

DECONTAMINATION



Chempak®

ULTRA BARRIER FABRIC



MULTI-THREAT

Residual Chemical Concentration Levels in Personal Protective Equipment (PPE) Materials After Chemical Exposure and Decontamination

A Comparison of GORE® CHEMPAK® Ultra Barrier Fabric to a traditional multi-layer PPE material

Summary

The data from this simulated decontamination study indicate that the GORE® CHEMPAK® Ultra Barrier Fabric can be effectively decontaminated to a level comparable to competitive multi-layer laminate film PPE material.

Background

This document describes the ability to decontaminate GORE® CHEMPAK® Ultra Barrier Fabric using a simulated HazMat incident wet decontamination method. The GORE® CHEMPAK® Ultra Barrier Fabric was exposed to various chemicals, treated to the simulated decontamination procedure, and tested for the presence of residual chemicals.

The efficacy of actual decontamination procedures and methods will vary depending on the incident and specific chemical to which the garment was exposed. It should be noted that any decision regarding decontamination and reuse of a garment that has been exposed to a hazardous chemical should be made by knowledgeable and informed personnel within the organization that are:

- aware of the type and extent of the chemical exposure
- aware of the toxicity and risks associated with chemical contaminant
- aware of the necessary methods to determine that the garment is safe to reuse
- able to consult with the garment manufacturer and other expertise as needed



Testing Protocol

A FEMA commissioned study (“Non-Destructive Testing and Field Evaluation of Chemical Protective Clothing”

EMW-89-C-3045, 1990)

examined the efficacy of a simple method to detect residual chemicals in PPE after exposure, wash, and aeration.

This procedure was used to evaluate the ability to decontaminate both GORE® CHEMPAK® Ultra Barrier Fabric and Tychem® TK multi-layer film laminate. Both are used as a barrier material for chemical personal protective equipment.

The approach used in the FEMA study is to expose the PPE material to a chemical, clean the material with light brushing using a commonly available detergent/water mixture, and allow the sample to air dry. A sample of the material is heated and off-gasses are collected and analyzed to determine the level of chemical residuals.

This method allows for evaluation of residual chemical at both “gross” and “matrix” contamination levels. Gross contamination is chemical on the material surface that is indicated by stains or discoloration, and is usually more easily removed. The level of gross contamination is determined visually after the material has been washed and dried. Matrix contamination is chemical that has been absorbed into the material, is not readily discernible by the naked eye, and is generally more difficult to remove. The level of matrix contamination is determined by quantitatively analyzing off-gassed residuals.



The specific steps of the exposure and cleaning procedure are:

- Saturate surface of specimen with chemical (see Table 1 for list of chemicals)
- After 30 minutes, rinse in cold water for 30 seconds
- Apply 1.2% Tide® Liquid and scrub with a soft brush for 30 seconds
- Rinse in cold water for 30 seconds
- Air dry in ventilated area for 16 hours, at ambient temperature

The desorption and detection procedures are as follows:

- Cut a test specimen from the contaminated sample
- Seal in an air tight vial
- Thermally desorb chemical residuals at 160°C for 30 minutes
- Collect and quantify off-gas residuals via gas chromatography

PPE Materials Tested

- a) GORE® CHEMPAK® Ultra Barrier Fabric, a three-layer laminate construction made of an impermeable high-strength fluoropolymer film between two flame- and melt-resistant textile layers.
- b) DuPont Tychem® TK, a three-layer film construction incorporating a nonwoven textile between two non-halogenated barrier films.

Table 1. Residual Chemical Levels after Decontamination

Chemical	Gross Contamination ¹ (Visual Observation)		Matrix Contamination ² (µg per 1" diameter specimen)	
	GORE® CHEMPAK® Ultra Barrier Fabric	DuPont Tychem® TK	GORE® CHEMPAK® Ultra Barrier Fabric	DuPont Tychem® TK
Carbon Disulfide	None	None	2.2	1.5
Hexane	None	None	0.2	0.1
Tetrachloroethylene	None	None	5.3	181.5
Toluene	None	None	3.0	21.0
Ethyl Acetate	None	None	0.3	9.8
Methanol	None	None	2.6	2.9
Acetone	None	None	0.6	6.9
Isooctane	None	None	< 0.09	0.2
Acrylonitrile	None	None	2.1	11.9
N,N-Dimethyl Formamide	None	None	13.4	48.3
Methylene Chloride	None	None	0.3	17.5
Diethyl Amine	None	None	0.1	0.3
¹ Chemical residuals on a material		² Chemical residuals held within a material		

Summary of Test Results

- The results indicate that the GORE® CHEMPAK® Ultra Barrier Fabric can be effectively decontaminated using typical wet decontamination methods. Every situation is unique and the user is advised that results may differ in actual use.
- Visual evaluation indicates no observable gross contamination on either PPE material after the wash/rinse/dry steps. No chemical stain or discoloration was visible on any of the specimens indicating that all gross contamination was removed upon washing.
- Analyses of the desorbed off-gasses indicate very low level matrix contamination of the

samples. Residual levels measured for the GORE® CHEMPAK® Ultra Barrier Fabric laminate were well below 20 micrograms per one inch diameter sample. The Tychem® TK samples also had residual levels below 20 micrograms per inch diameter sample, except for two chemicals which had residual levels of <50 and <200 µg per inch diameter sample. Residual chemical levels varied depending on the specific chemical to which the samples were exposed.

- The GORE® CHEMPAK® Ultra Barrier Fabric laminate can be cleaned to a level comparable to the Tychem® TK multi-layer laminate film PPE material.

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