DTAPS® Level C2 Coverall System with FR-3 PAPR

A fully integrated and CW agent tested Level C protective system
Excellent for use by medical personnel.

SYSTEM P/N 85-000

The fully integrated DTAPS® Level C2 coverall system includes the following:

- **Level C2 coverall suit**
  (P/N 10-500)

- **Complete DTAPS® NIOSH-approved FR-3 PAPR breathing system, including powered air hood**
  (P/N 26-200)

- **Protective boots**
  (P/N 40-300)

DESCRIPTION

The Level C2 coverall system was specifically designed under a Government contract for use in Domestic Preparedness, WMD, and CBRN environments. The system provides protection against chemical and biological warfare agents, as well as industrial chemicals. The system design also resists liquid splash. The Level C2 coverall is constructed of DuPont’s Tychem® SL fabric, which offers the light-weight protection of Tyvek® laminated to Saranex® 23-P chemical barrier film. It features a neck dam to minimize vapor intrusion into the coverall and a coil zipper with double splash flaps. The coverall also has integral booties and attached 16 mil butyl gloves.

- **Yielded a high overall protection factor when evaluated with the U.S. Army man-in-simulant test (MIST).**

- **Tychem® SL material provides over 3 hours of protection against the chemical warfare agents GB, HD, L, and VX**

- **Tychem® SL material is protective against most of the 21 ASTM F 1001 chemicals plus over 200 additional chemicals**

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Information Brief

Disposable Toxicological Agent Protective Suit (DTAPS®) System - Level C₂

General Information

Requirement Statement: Personal protective equipment for medical response, remediation, and clean-up personnel that will protect against chemical and biological threats. Such personnel need a low cost, limited-use ensemble that provides percutaneous (skin) and respiratory protection. These personnel also need an ensemble that can be donned quickly and easily while maintaining their capability to function in an emergency situation.

Technical Description: The Level C₂ DTAPS® system is designed for short-duration missions where liquid splash or direct contact with hazardous chemicals is unlikely. The suit provides protection against dual-use industrial chemicals, chemical warfare agents, and biological warfare agents. The fabric used in the DTAPS® Level C₂ suit is DuPont’s Tychem® SL. Tychem® SL material offers the lightweight protection of Tyvek® laminated with a chemical-resistant Saranex® film. This combination delivers effective protection against a broad range of chemicals and makes a lightweight, comfortable garment at an economical price. Extensive chemical testing has been conducted by DuPont and GEOMET to evaluate and document the performance of both the material and garment seams to ensure continued excellent chemical protection.

Recommended Use(s): Military, Federal, state, and local responders to chemical and biological terrorism incidents in non-IDLH situations. The Level C₂ system is targeted for use in short-duration missions (4 hours or less) in situations that meet the criteria for using an air-purifying respirator. This system can be used for emergency medical response and for other emergency services where liquid splash or direct contact with hazardous chemicals is unlikely. Although designed primarily for hospital use by doctors and nurses, the ensemble is ideal for remediation, environmental clean-up operations, cleanroom applications, hazardous materials response teams, and in radioactive environments.
Protection Statements

**CW Protection:** Suit material tested against GB, HD, L, and VX. Test results are reproduced in the following table.

<table>
<thead>
<tr>
<th>Chemical Warfare Agent</th>
<th>Permeation Data for Tychem® SL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent (common name)</td>
<td>Protocol*</td>
</tr>
<tr>
<td>GB (Sarin)</td>
<td>C</td>
</tr>
<tr>
<td>HD (sulfur mustard)</td>
<td>A</td>
</tr>
<tr>
<td>L (Lewisite)</td>
<td>A</td>
</tr>
<tr>
<td>VX (V-agent)</td>
<td>C</td>
</tr>
</tbody>
</table>

All tests conducted in triplicate for DuPont Nonwovens by an independent accredited laboratory at 22°C, 50% R.H.

* Fabric test protocols:
  A - MIL-STD-282, Method T-209 for HD (or modified for L) at 10 g/m² in 10 µL drops.
  C - MIL-STD-282, Method T-208 for GB (or modified for VX) at 10 g/m² in 10 µL drops.

**BW Protection:** Suit material provides excellent resistance against blood, body fluids, and viral contaminants and is protective against bacteria, protozoans, rickettsia, toxins, and viruses. The material passes ASTM F 1670 for synthetic blood penetration and also passes biopenetration resistance when tested in accordance with ASTM F1671, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a Test System*.

**TIMS Protection:** Suit material is protective against most of the 21 chemicals listed in ASTM F 1001 (except for carbon disulfide, dichloromethane, ethylene oxide, tetrachloroethylene, tetrahydrofuran, and toluene). Tychem® SL is also protective against numerous other toxic industrial materials (TIMs). Permeation data is available for more than 250 chemicals. For specific chemicals, refer to DuPont’s Permeation Guide for Tychem Fabrics and the DuPont Fax-on-Demand Data Service (800-558-9329).

**Duration of Protection:** Duration of protection ranges from 12 minutes to over 8 hours for ASTM F 1001 chemicals, depending on specific chemical (test results for the 21 chemicals in ASTM F 1001 are reproduced in the table below).
## Tychem® SL Permeation Data for ASTM F 1001 Recommended List of Chemicals for Evaluating Protective Clothing Materials

<table>
<thead>
<tr>
<th>Chemical Name (Physical Phase)</th>
<th>Average Normalized Breakthrough Time (minutes)</th>
<th>Average Permeation Rate (µg/cm²/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone (liquid)</td>
<td>24</td>
<td>1.6</td>
</tr>
<tr>
<td>Acetonitrile (liquid)</td>
<td>12</td>
<td>2.8</td>
</tr>
<tr>
<td>Ammonia (gas)</td>
<td>32</td>
<td>0.15</td>
</tr>
<tr>
<td>1,2-Butadiene (gas)</td>
<td>&gt; 480</td>
<td>&lt; 0.02</td>
</tr>
<tr>
<td>Carbon disulfide (liquid)</td>
<td>immediate (&lt; 10 min)</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>Chlorine (gas)</td>
<td>&gt; 480</td>
<td>0.1</td>
</tr>
<tr>
<td>Dichloromethane (liquid)</td>
<td>immediate</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>Diethylamine (liquid)</td>
<td>12</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>N,N-Dimethylformamide (liquid)</td>
<td>112</td>
<td>0.85</td>
</tr>
<tr>
<td>Ethyl acetate (liquid)</td>
<td>14</td>
<td>0.54</td>
</tr>
<tr>
<td>Ethylene oxide (gas)</td>
<td>immediate</td>
<td>8.4</td>
</tr>
<tr>
<td>n-Hexane (liquid)</td>
<td>146</td>
<td>0.48</td>
</tr>
<tr>
<td>Hydrogen chloride (gas)</td>
<td>&gt; 480</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Methanol (liquid)</td>
<td>&gt; 480</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Methyl chloride (gas)</td>
<td>&gt; 480</td>
<td>&lt; 0.006</td>
</tr>
<tr>
<td>Nitrobenzene (liquid)</td>
<td>102</td>
<td>2.3</td>
</tr>
<tr>
<td>Sodium hydroxide, 50% (liquid)</td>
<td>&gt; 480</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Sulfuric acid, 98% (liquid)</td>
<td>&gt; 480</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Tetrachloroethylene (liquid)</td>
<td>immediate</td>
<td>5.7</td>
</tr>
<tr>
<td>Tetrahydrofuran (liquid)</td>
<td>immediate</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>Toluene (liquid)</td>
<td>immediate</td>
<td>25</td>
</tr>
</tbody>
</table>

Numbers reported are averages of samples tested by the ASTM F 739 test method.
Operational Parameters

Operational Limitations: Minimal. In hot environments, operations can be extended with the optional cooling system to manage heat stress.

Environmental Conditions: The equipment is designed to operate under all common environmental conditions and climates. Tychem® SL material is rugged and durable – even in cold temperatures. The material offers little change in stiffness when exposed to extreme cold temperatures [68°F (20°C) down to -85°F (-65°C)], as measured per ASTM D 747.

Ease of Use: The Level C2 ensemble features fully integrated subsystems. Suit presents minimal restrictions on mobility and flexibility.

Training Requirements: 2 hours for operation.

Training Available: Yes.

Manuals Available: Yes, commercial operating/instruction manual.

Don/Doff Information: “Buddy” required for donning. The system can be doffed by the user.

Use/Reuse: This garment is designed for one operational use. The manufacturer has not conducted any suit integrity testing beyond a single operational wear. Level C2 suit must be disposed of after any liquid or vapor chemical exposure.

Launderability: Level C2 suit should be discarded after use.

Removal from Operational Service: This suit should be removed from operational service after one use.

Decontamination/Disposal: If the suit is contaminated by any liquid or vapor chemical exposure, it should be treated as hazardous waste. The recommended disposal method is to immerse the suit in household bleach (5% solution) for 24 hours. After 24 hours, the suit should then be landfilled, but can be incinerated in accordance with all applicable Federal, state, and local laws and regulations.

Logistical Parameters

Weight: Suit is approximately 1 lb 9 oz for size small up to 1 lb 15 oz for size 3X. 6 cfm PAPR blower with three filter canisters, batteries, hose, and powered air hood weighs approximately 5 lbs 11 oz.

Package Size and Volume: 15” x 10.25” x 10.5” (1ft³). PAPR blower with three filter canisters, batteries, hose, and powered air hood is approximately 14” H 10” H 11.5” (0.93 ft³).

Power Requirements: 6 cfm PAPR blower requires six size D alkaline batteries. Optional cooling system requires three size D alkaline batteries, which will last up to 4 hours.

Consumables: PAPR blower requires three filter canisters and six size D alkaline batteries. If using optional cooling system, three size D alkaline batteries and ice are consumable items.
Maintenance Requirements: None.

Maintenance Cost: None.

Shelf Life: 5 years. Suit must be stored under proper conditions [i.e. stored in a cool (20-25 degrees C), dark, dry place free from insects and away from direct sunlight (ultraviolet light)], and handled properly. Mishandling includes, but is not limited to, damage from compressing the suit under heavy objects and exposing the suit to sharp edges or projections.

Physical Parameters

Material Type: 13 mil Tychem® SL, which utilizes Saranex® 23-P coextruded barrier film laminated to Tyvek® (spunbonded olefin).

Construction Type: Suit seams are serged with texturized polyethylene thread, then sealed with Dow Saranex® seam seal tape.

Color: White.

Physical Properties of Tychem® SL:
Basis weight (ASTM D 3776) = 3.5 oz/yd²
Thickness (ASTM D 1777) = 13 mils
Mullen burst (ASTM D 3786) = 73 psi
Breaking strength grab (ASTM D 5034) = 47 lbs (md), 50 lbs (cd)
Trapezoidal tear (ASTM D 1117) = 9 lbs (md), 8 lbs (cd)

Suit Features: The Level C² suit features coil zipper with double storm flaps, integral booties, a neck dam, and 16 mil butyl gloves. Complete ensemble includes 6 cfm blower and powered-air hood with breathing hose.

Applicable Standards and Test/Evaluation Results for DTAPS System:

- Tested with U.S. Army TOP 10–2–022 methyl salicylate (MeS) man-in-simulant test (MIST), yielding an average overall protection factor of 630 (i.e., the suit protects against chemical agent simulant on average 630 times better than with no suit).

Source Information

Current Users: United States Air Force Medical Groups, United States Marine Corps (MARCORSYSCOM), United States Capitol Police, United States Customs, New Castle County, DE.

Sizes Available: SM, MD, LG, XL, 2X, and 3X.

Warranty: 90 days from date of invoice for defects in materials and workmanship. This warranty does not apply to damage or injury resulting from accident, misuse, neglect, or from alteration of any accessories or support equipment. It is the user’s responsibility to use reasonable care in maintaining, operating, and storing DTAPS®. See commercial operating/instruction manual for complete warranty information.
The Disposable Toxicological Agent Protective Suit (DTAPS®) systems were developed for the Government by GEOMET Technologies, Inc. under a contract with the Technical Support Working Group (TSWG). TSWG was established as the technology development component of a Federal interagency group on countering terrorism. TSWG is composed of various Executive Branch agencies, including the Department of Defense, the Department of State, and the Department of Justice.

The Department of Defense is responsible for TSWG program management. DoD manages and executes the TSWG program through the Combating Terrorism Technology Support Office. The DTAPS® systems were developed under the chemical, biological, radiological, and nuclear countermeasures subgroup of TSWG under contract number DAAD05-98-C-0012.
# Features and Benefits of the DTAPS® Level C2 Coverall Ensemble

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Benefit</th>
</tr>
</thead>
</table>
| Fully integrated and complete system | Complete system includes suit, gloves, boots & respiratory system; all individual components were configured & tested together as a unified system                                                                 | ' Satisfies operational need for safe, reliable & totally integrated system  
' Allows total package procurement  
' Ideal for use by medical personnel                                      |
| Extensive suit material testing   | Suit material tested against CW agents GB, HD, L & VX, the 21 ASTM F 1001 chemicals, plus over 250 additional chemicals                                                                                          | ' Suit material has proven chemical resistance                          |
| Tested as an integrated system    | Complete system yielded a high overall protection factor when evaluated with the U.S. Army man-in-simulant test (MIST) per TOP 10-2-022                                                                             | ' Verifies the safety & reliability of protective ensemble               |
| Coverall design                 | Tychem® SL coverall with separate powered air hood; Tychem® SL material offers the lightweight protection of Tyvek laminated with a chemical-resistant Saranex film | ' Delivers effective protection against a broad range of chemicals  
' Garment is white for high visibility  
' Provides a lightweight, comfortable & quiet garment  
' Material is rugged & durable  
' Economical price                                                                 |
| Powered air hood                | Powered air hood constructed of Tychem® SL with adjustable internal suspension system                                                                                                                     | ' Provides over-pressure for greater protection factor than APRs  
' One size fits all  
' No fit testing required  
' Accommodates conditions that would prevent a good face seal on a tight-fitting APR (e.g., facial hair, glasses)  
' Allows clearer voice communications than tight-fitting APRs  
' Less claustrophobic than tight-fitting APRs  
' Protects from liquid splash  
' Provides good peripheral vision                                                                 |
## Features and Benefits of the DTAPS® Level C₂ Coverall Ensemble (continued)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Benefit</th>
</tr>
</thead>
</table>
| Respiratory protective system    | NIOSH-approved 6 cfm FR-3 PAPR (includes powered air hood, breathing hose, blower, three multi-spectrum HEPA canisters & belt; blower can be powered by alkaline batteries or by optional lithium batteries) | PAPR provides higher protection factor than APRs  
Easier to breathe than APRs  
NIOSH approval verifies safety of PAPR  
Appropriate for use in CBRN environments  
D size alkaline cells are readily available  
Lithium batteries offer 15 year storage life  
Canisters are NIOSH approved for use against organic vapors, Cl₂, HCl, SO₂, NH₃, methylamine, formaldehyde, particulates (aerosols, dusts, fumes, mists, fogs, smokes), radionuclides & radon daughters  
Canisters also effective against CW/terrorist agents GB, GD, CK, CS, CN, HCN, phosgene & chloropicrin |
| Neck dam                        | Coverall incorporates a close-fitting adjustable neck dam                    | Resists vapor intrusion from the “bellows effect”                                                                                      |
| Suit closure                     | Closure assembly has 2-ply double splash flaps                               | Assembly resists liquid penetration  
2-ply splash flap design will not wick liquids  
No taping needed                                                                                     |
| Glove system                     | 16 mil butyl gloves are mechanically attached to coverall                    | Butyl gloves are resistant to chemical warfare agents  
Glove attachment assembly is vapor & liquid tight  
Gloves are easily changed out  
No taping needed                                                                                      |
| Booties                          | Integral booties incorporated into coverall                                  | Provides vapor & liquid tight attachment to coverall  
No taping needed                                                                                      |
| Overshoes                        | Injection molded seamless PVC construction                                  | Provide liquid protection  
Exceptional durability  
Excellent cold weather flexibility  
Fit over work shoes                                                                                   |