatory) requirements are defined and, where applicable, objective (desired) requirements are provided as text within braces { }. A garment’s ability to meet an objective requirement may be tested but the inability to meet an objective requirement will not be used as criteria for failure. Some threshold requirements are further defined as Key Performance Parameters (KPPs), which are capabilities or characteristics so significant that failure to meet the performance value can be cause for the concept or system selection to be reevaluated or the program to be reassessed or terminated. KPPs are identified with an asterisk “*”. This document will be updated at each acquisition phase of the UIPE I¹ Program. The first update will be based on the results of the Technology Development (TD) phase, the approved Capability Development Document (CDD), and the approved Test and Evaluation Master Plan (TEMP). The second major update will be based on the results of the Engineering and Manufacturing Development (EMD) phase and the approved Capability Production Document (CPD). Other updates will be made as deemed necessary by the Government throughout the acquisition cycle. UIPE I¹ will be fielded to Special Operations Force (SOF) and Navy warfighters to operate in the irregular, disruptive, traditional, and catastrophic operational environments. These environments are not discreet, and are expected to occur simultaneously and evolve over time as the nature of a particular conflict might evolve.

1.3. **Classification.** The garment described herein is intended to supplement but not replace the currently fielded chemical biological (CB) protective garments, i.e. the Joint Service Lightweight Integrated Suit Technology (JSLIST) and the All Purpose/Personal Protective Ensemble (AP/PPE).

2. **APPLICABLE DOCUMENTS**

2.1. **General.** The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not the documents are listed.
2.2. Government Documents

2.2.1. Specifications, Standards, and Handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-STD-810G Environmental Engineering Considerations and Laboratory Tests

DEPARTMENT OF THE ARMY

Developmental Test Command (DTC) Test Operations Procedures (TOP)

DTC TOP 8-2-501 Permeation and Penetration Testing of Air-Permeable, Semi-permeable, and Impermeable Material with Chemical Agents
DTC TOP 10-2-021 General Performance Tests of Protective Clothing
DTC TOP 10-2-022 Chemical Vapor and Aerosol System-Level Testing of Chemical/Biological Protective Suits

(Applications for copies should be addressed to the Defense Technical Information Center or by accessing the following: http://www.dtc.army.mil. Choose the TESTING drop-down menu and the PUBLICATIONS button under that menu, then the link to TEST OPERATION PROCEDURES (TOP)/INDEX OF INTERNATIONAL TEST OPERATION PROCEDURES (ITOP) INDEX SEARCH. This goes to the Developmental Test Command (DTC) Pam 25-32, last updated 04 June 2008, where there is an index and instructions for obtaining copies of TOPs.)

US Army Research Institute of Environmental Medicine (USARIEM) Technical Notes

USARIEM TN 08-01. General Procedure for Protective Clothing and Equipment Evaluations Relative to Heat and Cold Stress

(Request copies of USARIEM technical note through the Contracting Officer.)
### US Army Research, Development and Engineering Command

<table>
<thead>
<tr>
<th>Document Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1-2519</td>
<td>Universal Camouflage Pattern</td>
</tr>
<tr>
<td>2-1-2519-1</td>
<td>ARPAT Camouflage Pattern Desert Sand 500</td>
</tr>
<tr>
<td>2-1-2519-2</td>
<td>ARPAT Camouflage Pattern Urban Gray 501</td>
</tr>
<tr>
<td>2-1-2519-3</td>
<td>ARPAT Camouflage Pattern Foliage Green 502</td>
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(Copies of drawings are available from the U.S. Army Natick Research Development and Engineering Center, Natick Soldier Center, ATTN: RDNS-WPW-C, Natick, MA 01760.)

### 2.3. Non-Government Documents

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

**American National Standards Institute (ANSI)/American Society for Quality (ASQ)**

- ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

(A copy of this document is available online at [http://www.asq.org](http://www.asq.org) or from the American Society for Quality, P.O. Box 3005 Milwaukee, WI 53201-3005.)

**American Society for Testing and Materials (ASTM) International**

- ASTM F-1930 Standard Test Method for Evaluation of Flame Resistant Clothing for Protection against Flash Fire Simulations Using an Instrumented Manikin
- ASTM-D-6413 Standard Test Method for Flame Resistance of Textiles (Vertical Test)

(Applications for copies should be addressed to ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 or to their web site: [http://www.astm.org/](http://www.astm.org/).)

**American Association of Textile Chemists and Colorists (AATCC)**

- AATCC Evaluation Procedure 9 Visual Assessment of Color Difference of Textiles
AATCC Test Method  8  Colorfastness to Crocking: AATCC Crockmeter Method
AATCC Test Method 15  Colorfastness to Perspiration
AATCC Test Method 16  Colorfastness to Light

(Copies of these documents are available at http://www.aatcc.org or from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

2.4. Order of Precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1. Recycled, Recovered or Environmentally Preferable Materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.2. First Article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.3. Performance Characteristics

3.3.1. Thermal Burden / Heat Stress Management

* The garment shall reduce thermal burden by at least 25% relative to current CB Personal Protective Equipment (JSLIST and AP-PPE) in a Mission Oriented Protective Posture (MOPP) IV configuration (i.e. worn with CB protective mask, footwear and handwear). Submissions shall demonstrate evaporative resistance (im/clo) of greater than 0.17 at 1m/s wind speed and greater than 0.13 at 0.4 m/s when worn in MOPP IV configurations with full combat load. When in a MOPP IV configuration, the garment shall increase the number of minutes that the wearer can safely perform assigned missions and shall reduce the number of heat casualties, based on core temperature measurements, when compared to the current CB Personal Protective Equipment in the following mission scenarios:

Scenario 1: 20°C ≤Ta < 25°C, 30% ≤RH ≤ 50%, 425W ≤Work Rate ≤ 470W
Scenario 2: 25°C ≤Ta < 35°C, 10% ≤RH ≤40%, 400W ≤Work Rate ≤ 470W
Scenario 3: 35°C ≤Ta < 45°C, 10% ≤RH ≤15%, 400W ≤Work Rate ≤ 470W

Where:
Ta = ambient air temperature
RH = relative humidity

3.3.1.2 {The garment shall induce a thermal burden/heat stress equal to or less than the combat duty uniform in a MOPP IV configuration. When in a MOPP IV configuration, the garment shall allow the wearer to safely perform assigned missions, based on core temperature range measurements, for a length of time equal to or greater than the time allowed by the combat duty uniform in a MOPP IV configuration in the following mission scenario: $20°C \leq T_a < 50°C$, $0% \leq RH \leq 45%$, $415W \leq \text{Work Rate} \leq 470W$.}

3.3.1.3 The garment’s design shall maximize heat stress management through features that allow for improved ventilation when not in a contaminated environment.

3.3.2 Chemical Agent Resistance

3.3.2.1 * The garment shall provide 12 {24} hours of percutaneous CB protection from a liquid challenge of 5 {10} g/m² for chemical agents HD, TGD, and VX. The garment shall provide CB protection after a 5000 CT (mg-min/m³) vapor challenge and after a 5000 Ct (mg-min/m³) aerosol challenge.

3.3.2.2 * The garment shall provide 12 {24} hours of percutaneous CB protection after 48 {96} hours of unchallenged wear, from a liquid agent challenge of 5 {10} g/m², a 5000 CT (mg-min/m³) vapor challenge and a 5000 CT (mg-min/m³) aerosol challenge.

3.3.2.3 The CB protection time provided by the garment shall not be degraded by more than 20% {0%} after exposure to battlefield contaminants including Petroleum, Oils, Lubricants (POLs) (hydraulic fluid, gun lube, JP-8, motor gasoline), salt water, urine, standard decontaminant (RSDL, M291, M295, and M100), while being worn or stored.

3.3.3 Integration

3.3.3.1 * The garment shall integrate with protective footwear and gloves [Alternative Footwear Solutions (AFS), AFS Special Operations Variant (AFS-SV), Integrated Footwear System (IFS), JSLIST Block 1 Glove Upgrade (JB1GU), and JSLIST Block 2 Upgrade (JB2GU)], M53 mask, MCU-2P mask, and Joint Service General Purpose Mask (JSGPM) mask, ensuring whole-body protection is provided to the warfighter. {The garment shall integrate with protective gloves, overboots, and all Department of Defense (DoD) inventory Chemical Biological Radiological Nuclear (CBRN) masks to ensure no separations and provide whole-body protection is provided to the individual.}

3.3.3.2 The garment shall integrate with current and developmental clothing and equipment including load-bearing equipment, helmets, hand wear, footwear, body cooling systems, and protective masks.
3.3.4 Human Factors

3.3.4.1 The garment shall be capable of being donned during a mission.

3.3.4.2 The garment shall not interfere with the performance of routine and emergency mission duties.

3.3.4.3 The garment shall effectively accommodate the 5\textsuperscript{th} percentile female, based on height and weight, to the 95\textsuperscript{th} percentile male, based on height and weight, of the intended military population.

3.3.5 Safety

3.3.5.1 The garment shall permit assisted \{unassisted\} doffing or cutting off, of a contaminated ensemble without creating a hazard to the wearer or contaminating other personnel or equipment.

3.3.5.2 The garment shall not present undesirable or uncontrolled ergonomic hazards to personnel, nor will it create any hazards from special materials used in its construction.

3.3.5.3 The garment aggregate system weight shall not create an increased fatigue hazard to the wearer, compared to currently fielded CB protective garments.

3.3.5.4 The garment shall be made from the least hazardous materiel consistent with mission performance and economic constraints. The user shall have the ability to train, operate, maintain, and dispose of the system in full compliance with applicable U.S., foreign, and international environmental quality laws, regulations, executive orders, international agreements, and DoD policies. The design, production, operation, maintenance, and disposal of the system shall eliminate or minimize to the greatest extent possible, adverse environmental quality impacts, safety, and occupational health hazards, and ESOH risks including hazardous materials usage.

3.3.6 System Characteristics

3.3.6.1 The garment shall provide pockets to carry related individual CBRN medical items and individual decontamination kits.

3.3.6.2 The garment shall provide the capability to affix unit identification patches, without degrading protection, in accordance with component or unit doctrine.

3.3.6.3 Fasteners / closures shall remain functional when exposed to incidental soil, mud, sand, and salt water and be capable of operation without assistance while wearing chemical protective gloves.
3.3.6.4 The garment shall have the ability to be produced in Universal Camouflage and Operation Enduring Freedom Camouflage Pattern (OCP) pattern. The garment shall not increase {shall decrease} the audio, visual (assisted and unassisted), or olfactory signature of the wearer compared to JSLIST or current PPE {the standard duty uniform}.

3.3.6.4.1 The pattern of the Universal Camouflage shall match Drawing 2-1-2519 (see 2.2.2). The various areas of the Universal Camouflage pattern shall be properly registered in relation to each other and shall present definite sharp demarcations. The cloth shall be dyed to a ground shade either matching or approximating Desert Sand 500 and then overprinting with the camouflage pattern by roller or screen printing. When the ground shade is dyed to match Desert Sand 500, the remaining colors shall be obtained by subsequent printing using two rollers or screens, as appropriate for the Urban Gray 501 and Foliage Green 502 areas of the pattern. When the ground shade is dyed to approximate Desert Sand 500 all three colors of the camouflage pattern shall be obtained by subsequent printing using three rollers or screens to match all three colors. Resin bonded pigments are not permitted. The spectral IR reflectance values for each color of the camouflage pattern shall conform to the requirements specified in Table I.

**Table I. Spectral IR Reflectance Requirements, Universal Camouflage**

<table>
<thead>
<tr>
<th>Wavelength Nanometers (nm)</th>
<th>Reflectance Values (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Desert Sand 500</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>600</td>
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<td>620</td>
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<td>740</td>
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<td>760</td>
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<tr>
<td>780</td>
<td>54</td>
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<td>820</td>
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<td>840</td>
<td>56</td>
</tr>
<tr>
<td>860</td>
<td>56</td>
</tr>
</tbody>
</table>

3.3.6.4.2 The pattern of the OCP shall match the standard sample Roll 3807 (see 6.8). The various areas of the OCP pattern shall be properly registered in relation to each other and shall present definite sharp demarcations. The cloth shall be dyed to a ground shade either matching or approximating Cream 524 and then overprinting with the
camouflage pattern by roller or screen printing. When the ground shade is dyed to match Cream 524, the remaining colors shall be obtained by subsequent printing using six rollers or screens, as appropriate for the Tan 525, Pale Green 526, Olive 527, Dark Green 528, Brown 529 and Dark Brown 530 areas of the pattern. When the ground shade is dyed to approximate Cream 524 all seven colors of the camouflage pattern shall be obtained by subsequent printing using seven rollers or screens to match all seven colors. Resin bonded pigments are not permitted. The spectral IR reflectance values for each color of the camouflage pattern shall conform to the requirements specified in TABLE II.

### TABLE II. Spectral IR Reflectance Requirements, OCP (NYCO Fabrics)

<table>
<thead>
<tr>
<th>Wavelength, Nanometers (nm)</th>
<th>Cream 524 &amp; Tan 525</th>
<th>Pale Green 526, Olive 527 and Brown 529</th>
<th>Dark Green 528 and Dark Brown 530</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>22</td>
<td>12</td>
<td>30</td>
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<td>620</td>
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<td>860</td>
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<td>28</td>
<td>46</td>
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</tbody>
</table>

3.3.6.4.3. The finished cloth shall conform to the colorfastness requirements listed below in TABLE III

### TABLE III Colorfastness requirements.

<table>
<thead>
<tr>
<th>Colors Evaluation</th>
<th>Light (40 hrs or 170 KJ) 2/ (min.)</th>
<th>Perspiration (acid &amp; alkaline) 1/ (min.)</th>
<th>Crocking 3/ (min.)</th>
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</thead>
<tbody>
<tr>
<td>All colors</td>
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<td>3-4</td>
<td>3.5</td>
</tr>
<tr>
<td>Dk. Green 528, Brown 529, Dark Brown 530</td>
<td></td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>Cream 524, Tan 525, Pale Green 526, Olive 527, Desert Sand 500, Urban gray 501, Foliage Green 502</td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

1/ Rated using the AATCC Gray Scale for Color Change and AATCC Gray Scale for Staining.
2/ Rated using the AATCC Gray Scale for Color Change.
3/ Rated using the AATCC 9-Step Chromatic Transference Scale.

3.3.6.5 The garment’s aggregate system volume will be minimized so not to displace mission critical equipment. The volume shall not exceed that of currently fielded garments.

3.3.7 Flame Resistance

3.3.7.1 The garment shall provide flame resistance equal to the currently fielded combat uniform [(non-flame resistant Army combat uniform (non-FR ACU)]. {The garment will provide sufficient thermal protection to allow emergency egress from a burning aircraft / vehicle / vessel. Sufficient thermal protection is defined as less than 20% of the body receiving second and third degree burns.}

3.3.8 Reliability, Availability, Maintainability

3.3.8.1 * The garment shall have a materiel availability of 0.90 {0.99}. The garment shall have an operational availability of 0.90 {0.99}.

3.3.8.2 The garment shall have a material reliability of 0.90, defined as having a .90 probability of completing a 12 {24} hour mission without a non-repairable (by validated field expedient means) mission essential functional failure, after 48 {96} hours of wear.

3.3.8.3 The garment shall be capable of field expedient repair of minor repair of tears and/or punctures by the wearer, while in MOPP IV. The repair method shall effectively restore CB protection, following minor damage that occurs during the course of a mission, sufficient to allow mission completion. Maintenance of the garment shall be limited to field expedient repair. {An uncontaminated garment will be able to be repaired to full CB protection to allow for reuse.}

3.3.9 Integrated Logistics Support

3.3.9.1 The garment design and support package shall be deemed acceptable for military use,

3.3.9.2 The garment shall have at least a 7 month service life after its protective packaging is opened.

3.3.9.3 The garment shall have a shelf life of at least 5 years.

3.3.9.4 The garment shall be capable of operation after being stored in the temperature range of: -25 degrees Celsius to 71 degrees Celsius { -46 degrees Celsius to 71 degrees Celsius}.

3.3.9.5 The garment shall utilize the minimum number of sizes to ensure proper fit of the intended military population.
3.3.10 Operational Environment

3.3.10.1 The garment shall be capable of performing Mission Essential Functions (MEFs) when exposed to normal battlefield environmental conditions and hazards such as, but not limited to shock, corrosion, vibration, electromagnetic interference (EMI), dust, and smoke.

3.3.10.2 The garment shall withstand environmental conditions associated with worldwide use and maintain operational capability. Conditions include: temperature shock, solar radiation, fungus, blowing sand and dust, vibration, salt fog, explosive decompression, transit drop, and blowing rain.

3.3.10.3 The garment shall be able to be utilized on land, at sea, maritime, littoral, in any climate, with minimal impact on combat effectiveness.

3.3.10.4 The garment shall be capable of operation under climatic conditions Basic and Hot, -32 degrees Celsius to 49 degrees Celsius {-32 degrees Celsius to 65 degrees Celsius}.

3.3.10.5 The garment shall be capable of operation in 5% to 100% relative humidity.

4. VERIFICATION

4.1 Classification Of Inspection. The inspection requirements specified herein are classified as follows:

   a. Performance Qualification Testing (PQT) (See 4.2)
   b. First Article Inspection (See 4.3)
   c. Conformance Inspection (See 4.4)

4.2 Performance Qualification Testing (PQT). The Government will complete PQT to qualify the materials, components and garment designs for UIPE I1. The PQT will consist of inspections, tests, prediction modeling and analysis to verify that the garment sufficiently meets the requirements specified in Section 3 and is ready to transition into low rate initial production. Failure to meet any requirement in Section 3 that is identified with an asterisk will be cause for determining that the garment is not qualified for production. Failure to meet any other requirement in Section 3, except those requirements identified within brackets { }, may result in the Government determining that the garment is not qualified for production. Independent operational testing will be completed on the garment to determine acceptability for full rate production. Table III lists the requirements and verification references for each performance characteristic to be evaluated in PQT. The verification details are subject to change and the Government reserves the right to conduct any additional tests or evaluations it deems necessary to fully assess acceptability of the garment.
### Table II: Verification Matrix

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Section 3 Requirement</th>
<th>Section 4 Verification</th>
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<td>Thermal Burden/Heat Stress Management</td>
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<td></td>
<td>3.3.8.2</td>
<td>4.2.1.2.3 and 4.2.1.7.2</td>
</tr>
<tr>
<td></td>
<td>3.3.8.3</td>
<td>4.2.1.4.1 and 4.2.1.7.3</td>
</tr>
<tr>
<td></td>
<td>3.3.9.1</td>
<td>4.2.1.8.1</td>
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<tr>
<td></td>
<td>3.3.9.2</td>
<td>4.2.1.8.2</td>
</tr>
<tr>
<td></td>
<td>3.3.9.3</td>
<td>4.2.1.8.3</td>
</tr>
<tr>
<td></td>
<td>3.3.9.4</td>
<td>4.2.1.8.4</td>
</tr>
<tr>
<td></td>
<td>3.3.9.5</td>
<td>4.2.1.4.2 and 4.2.1.8.1</td>
</tr>
<tr>
<td>ILS</td>
<td>3.3.10.1</td>
<td>4.2.1.9.2</td>
</tr>
<tr>
<td>Operational Environment</td>
<td>3.3.10.2</td>
<td>4.2.1.9.2</td>
</tr>
</tbody>
</table>
### Performance Characteristic

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Section 3 Requirement</th>
<th>Section 4 Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.3.10.3</td>
<td>4.2.1.9.3 and 4.2.1.9.4</td>
</tr>
<tr>
<td></td>
<td>3.3.10.4</td>
<td>4.2.1.9.1 and 4.2.1.9.3</td>
</tr>
<tr>
<td></td>
<td>3.3.10.5</td>
<td>4.2.1.9.4</td>
</tr>
</tbody>
</table>

#### 4.2.1 Verification Procedures

#### 4.2.1.1 Thermal Burden/Heat Stress Management

**Thermal Manikin.** Thermal Manikin testing will be conducted in accordance with ASTM F1291 and ASTM F 2370. Evaporative resistance of the garment in several configurations [i.e. MOPP IV, MOPP II, with and without full combat load, to include ventilation design details incorporated to increase heat stress management while in MOPP I-II] will be measured. Testing will be conducted for 3 wind speeds (e.g., 0.4 m/s, 1.4 m/s and 2.2 m/s).

**Modeling & Simulation (M&S).** Data from the Thermal Manikin testing will be used as inputs to military thermoregulatory predictive models to determine the safe work duration afforded by each garment type and the risk of heat stress casualties. Analysis will include a broad range of hot/humid and hot/dry environments and work rates based on the operational scenarios identified in 3.1.1.1 {and 3.1.1.2}. Results will be compared to results for currently fielded CB protective garments, i.e. JSLIST and AP/PPE {and the currently fielded combat uniform, i.e. non-FR ACU}.

**Physiological Testing.** Testing will be conducted in accordance with U.S. Army Research Institute of Environmental Medicine (USARIEM) Technical Note TN08-01. A side-by-side comparison of currently fielded CB garments and the UIPE I\(^1\) garment will be conducted using human test subjects both in a temperature and humidity controlled chamber and during Field Exercises while subjects are performing operationally relevant tasks.

#### 4.2.1.2 Chemical Agent Resistance

**Swatch Testing.** Permeation testing of the UIPE I\(^1\) will be conducted in accordance with the U.S. Army Developmental Test Command (DTC) Test Operations Procedure (TOP) 8-2-501. Evaluations may also utilize emerging permeation test methods such as the Chemical Biological Agent Resistance Test (CBART) and quantitative liquid/liquid VX swatch test. An agent challenge level of 5 \{10\} g/m\(^2\) will be used.

**Unworn.** Unworn UIPE I\(^1\) material will be challenged with HD, TGD, and VX for 12 \{24\} hours. Results will be compared to current JSLIST Target Performance Values (TPVs) HD: 671.24 CT, GD: 357.29 CT as minimum performance criteria.
Current TPV's (HD: 671.24 CT, GD: 357.29 CT) will further be adjusted to account for potential differences relating to dual flow and convective flow test methods. Breakthrough values (in CT) will also be compared to side-by-side testing of JSLIST utilizing dual-flow testing to provide an Objective performance value (OPV). Materials will be ranked against each other based on their permeation amounts and variability; lower permeation and variability may result in better rankings. Post Milestone B testing will help to inform and support the development of new dual flow TPVs for enhanced future assessment of materials in terms of expected lower permeation.

4.2.1.2.1.2 Contaminated. Unworn materials will be exposed to battlefield contaminants including but not limited to Petroleum, Oils, and Lubricants (POLs), salt water, sweat, urine, and standard decontaminants. After contaminant exposure, materials will be challenged with HD and/or TGD for 9.6 {19.2} hours. Results will be compared to JSLIST Target Performance Values (TPVs). HD: 671.24 CT, GD: 357.29 CT as minimum performance criteria. Breakthrough values (in CT) for side-by-side testing of JSLIST (dual-flow) will provide an objective performance criteria for UIPE I1 candidate materials. Materials will be ranked as they were in unworn testing, against each other based on their permeation amounts and variability; lower permeation and variability may result in better rankings. Additional testing may occur to assess the effectiveness of oliophobic coatings.

4.2.1.2.1.3 Worn. Swatches will be taken from UIPE I1 garments after 48 {96} hours of uncontaminated wear in an operationally relevant environment (see 4.2.1.2.3). Material will be challenged with HD, TGD, and VX for 12 {24} hours. Performance criteria will be based on ranking of results compared to performance values and side-by-side testing of JSLIST.

4.2.1.2.2 Vapor and Aerosol System Testing. Vapor and Aerosol ensemble System Testing will be conducted in accordance with DTC TOP 10-2-022. Unworn and worn UIPE I1 garments will be compared side-by-side to unworn and worn JSLIST.

4.2.1.2.3 Wear Time. UIPE I1 wear time will be tested in accordance with DTC TOP 10-2-021. The test will be conducted in conjunction with the field durability test (see 4.2.1.4.1). Assigned military personnel will wear the UIPE I1 for a period of 48-96 hours of cumulative wear. At the end of the test, worn garments will be subjected to chemical agent resistance testing (see 4.2.1.2.1.3 and 4.2.1.2.2). Since the geographic location and mission of personnel assigned to the test will influence test results, the current PPE will always be included in the test as a control item. Garment and closure failures (tears, rips, etc.) during the test will be identified and scored based upon the UIPE I1 Failure Definition and Scoring Criteria (FDSC). This data will be used for Availability and Reliability calculations (see 4.2.1.7.1 and 4.2.1.7.2).

4.2.1.3 Integration
4.2.1.3.1 **User Acceptability.** A laboratory Human Factors Evaluation (HFE) will be conducted as well as Field Durability Testing (FDT) (see 4.2.1.4.1). During the HFE and FDT, subjects will don the garment with protective handwear, footwear, and masks. Observations will be noted on the ability of the garment to maintain protective orientation during operationally realistic movements. In addition, a user questionnaire will document user subjective responses to the garment. The garment design will also be evaluated to ensure features are in place to allow for ventilation when not in a contaminated environment.

4.2.1.4 **Human Factors**

4.2.1.4.1 **Field Durability Testing (FDT).** The garment will be evaluated to ensure no interference with routine and emergency mission duties. The test participants will perform operationally relevant activities while wearing the UIPE I submissions during the 48 and 96 hour field wear test with additional excursions as required. Subjective questionnaire data will be gathered as well as test director observations on the ability of the test participants to perform their duties without interference from the garment. Human Factors Evaluation will also assess overall user acceptability (to include interface with ensemble components and ease of field expedient repair), garment size/fit, comfort, donning/doffing, ability to achieve protective interface, safety and health, and military gear compatibility. The garment design will also be evaluated to ensure features are in place to allow for ventilation when not in a contaminated environment.

4.2.1.4.2 **Size & Fit.** Garments will be donned to determine whether an acceptable fit is achieved and properly maintained throughout accomplishment of mission duties.

4.2.1.4.3 **Detectability.**

4.2.1.4.3.1 **Visual Signature.**

4.2.1.4.3.1.1 **Visual shade and pattern matching.** The color and appearance of the cloth shall match the standard sample when viewed using the AATCC Evaluation Procedure 9, Option A or C, with sources simulating artificial daylight D75 illuminant with a color temperature of 7500 (± 200)°K illumination of 100 (± 20) foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2856 (± 200)°K. The camouflage pattern of the universal camouflage fabric shall be visually assessed to match the drawings for design, color placement, and registration (see 2.2.2). The camouflage pattern of the OCP fabric shall be visually assessed to match the standard sample for design, color placement and registration (see 6.8).

4.2.1.4.3.1.2 **Spectral reflectance.** Spectral reflectance data for each color in the camouflage pattern shall be obtained from 600 to 860 nanometers (nm) at 20 nm intervals on a spectrophotometer relative to the barium sulfate standard, the preferred white standard. Other white reference materials may be used provided they are calibrated to absolute white, e.g. magnesium oxide or vitrolite tiles. The spectral
band width shall be less than 26 nm at 860 nm. Reflectance measurements shall be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode of operation is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a continuous source that simulates either CIE Source A or CIE Source D65. Measurements shall be taken on a minimum of two (2) different areas and the data averaged. The measured areas should be at least 6 inches away from the selvage. The cloth shall be measured as a single layer backed with four layers of the same shade. The specimen shall be viewed at an angle no greater than 10° from normal, with the specular component included. Measurements shall be taken on a minimum of two different areas. Specimens shall be oriented in different directions during testing. When possible, the specimens tested shall not contain the same warp or filling yarns when presented to the sample port. Photometric accuracy of the spectrophotometer shall be within 1 percent and wavelength accuracy within 2 nm. The diameter for standard aperture size used in the color measurement device shall be 0.3725 inches or larger. Any color having spectral reflectance values falling outside the limits at four or more of the wavelengths specified shall be considered a test failure.

4.2.1.4.3.1.3 Colorfastness. The UIPE I1 garment material will be tested for colorfastness to crocking in accordance with AATCC Method 8, will be tested for colorfastness to perspiration in accordance with AATCC Method 15, will be tested for colorfastness to light in accordance with AATCC Method 16. When testing for colorfastness properties, each color shall be evaluated, whenever possible, separately and reported as such. In cases where the print pattern does not allow for the evaluation of each color separately, the test results should indicate which colors were evaluated together.

4.2.1.4.3.1.4 Visual Imagery. The signature will be assessed by capturing imagery of the garment side by with the JSLIST for Universal Camouflage and the ACU for OCP, in a controlled laboratory camouflage setting in woodland and desert backgrounds.

4.2.1.4.3.2 Aural Signature. The UIPE I1 will be tested in a quiet room and anechoic chamber to determine the noise characteristic / levels as compared to JSLIST and the non-FR ACU.

4.2.1.4.3.3 Olfactory Signature. TBD

4.2.1.5 Safety

4.2.1.5.1 Contaminated Doffing. The systems will allow safe doffing of a contaminated ensemble. A demonstration will occur with Service-specific procedures for assisted doffing of a contaminated ensemble using fluorescent powder as a visible representative of chemical agent.
4.2.1.5.2 **Skin Toxicity.** Material Safety Data Sheets (MSDS) for all chemicals used in the manufacture and/or production of the UIPE I^1^ materials will be reviewed for potential hazards associated with prolonged skin contact when worn as intended.

4.2.1.5.3 **Hazard and Safety Assessment.** The Health Hazard Analysis Report (HHAR) and Safety Assessment Report (SAR) for the garment will be analyzed for potential hazards and safety issues including adverse environmental impacts associated with production, use, and disposal.

4.2.1.6 **Flame Resistance.** The UIPE I^1^ garment material will be tested for flame resistance in accordance with ASTM F-1358. Results will be compared to side-by-side test results for the currently fielded combat uniform (non-FR ACU) material. If the burning distance is equal to the non-FR ACU, then the after flame must be equal to or greater than the non-FR ACU. If the burning distance is less than the non-FR ACU, then the after flame must be less than or equal to the non-FR ACU. If the threshold requirement is met, the UIPE I^1^ garment material will be tested in accordance with ASTM D-6413. If the material after flame time is two seconds or less, the char length is 5 inches or less, and does not melt or drip, the garment will be system tested in accordance with ASTM F-1930 to determine if it meets the objective requirement.

4.2.1.7 **Reliability, Availability, Maintainability**

4.2.1.7.1 **Material Availability.** Test assets will be inspected prior to each test to determine whether they are ready for use based on material condition upon inspection. Material availability will be further developed before contract award.

4.2.1.7.2 **Material Reliability.** Failure data will be collected throughout testing. To meet the requirement of 3.3.8.2, the test assets must complete 90% of the 12 {24} hour missions without a non-repairable essential function failure defined in the Failure Definition and Scoring Criteria (FDSC).

4.2.1.7.3 **Repair Effectiveness.** Liquid/vapor swatch testing (see 4.2.1.2.1) will be conducted on field expedient repaired swatches with HD for 12 hours. Results will be compared to the unworn UIPE I^1^ results of 4.2.1.2.1.1. The repaired garment material must perform equal to or better than unrepaired material.

4.2.1.8 **Integrated Logistics Support**

4.2.1.8.1 **Logistics Demonstration.** The system will be demonstrated to determine whether the maintenance, use care instructions, field repair capability, operational storage, and safety is acceptable, and that the system support package is supportable.

4.2.1.8.2 **Service Life.** Garments will be removed from packaging and held at an appropriate storage facility for a period of 7 months. Liquid/vapor swatch testing (see 4.2.1.2.1) will be conducted on material samples from the garments with HD
for 12 hours. Results will be compared to the unworn UIPE I¹ results of 4.2.1.2.1.1.

4.2.1.8.3 **Shelf Life.** TBD

4.2.1.8.4 **Storage Temperature.** (will be further developed before contract award) Packaged garments will be exposed to 3 conditions of storage temperatures (high temperature/dry, high temperature/high humidity, and cold temperature) as defined in MIL-STD-810G. The garment test population will be divided among the three conditions; each garment will be subjected to one of the three conditions. The test duration will be XX days. Garments will then be removed from the packaging and inspected for physical damage. Liquid/vapor swatch testing (see 4.2.1.2.1) will then be conducted on material samples from the garments with HD for 12 hours. Results will be compared to the unworn UIPE I¹ results of 4.2.1.2.1.1.

4.2.1.9 **Operational Environment**

4.2.1.9.1 **Operating Temperature Chamber Testing.** (will be further developed before contract award) Unpackaged garments will be exposed to 3 conditions of operating temperatures (high temperature/dry, high temperature/high humidity, and cold temperature) as defined in MIL-STD-810G, “Environmental Engineering Considerations and Laboratory tests”. The garment test population will be divided among the three conditions; each garment will be subjected to one of the three conditions. The test duration will be XX days. During storage, garments will be removed from the bag and the material flexed to simulate donning and doffing twice daily. Liquid/vapor swatch testing (see 4.2.1.2.1) will then be conducted on material samples from the garments with HD for 12 hours. Results will be compared to the unworn UIPE I¹ results of 4.2.1.2.1.1.

4.2.1.9.2 **Environmental Testing.** Systems will be tested in accordance with MIL-STD-810G, to address shock, corrosion, vibration, dust, smoke, high/low operational and storage temperatures, temperature shock, solar radiation, humidity, fungus, blowing sand, salt fog, and blowing rain.

4.2.1.9.3 **Operational Temperature.** A record of temperature will be kept for each test site. In addition, modeling and simulation of both physiological and thermal manikin data will supplement data provided from field trials and human factors evaluations. All data will be compiled and any operational abnormalities will be noted.

4.2.1.9.4 **Operational Humidity.** The UIPE I¹ must be capable of operation in 5-100% relative humidity. A record of humidity will be kept for each test site. In addition, modeling and simulation of both physiological and thermal manikin data will supplement data provided from field trials and human factors evaluations. All data will be compiled and any operational abnormalities will be noted.
4.2.1.10 **Packaged Weight and Volume.** Packaged weight and volume of the UIPE I\(^1\) submissions will be measured. Each UIPE I\(^1\) garment will be weighed while in production representative packaging on a calibrated scale. For packaged volume, each UIPE I\(^1\) garment (in production representative packaging) will be immersed in a container of water. The amount of water displaced will be measured to the nearest cubic centimeter.

4.3 **First Article Inspection.** The first article inspection will consist of examinations and tests performed to determine that the production item conforms to the requirements of this specification and to the levels of performance demonstrated during the development phases. First Article inspection will be performed when specified in the contract, which will identify the details and quantities of the first article sample. Initial details of the first article inspection will be developed based on the selection of design and materials prior to contract award. Final details will be developed based on testing results and design evolution and will be included in the version of this specification provided with the low-rate initial production delivery order.

4.4 **Conformance Inspection.** The conformance inspection will verify the conformance of individual production lots during production and will consist of:

a. Component examinations and tests
b. Material acceptance tests (MAT)
c. In-process examinations and tests (INPET)
d. Production lot acceptance examinations and tests (PLT)

Initial details of the conformance inspection will be developed based on the selection of design and materials prior to contract award. Final details will be developed based on testing results and design evolution and will be included in the version of this specification provided with the low-rate initial production delivery order.

5. **PACKAGING**

5.1 **Packaging.** For acquisition purposes, the packaging requirements will be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point’s packaging activities within the Military Service or Defense Agency, or within the military service’s system commands. Packaging data retrieval is available from the managing Military Department’s or Defense Agency’s automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.
6. **NOTES**
   (This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1. **Intended Use.** The garment is intended for use by combat personnel to provide protection against chemical and biological warfare agents when worn as part of a chemical protective ensemble.

6.2. **Acquisition Requirements.** Acquisition documents must specify the following:

   a. Title, number, and date of this specification
   b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3)
   c. When a first article is required (see 3.2 and 4.3)
   d. Conformance Inspection Acceptance Criteria (see 4.4)
   e. Packaging Requirements (see 5.1)

6.3. **First Article.** When a first article is required, it should be inspected and approved in accordance with the appropriate provisions of this specification and the purchase document. The first article should be a production sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article. (See 3.2 and 4.3)

6.4. **Protection of In-process and Processed Goods.** Processed goods should be protected from exposure to chemical vapors.

6.5. **Subject (key word) Listing:**

   Chemical and Biological Warfare Agent
   Combat
   Suit
   Life Support Clothing & Equipment (LSC&E)
   Protection

6.6. **Equal Item.** Prior to the use of an “or equal” item, the suppliers are required to submit the item with supporting data to the contracting office for subsequent approval or disapproval by the responsible military agency.

6.7. **Surveillance Program.** Items to be set aside for surveillance should be shipped separately to the address(es) below:

   Joint Service-Set Aside Program (JSSAP)
   Traffic Management Officer
   MF M93160 WHSE 2234, MCLB
6.8 Standard sample for Operation Enduring Freedom Camouflage Pattern (OCP). For access to the standard sample, contact contracting officer (see 3.3.6.4.2).