



THE FUTURE OF CHEMICAL PROTECTIVE GARMENT SELECTION:

Using Technology to Determine Safe-Use Time

Managing work environments where significant risks for exposure to chemical and biological hazards are present is challenging. With frequent modifications to ISO and NFPA standards, along with complex research related to “safe-use” time, it can be difficult for industrial, emergency responder and law enforcement safety professionals to keep current with changes in industry best practices and make the best chemical protective clothing selection.

How do you ensure you have the right suit for the job? Or, given a specific suit, how long will it keep the wearer safe?

Knowing how long a particular garment can be used in a specific situation is vital. These are important considerations for safety professionals when selecting chemical protective clothing:

- Permeation, as relates to the dosage the wearer is exposed to.
- Environmental factors and temperature, as they impact permeation rates and dosage.
- Safe-use time, dosage compared to toxicity limits, for a specific chemical.
- Timing and toxicity risk analysis.
- The absence of specific chemical data.

What if we told you... your suit selection could include a cutting edge online tool that provides immediate access to critical information to better assess worker safety?

Understanding “Breakthrough” in Permeation Testing: How Long Am I Safe?

“Breakthrough” in Permeation test reports is often used to estimate a safe-use time, but according to the test standards, permeation testing is designed for fabric comparison only.

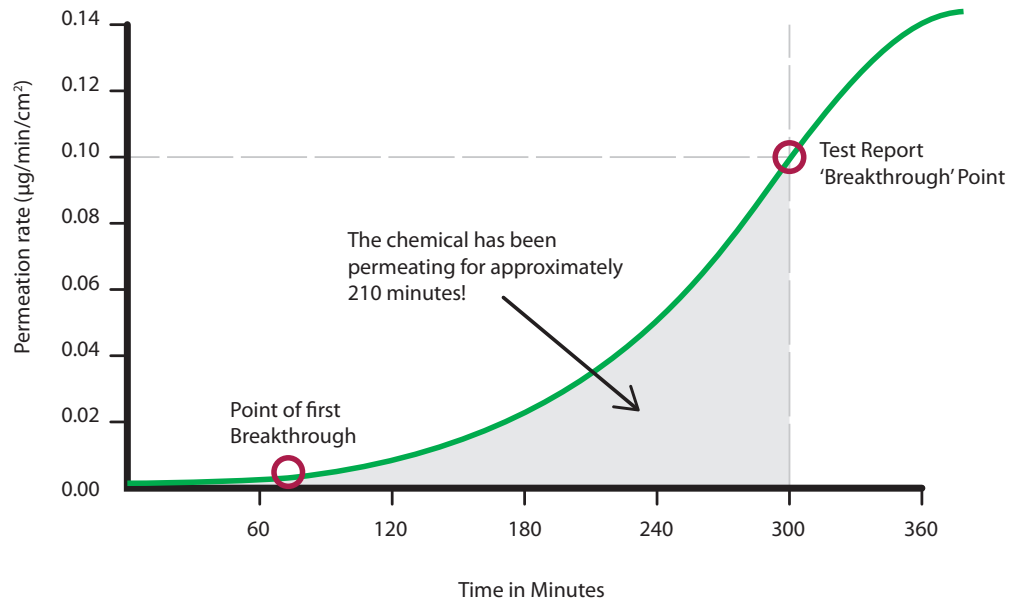
The use of permeation testing data can result in misleading conclusions about how long a worker is safe.

What does a permeation test tell you?

‘Breakthrough’ in a permeation test report is not recorded when the chemical first breaks through the fabric, but instead, when the permeation rate reaches 0.1ug/min/cm(2), and in the controlled environment of a lab with ambient temperature of 73° F.

What a permeation test does NOT tell you:

The first actual point of ‘breakthrough’ or exposure may occur well before the ‘breakthrough’ test report indicates, especially when environmental temperatures exceed 73° Fahrenheit.



Does a permeation test account for the following?

- “Real World” ambient or actual suit temperature? **NO**
- Faster permeation at higher temperatures due to increased molecular volatility? **NO**
- Toxicity level of the specific chemical? **NO**
- Amount permeated? **NO**

For Example:

If your worker is in an environment where the room temperature is 72° Fahrenheit and his body temperature is 98.6° Fahrenheit, the temperature of the suit fabric will quickly approach 90° F. Out in the sun in the summer, suit temperature can quickly soar well over 100° F. The permeation rate of many chemicals can increase exponentially with even a modest rise in the temperature of the suit fabric.



Differences in the toxicity levels of chemicals mean that similar doses can vary significantly in how harmful they are. Toxicity must be taken into account when determining safe use times.

Recent modifications to NFPA 1991 highlight a paradigm shift from using “normalized breakthrough times,” to compare fabrics, to cumulative permeate. Determining the amount of cumulative permeate moves us closer to determining the dosage the wearer is being exposed to and how that should best be accounted for.

Permeation and Temperature:

The concentration and temperature of a chemical plays a critical role in permeation rate.

Unless otherwise requested, all permeation testing is conducted at 73° F so that data is collected under constant conditions. This is important because the permeation test was designed and intended to be used for a relative comparison between different fabrics. This is clearly stated in the test method.

Important temperature considerations include:

- Higher environmental temperatures can result in accelerated breakthrough, while lower temperatures potentially can lead to a slower breakthrough for certain chemical and material combinations.
 - Some chemicals are in a solid state at 73° Fahrenheit, making permeation testing data and safe-use time recommendations inapplicable.
 - Work environment and body temperature, and their impact on garment temperature, are not considered when “Breakthrough” times are used as the sole indicator of safe use times.
- To properly evaluate safe-use time, it is essential that you take the temperature factors for your unique working environment into consideration.

How Do You Calculate A Safe-Use Time?

Safe-use time must account for: specific chemical permeation behavior, chemical state, amount of chemical available for exposure, temperature, permeation rate, toxicity and area of suit likely to be exposed.

1. Calculate Volume Permeated	Permeation Rate X	Duration of Exposure X	Area of Suit Exposed =	Volume Permeated
	As permeation rate per unit area varies over time an average can be calculated - or use the maximum rate for a wide safety margin	The time the suit may be exposed to the chemical - how long the task will take.	The total area of the suit that might be contaminated.	
2. Compare with Chemical Toxicity Limit	Is the volume permeated greater or less than the chemical toxicity limit?			
	Volume Permeated < Toxicity Limit = SAFE		Volume Permeated > Toxicity Limit = NOT SAFE	
3. Consider Environmental Factors	Chemical State	Room Temperature	Outside Temperature	Body Temperature
	Evaluate environmental temperature to determine the exact effects on suit temperature and how that impacts permeation for the chemical being used and calculate a more accurate safe-use time.			

Lakeland's Innovative Technology Helps You Manage Risk by Accurately Monitoring Safe-Use Time

Make the best chemical protective garment selection with the ability to assess toxicity risk and better protect the health of your workers — for more than 4000 chemicals!

Traditional “breakthrough” testing data shows, that in the majority of cases, the performance of Lakeland garments is as good or better than other brands’ offerings.

In fact, Lakeland’s ChemMAX Plus 3 & 4 and Interceptor Plus match or outperform the competition when it comes to:

- Cost
- Comfort
- Chemical Barrier
- Design features and options

But with Lakeland’s ChemMAX Plus 3 & 4 and Interceptor Plus, you get the added bonus of PermaSURE®.

PermaSURE® is a free, mobile-friendly online tool that models permeation rates and provides safe-use times by incorporating environmental, temperature and chemical exposure factors. It is a state-of-the-art technology developed initially by leading Polymer chemists for defense forces to quickly determine which suits are needed for various chemical warfare agents and dual use chemicals. It is based on the known molecular characteristics and behavior of 4000+ chemicals interacting with Lakeland’s specific chemical fabrics.

PermaSURE® provides users with both toxicity information and a guide as to how long one can be exposed to a chemical before harmful toxicity limits



are reached. It is also an effective tool to aid safety professionals in collecting and recording the necessary documentation when an incident occurs. It allows for desktop contingency planning for spills and clean ups under varying climatic conditions so that procedures can be written for specific conditions.

PermaSURE® Fills a Great Need for Companies That:

- Need to know which suit is optimal for the various chemicals they use.
- For hazmat teams who may not know what the chemical is before they arrive on the scene, and have to quickly determine what to wear.
- Reduces the uncertainty from variables that are not taken into account using breakthrough times or cumulative permeate, like the effect of temperature and toxicity, so that good decisions on what suit to wear and for how long are easier to make.

PermaSURE® Key Features:

- Easy input of suit type, exposure time, temperature and chemical.
- PermaSURE® provides calculation of how much the chemical has permeated.
- Calculates safe-use times, taking into account environmental temperature and the toxicity thresholds of specific chemicals.
- Alarm sounds on mobile device when safe use time limit is being approached.
- Provides instant basic chemical hazard data and single-click links to detailed online safety data sheets.
- Over 4000 chemicals in the database.
- Robust documentation capabilities.

Please contact a Lakeland representative today to learn more about the ChemMax Plus line of products, PermaSURE® and to schedule a more detailed discussion on the benefits of choosing Lakeland chemical protective clothing with the added safety of PermaSURE®.