

# Type 3 and 4 Chemical Suit Selection Guide

A guide to the selection of Lakeland manufactured clothing for protection against hazardous chemicals

## PermaSure

FREE download smart phone app that calculates safe-use times!

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## ChemMax®

Lakeland Brand chemical protective clothing

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## Interceptor® Plus

Type 1a Encapsulated suit

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## Push-Lock Glove System

Quickly install or remove chemical gloves on Lakeland ChemMax® or Interceptor® Plus suits

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Why choose Lakeland?



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Lakeland delivers the most innovative Protective Clothing products and fabric choices in the world

The wide choice of fabrics and styles offered means users can target selected protection more specifically to their application - which means better protection, greater comfort and lower cost. Lakeland offers the right tool for the job... because if all you have is a hammer... everything looks like a nail!

Expertise from experience

Lakeland was the original manufacturer of disposable protective clothing and continues to be the best. Our expertise is derived from over forty years experience of developing, designing and manufacturing industrial clothing for protection against chemicals, flame and heat.

World-wide presence and growth

Lakeland International is growing rapidly, with production and sales operations in more than 40 countries. So we can bring you the best in fabrics and innovations the world has to offer. And technical expertise for wherever you do business.

Know the maker - we manufacture our own products

Lakeland Protects People. It is our core business. Unlike many of our competitors we don't use contractors for our key products. We make our own apparel so we have complete control over planning, quality and delivery. For most contractors protective clothing is only a portion of their business and they lack our expertise and focus on protecting the end-user - whereas that is what we are all about.

We design the fabric, we make the garment, we inspect it, we ship it.

Let us help you Protect Your People.

Is meeting a standard enough?

Many users now rely on CE standards to ensure that the PPE they choose will provide protection. But does merely ensuring PPE is certified ensure you are protected? No!

There are three reasons why just meeting a standard is not enough...

1.

**CE standards represent MINIMUM performance levels**

For example, in chemical protection, Type 3,4 5 and 6 testing allows for SOME penetration of a chemical inside the suit below defined levels.

Most users assume passing these tests means NO penetration has occurred.

**If a chemical is highly toxic with a chronic effect, this might be critical.**

2.

**Standards deal with generalities and cannot account for wide variations in real-world conditions.**

In CE standards garments are tested in consistent laboratory conditions. In the real world, garments are used in a huge variety of applications, environments and conditions. It is not possible that standards can account for or anticipate every environment in which PPE might be used.

So for example in chemical protection permeation testing is always conducted at 23oC. In the real world temperatures might be much higher or lower than this. And chemical permeation rates change with temperature.

**So a permeation test on a chemical suit fabric might have little relevance to where or when you actually use a garment.**

3.

**Standards are commonly misunderstood or misinterpreted, or the detail of standards is not considered.**

CE standards and tests are complex. In a busy world users often draw mistaken conclusions about what a particular test means and how it should be interpreted and used in PPE selection.

So for example, in chemical protection users generally assume that a permeation test breakthrough is an indication that no permeation has occurred and thus suggests the suit is safe to use for that period.

**Yet this is is founded on a complete misunderstanding; in fact permeation of the chemical may well have occurred, and in the case of a highly toxic chemical this might be vital. (see page 4)**

Introduction

There is more to selecting a chemical suit than simply checking it meets a CE standard. The following pages provide a guide to the factors that should be considered when selecting the correct chemical protective garment for your specific application. Selection of an appropriate chemical suit is vital in ensuring and optimising protection, comfort and cost. Providing too high protection means paying for more protection than needed, and users may be less comfortable than they could be.

There are three general areas that should be considered:

1. The chemical

- The primary consideration is the chemical.
- What does a permeation test 'breakthrough' mean?
- How toxic is it and how much will cause harm?
- How to calculate safe-use times.

2. Which hazard/spray type?

- What type of spray hazard does the application present?
- Determining which applies can have important consequences
- for garment options.

3. Physical environment factors

- What physical and environmental factors might be important in the application?

Which garment to use?

1. The chemical

The critical question is...  
How long am I safe?

The chemical in use is the primary factor in fabric choice.

The critical question is: "How long am I safe?" Permeation test results are often incorrectly used to answer this question.

Why? Some users make the **incorrect assumption that:**

*"Permeation test breakthrough is >480 minutes, therefore no chemical has broken through the fabric in 480 minutes. Therefore, I am safe for over 480 minutes..."*

This statement is incorrect!

Permeation testing is designed for *fabric comparison only* and not to indicate a safe-use time. Use of permeation testing to indicate safe-use in this way could result in a misleading conclusion about how long you are safe.

**EN 6529** The permeation test breakthrough gives NO information about how long you are safe! This is made clear in the EN 6529 standard itself. The introduction states: "These test methods provide various options... to allow a comparison of protective clothing material permeation resistance".

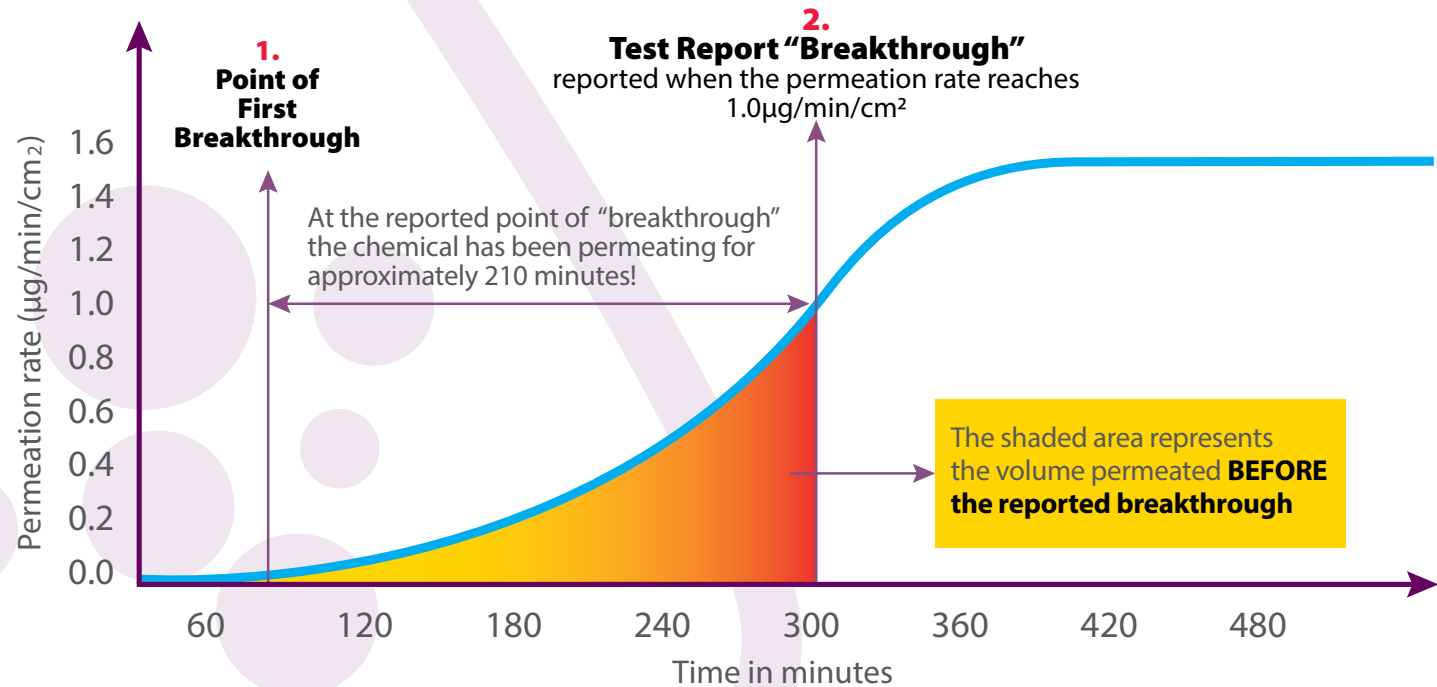
What is the difference between "First Breakthrough" and "Test Breakthrough?"

"Breakthrough" in a permeation test is not recorded when the chemical first breaks through the fabric but when the rate of permeation reaches a particular speed.

This is more easily understood by looking at a graph of permeation. The graph below shows a classic permeation curve and indicates the point of Reported Breakthrough (2) compared with the point of First Breakthrough (1).

As the purpose of permeation testing is comparison of fabric performance, pages 6 to 8 include tables comparing Lakeland garments with main brand equivalents.

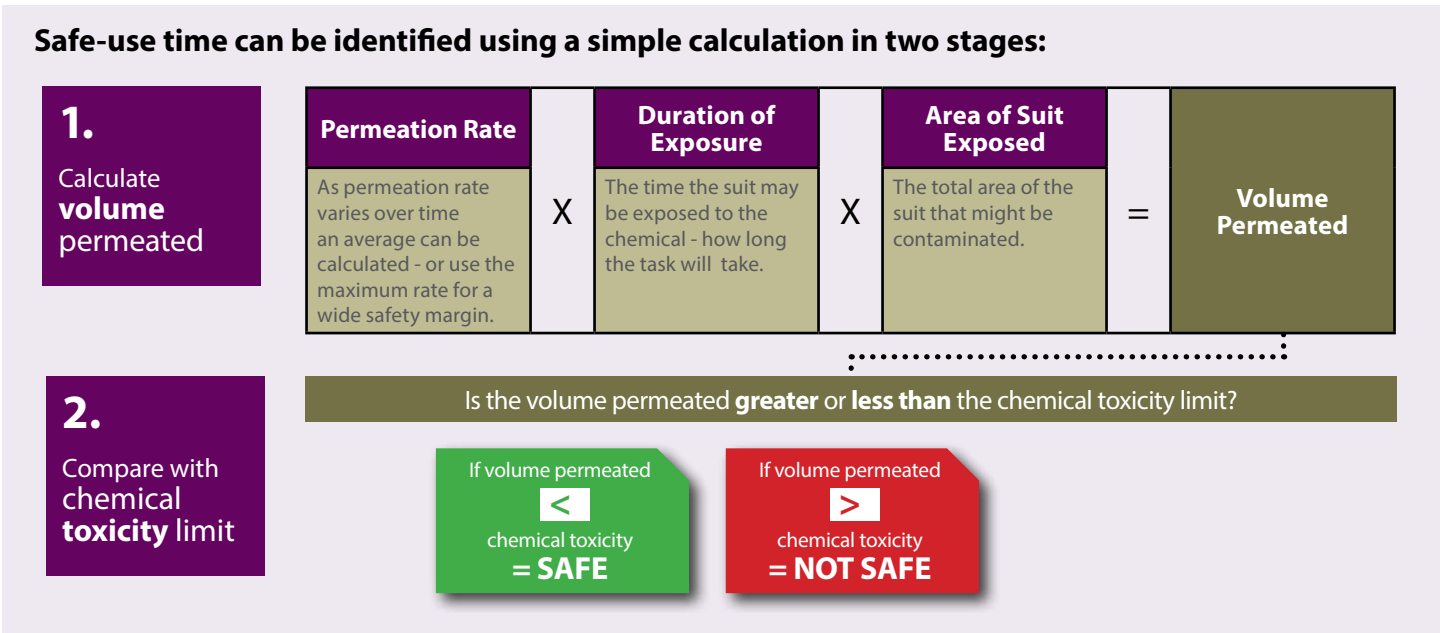
Note: the standard also offers an optional rate of 0.1µg/min/cm2. This is also used in the equivalent North American Permeation Test. In Europe 1.0µg/min/cm2 is normally used.



How to calculate safe-use times

Safe-use time

Breakthrough should only be used for fabric comparison - to indicate if one fabric is a better barrier than another... **so how do you know how long you are safe against a specific chemical?**



Such analysis should only be undertaken by qualified personnel and wide safety margins should be allowed as information is often limited, permeation times vary with temperature and exposure limits may be uncertain, variable or not available.

The problem of temperature

All permeation tests are conducted at 23° C - required by the standard and necessary given the objective is fabric performance comparison. However, a higher temperature of fabric or chemical will result in faster permeation as permeation rate increases with temperature. This is ignored in permeation testing so calculations of safe-use time are limited to the test temperature. Any use of permeation test figures for assessing safe-use should allow for higher permeation rates at higher temperatures.

EN 14325:2018 Supports PermaSURE®!

EN 14325 is the standard that defines how the various properties of chemical suit fabrics are defined - including the method of defining permeation resistance. The 2018 revision acknowledged that using permeation test breakthrough data as a safe-wear time is dangerous and can lead to users thinking they are safe when they may not be. It also introduced a new method of classification - the same method as used by PermaSURE®: calculating volume permeated over time and using chemical toxicity to determine a time until a toxic volume permeated may be reached.

PermaSURE®

The smart-phone app that calculates Safe-Use times for ChemMax®3, ChemMax®4 Plus and Interceptor® Plus garments!

PermaSURE® is a smart-phone app that calculates permeation rates and volumes according to temperature and uses chemical toxicity to calculate a real-world safe-wear time for over 4000 chemicals... in seconds.





Permeation Test Comparison – Table1

Permeation Test Comparison Tables

Permeation testing to EN 6529 is required by the Type 3 & 4 standard to allow comparison of fabric permeation barrier. These tables offer comparison of Lakeland chemical suit fabrics with main brands.

Permeation testing gives NO information regarding safe-use time. (See below and pages 4 to 5). Pages 6-8 show Lakeland Chemical Suit fabrics compared with common alternative brands\*.

Table 1: ChemMax® 1 vs Brands A and B

Achieves an equal or better result for 77% of comparable chemicals.

Table 2: ChemMax® 2, 3 and 4 Plus vs Brands C and D

ChemMax® 2 - achieves an equal or better result for 72% of comparable chemicals.

ChemMax® 3 - achieves an equal or better result for 96% of comparable chemicals.

ChemMax® 4 Plus - achieves an equal or better result for 91% of comparable chemicals.

TABLE LEGEND

In some cases the EN Class 6 result for Lakeland fabrics has been assumed from the equivalent US permeation test ASTM F739. This is the same test but uses a permeation rate ten times LOWER than the European version. Thus where the result in the US test is >480m it is reasonable to assume that a test measuring to a HIGHER rate would be at least the same.

NT = Not Tested  
NA = Not Available  
Imm = Immediate

Green indicates ChemMax® is similar or better where there is a comparable result.

TABLE 1 ChemMax® 1 vs Brands A and B			Performance Class 1 to 6 (6 is highest, represents >480 mins)		
CAS No.	Chemical	Conc.	ChemMax® 1	Brand A	Brand B
123-91-1	1,4-Dioxane	99%	Imm	NA	NT
64-19-7	Acetic Acid	99%	5	NT	6
108-24-7	Acetic Anhydride	99%	6	NA	6
79-10-7	Acrylic Acid	99%	3	NT	6
62-53-3	Aniline	99%	6	NT	6
68-12-2	Dimethylformamide	99%	6	NT	6
107-21-1	Ethylene Glycol	99%	6	NT	6
75-21-8	Ethylene Oxide	99%	6	NT	NA
50-00-0	Formaldehyde	37%	6	6	6
64-18-6	Formic Acid	99%	6	NT	6
124-09-4	Hexamethylenediamine	47.50%	6	NT	6
10035-10-6	Hydrobromic Acid	48%	6	NA	6
7647-01-0	Hydrochloric Acid	37%	5	NA	6
7647-01-0	Hydrogen Chloride	99%	Imm	NT	0
74-90-8	Hydrogen Cyanide	95%	Imm	NA	0
7722-84-1	Hydrogen Peroxide	70%	6	NT	6
7722-84-1	Hydrogen Peroxide	50%	6	6	6
7553-56-2	Iodine	99%	6	NT	6
74-88-4	Iodomethane/Methyl Iodine	99%	Imm	NT	6
67-63-0	Isopropanol	99%	6	NT	6
7447-41-8	Lithium Chloride	99%	6	NA	NT
1310-65-2	Lithium Hydroxide	20%	6	NA	NT
67-56-1	Methanol	95%	Imm	NA	6
625-45-6	Methoxyacetic Acid	98%	6	NA	6
101-77-9	Methylene Dianiline	99%	Imm	NT	NT
71-36-3	N-Butanol	99%	6	NT	NA
110-54-3	N-Hexane (Hexane)	95%	Imm	NT	0
7697-37-2	Nitric Acid	99%	5	NA	NT
MIXTURE	Oleum	40%	1	NA	NA
144-62-7	Oxalic Acid	10%	4	NA	6
7601-90-3	Perchloric Acid	30%	6	6	6
108-95-2	Phenol	80%	6	NT	6
7664-38-2	Phosphoric Acid	85%	6	6	NA
1310-58-3	Potassium Hydroxide	30%	6	NA	6
1310-58-3	Potassium Hydroxide	86%	6	NA	6
7722-64-7	Potassium Permanganate	99%	6	NA	NA
123-38-6	Propionaldehyde	99%	6	NA	3
107-12-0	Propionitrile	99%	6	NA	NA
107-10-8	Propylamine	99%	Imm	NA	NA
106-42-35	P-Xylene	99%	Imm	NA	NT
7681-38-1	Sodium Bisulphate	40%	6	NA	6
497-19-8	Sodium Carbonate	5%	6	NA	NT
7647-14-5	Sodium Chloride	35%	6	NA	6
1310-73-2	Sodium Hydroxide	50%	6	6	6
7664-93-9	Sulfuric Acid	96%	6	6	6
1634-04-4	T-Butyl Methyl Ether	99%	Imm	NA	0
127-18-4	Tetrachloroethylene	95%	Imm	NA	NA
108-88-3	Toluene	99%	NT	NA	0
584-84-9	Toluene-2,4-Diisocyanate	95%	3	NT	6
76-03-9	Trichloroacetic Acid	99%	6	NT	6
7699-45-8	Zinc Bromide	99%	6	NA	6

Permeation Test Comparison – Table 2

TABLE 2 ChemMax® 2, 3 and 4 Plus vs Brands C and D			Performance Resistance Class 1 to 6 (6 highest, represents >480 mins)				
CAS No.	Chemical	Conc	ChemMax® 2	ChemMax® 3	Brand C	Brand D	ChemMax®4 Plus
107-06-2	1,2-Dichloroethane	99%	6	6	NA	6	6
106-99-0	1,3-Butadiene	99%	6	6	6	6	6
123-91-1	1,4-Dioxane	99%	2	2	6	6	NT
115-20-8	2,2,2-Trichloroethanol	99%	NT	NT	6	NA	6
78-88-6	2,3-Dichloro-1-Propene	98%	NT	NT	2	NA	6
120-83-2	2,4-Dichlorophenol	99%	NT	6	NA	NA	6
94-75-7	2,4-Dichlorophenoxy Acetic Acid	99%	NT	6	NA	NA	6
460-00-4	4-Bromofluorobenzene		NT	NT	6	NA	6
64-19-7	Acetic Acid	99%	6	6	6	6	5
108-24-7	Acetic Anhydride	99%	6	6	NA	6	NT
67-64-1	Acetone	99%	6	6	6	6	6
75-05-8	Acetonitrile	99%	6	6	6	6	6
75-36-5	Acetyl Chloride		NT	NT	6	NA	4
107-02-8	Acrolein	98%	NT	6	6	NA	6
79-10-7	Acrylic Acid	99%	6	6	6	6	5
107-13-1	Acrylonitrile	99%	6	6	6	6	6
107-18-6	Allyl Alcohol	99%	NT	6	6	6	NT
107-05-1	Allyl Chloride	98%	NT	6	6	NA	6
7664-41-7	Ammonia	99%	1	6	6	6	6
12125-01-8	Ammonium Fluoride	40%	NT	NT	NA	6	6
1336-21-6	Ammonium Hydroxide	29%	6	3	NA	6	NT
628-63-7	Amyl Acetate	99%	NT	6	6	6	NT
62-53-3	Aniline	99%	6	6	6	6	NT
71-43-2	Benzene	99%	Imm	6	6	6	5
7726-95-6	Bromine	98%	NT	NT	Imm	Imm	2
75-15-0	Carbon Disulfide	99%	Imm	6	6	Imm	6
630-08-0	Carbon Monoxide	99%	6	5	NA	NA	NT
7782-50-5	Chlorine	99%	6	6	6	6	6
108-90-7	Chlorobenzene	99%	NT	NT	6	6	6
7790-94-5	Chlorosulfonic Acid	97%	NT	NT	6	3	6
108-94-1	Cyclohexanone	99%	4	6	6	NA	6
98-82-8	Cumene	98%	NT	NT	6	6	6
75-09-2	Dichloromethane	99%	Imm	6	Imm	Imm	6
109-89-7	Diethylamine	99%	NT	NT	6	Imm	6
MIXTURE	Diesel Fuel	NEAT	6	6	6	6	NT
60-29-7	Diethyl Ether	99%	NT	6	NA	Imm	NT
109-89-7	Diethylamine	99%	1	6	6	Imm	NT
67-68-5	Dimethyl Sulfoxide	99%	NT	6	3	6	NT
111-40-0	Diethylenetriamine	98%	NT	NT	6	6	6
77-78-1	Dimethyl Sulfate	99%	NT	NT	6	6	6
127-19-5	Dimethylacetamide	99%	NT	NT	6	6	6
68-12-2	Dimethylformamide	99%	6	6	6	6	6
88-85-7	Dinoseb	PPM	NT	6	NA	NA	NT
106-89-8	Epichlorohydrin	99%	5	6	6	6	NT
141-43-5	Ethanol Amine	99%	NT	6	6	6	NT
141-78-6	Ethyl Acetate	99%	6	6	6	6	6
140-88-5	Ethyl Acrylate	99%	NT	NT	NT	NA	6
541-41-3	Ethyl Chloroformate	97%	NT	NT	NA	NA	6
60-29-7	Ethyl Ether (Diethyl Ether)	98%	NT	NT	6	NA	6

Table 2 continued on next page

Permeation Test Comparison – Table 2 continued

TABLE 2 ChemMax® 2, 3 and 4 Plus vs Brands C and D			Performance Class 1 to 6 (6 is highest, represents >480 mins)				
CAS No.	Chemical	Conc	ChemMax® 2	ChemMax® 3	Brand C	Brand D	ChemMax®4 Plus
74-85-1	Ethylene	99%	NT	6	NA	NA	NT
106-93-4	Ethylene Dibromide	99%	NT	6	6	6	NT
107-21-1	Ethylene Glycol	99%	6	6	6	6	NT
75-21-8	Ethylene Oxide	99%	6	6	3	6	6
75-21-8	Ethylene Oxide	10%	NT	6	3	6	NT
462-06-6	Fluorobenzene	99%	NT	6	6	3	6
16961-83-4	Fluorosilicic Acid (25Wt% Aqueous Sol.)	25%	NT	NT	NA	NA	6
50-00-0	Formaldehyde	37%	6	6	6	6	NT
64-18-6	Formic Acid	95%	6	6	6	6	6
MIXTURE	Gasoline	NEAT	NT	6	6	6	NT
87-68-3	Hexachloro-1,3 Butadiene	99%	NT	NT	NA	6	6
822-06-0	Hexamethylene Diisocyanate	99%	NT	6	6	NA	NT
7647-01-0	Hydrochloric Acid	37%	6	6	NA	6	6
7664-39-3	Hydrofluoric Acid	30%	NT	6	NA	6	NT
7664-39-3	Hydrofluoric Acid	48%	NT	6	6	6	NT
7664-39-3	Hydrofluoric Acid	50%	NT	6	6	6	4
7664-39-3	Hydrofluoric Acid	99%	NT	NT	NA	NA	6
7647-01-0	Hydrogen Chloride	99%	6	6	6	6	6
74-90-8	Hydrogen Cyanide	95%	NT	6	NA	6	NT
7664-39-3	Hydrogen Fluoride	99%	NT	6	6	6	6
7722-84-1	Hydrogen Peroxide	50%	NT	6	6	6	6
10034-85-2	Hydroiodic Acid	58%	NT	NT	6	NA	6
67-63-0	Isopropanol	99%	2	6	6	6	NT
N/A	Jet Fuel Jp-8	NEAT	NT	6	NA	NA	NT
67-56-1	Methanol	99%	6	6	6	6	6
74-83-9	Methyl Bromide	99%	6	6	NA	NA	NT
74-87-3	Methyl Chloride	99%	6	6	6	6	NT
78-93-3	Methyl Ethyl Ketone	99%	6	6	6	6	NT
74-88-4	Methyl Iodide	99%	NT	NT	6	NA	6
74-93-1	Methyl Mercaptan	99%	NT	6	6	NA	6
74-89-5	Methylamine	40%	6	6	6	NA	6
101-77-9	Methylene Dianiline	99%	NT	6	NA	NA	NT
101-68-8	Methylene Diphenyldiisocyanate	99%	NT	6	NA	NA	NT
3268-49-3	Methylthiopropionaldehyde	99%	NT	6	NA	NA	NT
121-69-7	N,N-Dimethylaniline	99%	NT	NT	6	NA	6
123-86-4	N-Butyl Acetate	99%	NT	NT	NA	NA	6
142-96-1	N-Butyl Ether (Di-N-Butyl Ether)	99%	NT	6	6	NA	6
142-82-5	N-Heptane	99%	Imm	6	NA	6	NT
110-54-3	N-Hexane (Hexane)	99%	6	6	6	6	6
7697-37-2	Nitric Acid	70%	6	6	6	6	6
98-95-3	Nitrobenzene	99%	4	4	6	6	6
10102-44-0	Nitrogen Dioxide	99%	6	6	Imm	NA	NT
872-50-4	N-Methyl Pyrrolidone	99%	NT	6	6	6	NT
10544-72-6	Nitrogen Tetroxide (<10oC)	99%	NT	NT	NA	NA	6
108-95-2	Phenol	40%	6	6	5	6	6
7664-38-2	Phosphoric Acid	85%	6	6	6	6	6
1310-58-3	Potassium Hydroxide	88%	NT	NT	NA	NA	6
02-12-7719	Phosphorus Trichloride	95%	Imm	1	NA	NA	NT

Table 2 continued on next page

Permeation Test Comparison – Table 2 continued

TABLE 2 ChemMax® 2, 3 and 4 Plus vs Brands C and D			Performance Class 1 to 6 (6 is highest, represents >480 mins)				
CAS No.	Chemical	Conc	ChemMax® 2	ChemMax® 3	Brand C	Brand D	ChemMax®4 Plus
7789-00-6	Potassium Chromate	SAT	6	6	6	NA	NT
107-10-8	Propylamine	99%	NT	NT	6	NA	6
110-86-1	Pyridine	99%	NT	NT	6	NA	6
75-56-9	Propylene Oxide	99%	NT	6	6	1	NT
106-42-3	P-Xylene	99%	NT	6	NA	NA	NT
110-86-1	Pyridine	99%	NT	6	6	NA	6
497-19-8	Sodium Carbonate	5%	6	6	NA	NA	6
7647-14-5	Sodium Chloride	99%	NT	NT	NA	6	6
1310-73-2	Sodium Hydroxide	50%	6	6	NA	6	6
7681-52-9	Sodium Hypochlorite	15%	6	6	NA	6	6
05-09-7446	Sulfur Dioxide	99%	6	6	NA	NA	6
10025-67-9	Sulfur Monochloride	99%	NT	6	NA	NA	NT
09-11-7446	Sulfur Trioxide	99%	NT	3	NA	NA	NT
7664-93-9	Sulfuric Acid	97%	6	6	6	6	6
7664-93-9	Sulfuric Acid	30%	6	6	NA	6	NT
7791-25-5	Sulfuryl Chloride	99%	NT	1	6	NA	6
1634-04-4	T-Butylmethyl Ether	99%	NT	6	6	6	NT
127-18-4	Tetrachloroethylene	99%	6	6	6	6	6
109-99-9	Tetrahydrofuran	99%	3	6	6	Imm	6
110-01-0	Tetrahydrothiophene	99%	Imm	6	NA	NA	NT
7719-09-7	Thionyl Chloride	99%	NT	NT	3	Imm	6
7550-45-0	Titanium Tetachloride	99%	6	6	6	6	NT
108-88-3	Toluene	99%	Imm	6	6	6	6
76-02-9	Trichloroacetic Acid	70%	NT	6	6	6	NT
87-61-6	Trichlorobenzene	99%	NT	6	NA	NA	NT
12002-48-1	Trichlorobenzene	99%	NT	6	NA	NA	NT
79-01-6	Trichloroethylene	100%	NT	6	6	Imm	6
76-05-1	Trifluoroacetic Acid	99%	6	6	6	NA	NT
Mixture	Unleaded Petrol	99%	Imm	6	NA	6	NT
108-05-4	Vinyl Acetate	95%	NT	6	Imm	6	6
75-01-4	Vinyl Chloride	99%	NT	6	6	NA	NT
1330-20-7	Xylene	99%	NT	6	6	6	NT

Green indicates ChemMax® is similar or better where there is a comparable result.

Permeation Test Comparison – Table 3

TABLE 3 ChemMax® 4 Plus & Interceptor® Plus vs Brands E, F and G				Performance Class 1 to 6 (6 is highest, represents >480 mins)				
CAS No.	Chemical	Conc	Phase	ChemMax®4 Plus	Interceptor® Plus	Brand E	Brand F	Brand G
106-88-7	1,2 Butylene Oxide	99%	Liquid	NT	6	NA	NA	NA
107-06-2	1,2-Dichloroethane	99%	Liquid	6	6	6	6	NA
106-99-0	1,3-Butadiene	99%	Gas	6	6	6	6	6
115-20-8	2,2,2-Trichloroethanol	99%	Liquid	6	6	6	NA	NA
78-88-6	2,3-Dichloro-1-Propene	98%	Liquid	6	6	6	NA	NA
118-79-6	2,4,6-Tribromophenol	98%	Sat.	6	NT	NA	NA	NA
920-37-6	2-Chloroacrylonitrile	99%	Liquid	NT	6	NA	NA	NA
101-77-9	4,4-Methylene Dianiline	97%	Sat.	NT	5	6	NA	NA
460-00-4	4-Bromofluorobenzene	99%	Liquid	6	6	6	NA	NA
64-19-7	Acetic Acid	99%	Liquid	5	5	6	NA	NA
67-64-1	Acetone	99%	Liquid	6	6	6	6	6
75-05-8	Acetonitrile	99%	Liquid	6	6	6	6	6
75-36-5	Acetyl Chloride	98%	Liquid	4	4	6	5	6
107-02-8	Acrolein	98%	Liquid	6	6	6	NA	NA
79-10-7	Acrylic Acid	99%	Liquid	5	5	6	NA	NA
107-13-1	Acrylonitrile	99%	Liquid	6	6	NA	NA	NA
107-05-1	Allyl Chloride	98%	Liquid	NT	6	6	NA	NA
7664-41-7	Ammonia	99%	Gas	6	6	6	6	6
12125-01-8	Ammonium Fluoride	40%	Liquid	6	6	6	NA	NA
98-88-4	Benzoyl Chloride	98%	Liquid	NT	6	NA	NA	NA
7726-95-6	Bromine	98%	Liquid	2	3	1	1	1
75-15-0	Carbon Disulfide	99%	Liquid	6	6	6	6	6
7782-50-5	Chlorine	99%	Gas	6	6	6	6	6
79-04-9	Chloroacetyl Chloride	98%	Liquid	NT	6	4	6	6
108-90-7	Chlorobenzene	99%	Liquid	6	6	6	NA	NA
7790-94-5	Chlorosulfonic Acid	97%	Liquid	6	6	6	NA	NA
108-94-1	Cyclohexanone	99%	Liquid	6	6	6	6	NA
108-91-8	Cyclohexylamine	99%	Liquid	NT	6	NA	NA	NA
75-09-2	Dichloromethane	99%	Liquid	6	6	6	6	6
64-67-5	Diethyl Sulfate	98%	Liquid	NT	6	6	NA	NA
109-89-7	Diethylamine	99%	Liquid	NT	6	6	6	6
111-40-0	Diethylenetriamine	98%	Liquid	6	6	6	NA	NA
624-92-0	Dimethyl Disulfide	99%	Liquid	NT	6	NA	6	6
115-10-6	Dimethyl Ether	99%	Gas	NT	6	6	NA	NA
77-78-1	Dimethyl Sulfate	99%	Liquid	6	6	NA	NA	NA
67-68-5	Dimethyl Sulfoxide	99%	Liquid	NT	6	6	NA	NA
68-12-2	Dimethylformamide	99%	Liquid	6	6	6	NA	6
141-78-6	Ethyl Acetate	99%	Liquid	6	6	6	6	6
140-88-5	Ethyl Acrylate	99%	Liquid	6	6	6	NA	NA
60-29-7	Ethyl Ether (Diethyl Ether)	98%	Liquid	6	6	6	NA	NA
97-63-2	Ethyl Methacrylate	99%	Liquid	NT	6	NA	NA	NA
75-04-7	Ethylamine	97%	Gas	NT	6	6	NA	NA
75-21-8	Ethylene Oxide	99%	Gas	6	6	6	6	6
7705-08-0	Ferric Chloride	SAT	Liquid	NT	6	NA	NA	NA
462-06-6	Fluorobenzene	99%	Liquid	6	6	6	NA	NA
16961-83-4	Fluorosilicic Acid (25Wt% Aqueous Sol.)	25%	Liquid	6	6	NA	NA	NA
64-18-6	Formic Acid	99%	Liquid	6	6	NA	NA	NA
87-68-3	Hexachloro-1,3 Butadiene	99%	Liquid	6	NT	6	NA	NA

Green indicates ChemMax® is similar or better where there is a comparable result.

Permeation Test Comparison – Table 3 continued

TABLE 3 ChemMax® 4 Plus & Interceptor® Plus vs Brands E, F and G				Performance Class 1 to 6 (6 is highest, represents >480 mins)				
CAS No.	Chemical	Conc	Phase	ChemMax®4 Plus	Interceptor® Plus	Brand E	Brand F	Brand G
10217-52-4	Hydrazine Hydrate (64% Hydrazine)	100%	Liquid	NT	6	6	NA	NA
7647-01-0	Hydrochloric Acid	37%	Liquid	6	6	6	NA	NA
7664-39-3	Hydrofluoric Acid	99%	Liquid	6	6	NA	6	NA
7664-39-3	Hydrofluoric Acid	52%	Liquid	4	6	6	NA	NA
7647-01-0	Hydrogen Chloride	99%	Gas	6	6	6	6	6
7664-39-3	Hydrogen Fluoride	99%	Gas	6	6	6	6	3
10034-85-2	Hydroiodic Acid	58%	Liquid	6	6	NA	NA	NA
75-28-5	Isobutane	99%	Gas	NT	6	NA	NA	NA
538-93-2	Isobutylbenzene	99%	Liquid	NT	6	NA	NA	NA
78-79-5	Isoprene	98%	Liquid	NT	6	NA	NA	NA
110-16-7	Maleic Acid	SAT	Liquid	NT	6	NA	NA	NA
108-31-6	Maleic Anhydride	SAT	Liquid	NT	6	NA	NA	NA
79-41-4	Methacrylic Acid	99%	Liquid	NT	6	6	NA	NA
67-56-1	Methanol	99%	Liquid	6	6	6	6	6
74-87-3	Methyl Chloride	99%	Gas	NT	6	6	NA	NA
79-22-1	Methyl Chloroformate	99%	Liquid	NT	6	6	NA	NA
107-31-3	Methyl Formate	97%	Liquid	NT	6	NA	NA	NA
74-88-4	Methyl Iodide	99%	Liquid	6	6	6	NA	NA
74-93-1	Methyl Mercaptan	99%	Gas	6	6	6	NA	NA
74-89-5	Methylamine	99%	Liquid	6	6	6	NA	NA
121-69-7	N,N-Dimethylaniline	99%	Liquid	6	6	6	NA	NA
123-86-4	N-Butyl Acetate	99%	Liquid	6	6	6	NA	NA
142-96-1	N-Butyl Ether (Di-N-Butyl Ether)	99%	Liquid	6	6	6	NA	NA
110-54-3	N-Hexane (Hexane)	99%	Liquid	6	6	6	6	6
7697-37-2	Nitric Acid	90%	Liquid	6	6	6	NA	NA
10102-43-9	Nitric Oxide	99%	Solid/ Powder	NT	6	6	NA	NA
98-95-3	Nitrobenzene	99%	Liquid	6	6	6	6	6
201-854-9	Nitrochloro Benzene (Ethanol Sol'n)	SAT	Liquid	NT	6	NA	NA	NA
10102-44-0	Nitrogen Tetroxide	99%	Liquid/ Gas Mix.	NT	6	6	NA	NA
10544-72-6	Nitrogen Tetroxide (<10 C)	99%	Liquid/ Gas	6	6	NA	NA	NA
112-20-9	Nonylamine	98%	Liquid	NT	6	NA	NA	NA
Mixture	Oleum	98%	Liquid	NT	6	6	NA	NA
144-62-7	Oxalic Acid	SAT	Solid	NT	6	NA	NA	NA
108-95-2	Phenol	90%	Liquid	6	6	6	3	2
7664-38-2	Phosphoric Acid	85%	Liquid	6	6	6	NA	NA
1310-58-3	Potassium Hydroxide	88%	Liquid	6	6	NA	NA	NA
123-38-6	Propionaldehyde	99%	Liquid	NT	6	NA	NA	NA
79-09-4	Propionic Acid	99%	Liquid	NT	6	NA	NA	NA
110-86-1	Pyridine	99%	Liquid	6	6	6	4	NA
497-19-8	Sodium Carbonate	5%	Liquid	6	6	NA	NA	NA
7681-49-4	Sodium Fluoride (Fluorine)	99%	Liquid	NT	6	NA	NA	NA
1310-73-2	Sodium Hydroxide	50%	Liquid	6	6	6	6	6
7681-52-9	Sodium Hypochlorite	15%	Liquid	6	6	6	NA	NA
09/11/7446	Sulfur Trioxide	99%	Liquid	NT	6	3	NA	NA
7664-93-9	Sulfuric Acid	98%	Liquid	6	6	6	6	6

Table 3 continued on next page

Permeation Test Comparison – Table 3 continued

TABLE 3 ChemMax® 4 Plus & Interceptor® Plus vs Brands E, F and G				Performance Class 1 to 6 (6 is highest, represents >480 mins)				
CAS No.	Chemical	Conc	Phase	ChemMax®4 Plus	Interceptor® Plus	Brand E	Brand F	Brand G
127-18-4	Tetrachloroethylene	99%	Liquid	6	6	6	6	6
109-99-9	Tetrahydrofuran	99%	Liquid	6	6	6	6	6
07/09/7719	Thionyl Chloride	99%	Liquid	1	1	3	1	6
108-88-3	Toluene	99%	Liquid	6	6	6	6	6
584-84-9	Toluene-2,4-Diisocyanate	98%	Liquid	NT	6	NA	NA	NA
79-01-6	Trichloroethylene	99%	Liquid	6	6	6	NA	NA
998-30-1	Triethoxysilane	95%	Liquid	NT	6	NA	NA	NA
354-32-5	Trifluoroacetyl Chloride	100%	Liquid	NT	6	NA	NA	NA
108-05-4	Vinyl Acetate	99%	Liquid	6	6	6	NA	NA
593-60-2	Vinyl Bromide	99%	Liquid	NT	6	NA	NA	NA

Green indicates ChemMax® is similar or better where there is a comparable result.

Table 3: ChemMax® 4 Plus and Interceptor® Plus vs Brands E, F and G

**ChemMax® 4 Plus** - achieves an equal or better result for 89% of comparable chemicals.

**Interceptor® Plus** - achieves an equal or better result for 94% of comparable chemicals.

Permeation testing is for comparison purposes only and should not be used to indicate safe-use times.

A test breakthrough of >480m does NOT mean you are safe for 480 minutes or that no chemical has broken through the fabric in that time.

Conclusion

These comparisons show that in the majority of cases performance of Lakeland garments is as good or better than similar brand alternatives.

Garment selection decisions can therefore be made on the basis of other considerations such as physical factors or comfort and design features and options.

In particular ChemMax® 2 and 4 Plus may provide suitable options that are less expensive and more comfortable than other brand options.

Beware!

See pages 4 to 5 for a detailed explanation of permeation testing. Breakthrough in testing is NOT when the chemical first breaks through the fabric but when the permeation rate reaches a particular speed.

Permeation rate is affected by temperature. All permeation testing is conducted at 23° C. The specific purpose of EN 6529 is COMPARISON of fabrics only and results should NOT be used to indicate a safe use time.

A test breakthrough of >480m does NOT mean you are safe for 480 minutes or that no chemical has broken through in 480 minutes.

For the latest information on chemical permeation test data, use the Chemical Search Page on our web site at:

<https://www.lakeland.com/europe/chemmax-chemical-search>

Or use this QR code to link to the page



PermaSURE®

The FREE downloadable smart-phone app that calculates Safe-Use times for ChemMax®3, ChemMax® 4 Plus and Interceptor® Plus garments!



- Garment Tab**

  - Choose the garment used
  - Input suit and chemical temperature
  - Enter the duration of exposure (the maximum time you may be exposed to the chemical)
- Chemical Tab**

  - Choose the chemical from over 4,000 in the database
- Assessment Tab**

  - Click Calculate
- Results**

  - If safe, go ahead.
  - If not safe, revise the task or upgrade to a higher level of protection
- Works on any browser-enabled device

PermaSURE® allows users to calculate safe-use times for ChemMax® 3 & 4 Plus and Interceptor® Plus garments based on real world data including temperature and exposed area

- Works on any browser enabled tablet or smartphone with internet connection.
- Simple to use. Easy-to-access interface with data input and output fields.
- User inputs suit type, exposure time, temperature and chemical.
- PermaSURE® provides key hazard data and in seconds an assessment of whether the user is safe in the input exposure time.
- Over 4,000 chemicals in the database.
- PermaSURE® calculates safe-use times taking into account temperature and the toxicity thresholds of specific chemicals.
- PermaSURE® provides instant basic chemical hazard data and single-click links to detailed online safety data sheets.

EN 14325:2018

The new standard clearly states that using permeation test data to indicate safe use of a chemical suit is dangerous and introduced a new method of classifying chemical permeation resistance using the same principle as PermaSURE®, assessing the volume of chemical permeated over time and using the toxicity of the chemical to determine a safe wear time.

The molecular model behind PermaSURE® was developed in conjunction with the UK Ministry of Defence for assessing protection against chemical warfare agents.



PermaSURE® is a registered trade mark of Industrial Textile & Plastics Ltd, Easingwold. UK



Which garment to use?

2.

Which hazard/  
spray type?






The critical question is...

# What is the Spray Type?

Light Spray | Liquid Spray | Jet Spray | Vapors/gases



CE Types are a good guide to the different types of chemical contact and a clear indication of garment choice. The task may suggest a choice of fabric and garment design.

 TYPE 6	 TYPE 5	 TYPE 4	 TYPE 3	 TYPE 1
Light Spray TYPE 6	Hazardous Dust TYPE 5	Liquid Spray TYPE 4	Jet Spray TYPE 3	Gas or Vapor TYPE 1
Light spray / aerosol protection	Dry particle protection	General overall spray: no pressure but coverall soaked. Wider, lower spray over a wider surface area.	Strong jet sprays - single jet sprays of liquid at pressure. Type test : the jet is aimed at weak areas of the suit.	Surrounding gases or vapors
Type 6 garment	Type 5 garment	More comfortable design options? 2-piece ensemble?	Single piece coverall with sealed seams and effective front fastening	Gas-Tight - fully enclosed / air-tight seams and closures; access to portable air
MicroMax® SafeGard®	MicroMax® SafeGard®	ChemMax® 1 Cool Suit® ChemMax® 1,2,3 ChemMax® 4 Plus	ChemMax® 1,2,3 ChemMax® 4 Plus	Interceptor® Plus

Design choices are subject to the chemical toxicity. eg: A Type 6 application may require sealed seams if the chemical is highly toxic.

### Type 5 and 6 applications

A ‘non-barrier’ fabric such as SMS (SafeGard®) or microporous film laminate (MicroMax®) with simple suit design (serged seams / basic zip flap). In some cases a higher spec (Type 4 to 1) garment might be appropriate.

For example: a liquid aerosol or dust concentrated in a high volume or poorly ventilated area.

Or if the chemical is highly toxic or dangerous so the consequences of minor contamination are greater.



### Type 3 and 4 applications

An application defined as Type 4 (rather than Type 3) allows a wider choice of more comfortable options (subject to the chemical hazard).

Most suits are certified to Types 3 and 4. Yet many applications are either Type 3 or 4. Distinguishing between the two can be an important indicator of garment choice.

### Liquid or Gas?

Liquid would normally suggest a Type 3 or 4 hazard. However, some chemicals have low boiling points, becoming vapor at low temperatures. In such cases a gas-tight suit might be appropriate.

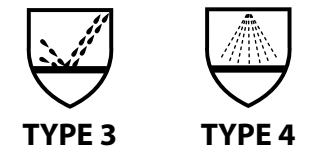
### Physical factors such as strenuous work?



The physical demands of a task, such as climbing ladders, crawling or working in confined spaces, especially if the chemical is highly toxic, might suggest higher strength fabric or a specific design, even though permeation analysis and/or the hazard spray type indicate a lighter/more comfortable garment.

## Type 3 and 4 Hazard Spray Type – Why define the difference between Type 3 and 4 protection?

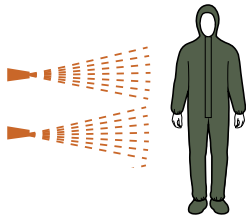
### EN 14605



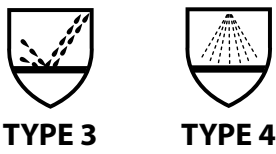
The EN 14605 standard defines two different levels of liquid spray protection: Type 3 & 4.



Most garments on the market are Type 3 and 4. Why?

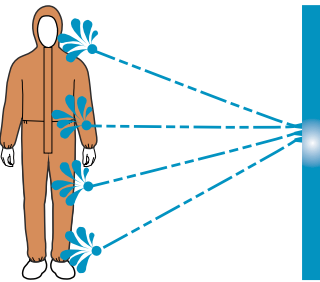


Each type is tested with a distinct finished garment spray test. (see spray graphics below)



By identifying that your application is either Type 3 or Type 4 allows more options for garment design choice and enables a greater level of comfort.

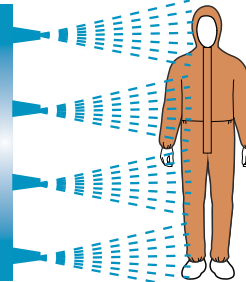
### EN 14605 - Type 3 : “Jet” sprays



- Strong, directional jets of liquid spray
- Results in intense, local pressure on fabric, seams and joins.
- Back-spray will penetrate under, up or behind any loose flaps or joins
- Single nozzle spraying jets of liquid are sprayed at “potential” weak areas in suit(eg, seams, crotch, zip flap etc.)

Type 3 demands full coverall design with fully sealed seams and effective front fastening.

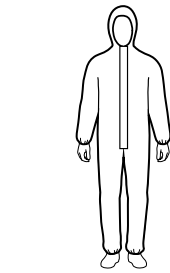
### EN 14605 - Type 4 : “Liquid” sprays



- Wider, less pressurised liquid sprays.
- Results in saturation of fabric (so sealed seams required) but no pressure on garment, seams or joins.
- No risk of backspray penetrating under, up or behind loose flaps or joins.
- Four nozzles with general overspray of liquid.

Allows more flexible and more comfortable design options.

### Lakeland Type 4 Garment Options



**428**  
Coverall with elasticized hood, cuffs, waist and ankles. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



**430**  
Coverall ‘Plus’ with hood and attached feet/boot flap. Elasticized cuffs and waist. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



**C2T730**  
Encapsulated suit with flat back. To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit.  
Size: M - XXL



**C2T735**  
Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.  
Size: M - XXL



**ChemMax® 1,3 and Pyrolon™ CRFR Cool Suits**  
More comfortable, breathable Type 4 coveralls. Feature a covered panel to the rear which allows air circulation for comfort.



Which garment to use?

3. Physical environment factors

What factors in the environment affect Garment Choice?

Can guide both fabric and design choices. These can be assessed in three groups.

1. The Task

Aspects of the task might affect fabric and garment choice.

Kneeling or crawling required?

Could suggest tougher fabric requirement - even though the chemical hazard could indicate a lighter fabric is acceptable. Or perhaps a garment with knee-pads might be chosen?

Climbing ladders?

Climbing places stress on the crotch. Stronger seam construction and/or a garment with a crotch gusset might be required.

Working in confined space?

Could increase damage caused by stress. A fabric with higher abrasion, puncture and/or tear strength might be selected.

Mobility required?

Effective mobility (perhaps for rapid escape?) might suggest a stronger and lighter fabric. Or ergonomic design, allowing good freedom of movement could be important

Communication?

Where communication is important fabric with a low noise level might be important.

2. The Environment

Visibility?

Low light areas might suggest a brighter colour fabric so the wearer can be seen (such as yellow ChemMax® 1 or ChemMax® 3 in orange) Hi-vis strips could also be added as an option.

Moving vehicle hazards?

A brighter colour fabric or optional hi-vis strips help ensure the wearer can be seen. Also a fabric with a low noise level improves the wearers ability to hear approaching vehicles.

Sharp edges?

Might indicate a fabric with higher tear or tensile strength.

Heat or flame hazards?

A chemical suit that is also FR (to EN 14116) is vital. See Lakeland's Pyrolon® options (see page 22)

Warm environments?

Discomfort is a hazard. A choice of a two-piece suit or the ChemMax Cool Suit® Advance (page 24) improves comfort of the hazard/spray type allows. A Cool Vest can keep wearers cooler and extend operating times (see page 26).

Explosive atmosphere?

Risk of explosion? Or perhaps the chemical might release flammable vapors? Approval to EN 1149-5 anti-static is a MINIMUM requirement. NOTE: approval to EN 1149 does NOT mean a garment is suitable for ALL explosive atmospheres. Further, anti-static treatments will erode with wear and rely on suitable grounding of the garment.

3. Other Issues

Other PPE required?

Other PPE required, eg. gloves, SCBA, boots, fall-arrest equipment). Consider the overall effectiveness of the ensemble. Will one impair the function of another? Do they fit together appropriately?

For a tested liquid-tight seal between gloves and suit sleeves see the Push-Lock® glove connection system (page 25).

Staff experience? Training required?

Availability of training from the garment manufacturer might be an important factor in garment choice.

Donning & doffing requirements?

What donning and doffing facilities are available? Can be critical.

Is an appropriate written procedure established and documented?

Does that affect garment choice?

Other regulations?

National, local or site-specific regulations may apply and may affect garment choice.

This is not an exhaustive list of environmental factors that might affect garment choice. All choices affected are subject to the primary concerns of the chemical toxicity and permeation.

Comparison Tables

The tables on page 15 compare physical properties of Lakeland garments with main competitor options to assist selection.

Physical Properties Comparison Table

Selection of a chemical suit may require assessment of garment and fabric physical properties and suitability for the physical demands of the application. The tables below compare Lakeland fabrics with common equivalent brands.

		ChemMax® 1	Brand A	Brand B		
Property	EN Standard	CE Class	CE Class	CE Class		
Abrasion Resistance	EN 530	2	5	3		
Flex Cracking	ISO 7854	1	3	6		
Trapezoidal Tear	ISO 9073	3	1	2		
Tensile Strength	EN 13934	3	3	2		
Puncture Resistance	EN 863	2	2	2		
Surface Resistivity	EN 1149	Pass	Pass	Pass		
Seam Strength	EN 13935-2	170N	>125N	>125N		

		ChemMax® 2	ChemMax® 3	Brand C	Brand D	ChemMax®4 Plus
Property	EN Standard	CE Class	CE Class	CE Class	CE Class	CE Class
Abrasion Resistance	EN 530	6	6	6	6	6
Flex Cracking	ISO 7854	6	4	1	5	1
Trapezoidal Tear	ISO 9073	4	4	2	3	6
Tensile Strength	EN 13934	4	2	3	2	4
Puncture Resistance	EN 863	2	2	2	2	2
Surface Resistivity	EN 1149	Pass	Pass	Pass	Pass	Pass
Seam Strength	EN 13935-2	148.3N	165.28N	>125N	>125N	449N

		ChemMax®4 Plus	Interceptor® Plus	Brand E	Brand F	
Property	EN Standard	CE Class	CE Class	CE Class	CE Class	
Abrasion Resistance	EN 530	6	6	6	6	
Flex Cracking	ISO 7854	1	2	1	1	
Trapezoidal Tear	ISO 9073	6	6	5	3	
Tensile Strength	EN 13934	4	4	4	4	
Puncture Resistance	EN 863	2	2	2	2	
Surface Resistivity	EN 1149	NT	NT	N/A	Pass	
Seam Strength	EN 13935-2	449N	648N	607N	>300<500N	

The tables show that for the majority of physical factors Lakeland options have superior or similar properties to the main alternatives.

Various physical properties may be more critical in different applications. Higher tear resistance indicates a softer fabric with greater stretch properties, resulting in a more comfortable garment.

Where required properties are similar, selection can be based on other factors such as permeation resistance, garment features and comfort.



Physical properties can be enhanced by design. For example, Lakeland ChemMax® 1,2 and 3 garments feature cushioned knee-pads.

Physical Properties Testing Glossary

- These fabric tests are a standard requirement of certification to chemical protective clothing standards.
- Abrasion Resistance**  
Fabric is abraded by a rotating disc with a set force applied. Measured in cycles required to cause damage. Reflects resistance to rubbing or general wear.
- Flex Cracking Resistance**  
Fabric is repeatedly flexed between two opposing grips. Measured in cycles required to cause "cracking" or damage. Reflects resistance to general wear.
- Trapezoidal Tear Resistance**  
Measures the force required to continue a "tear" in the fabric edge. Measured in Newtons (N) and in machine and cross fabric directions. Reflects resistance to damage from sharp points and edges.
- Tensile Strength**  
Measures the force required to tear the fabric with opposing, increasing force. Measured in Newtons (N) and in machine and cross fabric direction. Reflects basic fabric strength.
- CD or MD?**  
Some tests are undertaken in cross (CD) and machine (MD) directions. CD is across the width of the fabric roll. MD is along its length. In most fabrics more fibres tend to orient in the machine direction so MD tends to be stronger.
- Puncture Resistance**  
Measures the force required to hole the fabric with a spike with increasing pressure applied. Measured in Newtons (N). Reflects resistance to damage by sharp points and edges.
- Anti-Static (Electrostatic Surface Resistance)**  
Measures the tendency of the fabric to resist surface dissipation of an electrostatic charge (i.e. a lower resistance allows a charge to dissipate and go to earth). Measured in ohms(Ω). Requires maximum of 2.5 x 109 Ω. Important for garments used in potentially flammable atmospheres. If resistance is high a charge may build to the point of discharge in the form of an igniting spark.
- Seam Strength**  
Measures force required to burst a seam using an increasing opposing force. Measured in Newtons (N). Reflective of garment construction strength.



The Importance of Garment Design and Super-B Style

Protective clothing is used in a wide variety of environments, situations and applications throughout a range of industries. Each one is different and each places garments under a unique set of stresses, strains and physical demands.

Yet most chemical protective clothing is made from polymers and non-woven materials which while having the benefit of being

inexpensive, feature strength properties that are generally lower than their woven counterparts. So good design is vital in ensuring garments are built to cope with the various physical demands that might be placed on them.

Similarly, while comfort is primarily defined by the air permeability of the fabric, even a garment that is breathable will be uncom-

fortable if it is too tight, restricts movement or is poorly designed.

So effective ergonomic design is important in both maintaining the comfort of the wearer and in ensuring a garment lasts as long as required by the job.

Lakeland CE garments use a specific ergonomically styled pattern that features a unique combination of three key factors, along with other helpful design elements.

1. Inset Sleeves

Most garments use the traditional 'bat-wing' style sleeve, in which the body forms a diagonal between the elbow and the waist. This is cheaper to produce as it uses less fabric, but it also restricts movement when a user reaches up. It also explains why some garments need thumb loops – because it results in pulling back of the sleeve and cuff.

Lakeland garments use the more expensive inset sleeve in which the body and arm follows the shape of the body. This allows greater freedom when reaching up and results in much less pulling back of the sleeve – so no thumb loops are required.

2. Double zip and storm flap

ChemMax® garments feature a double zip with handy ring-pulls and double storm flap front fastening for superior protection.

3. Two-piece crotch gusset

The crotch is invariably the point where garments split first, partly because this is where most stress is apparent, and partly because on cheaper garments it is the point where four seams – two body and two leg - meet at one point.

Lakeland garments feature an inserted crotch gusset of two dart-shaped fabric pieces. This creates a more shaped body which spreads the stress and allows greater freedom of movement.

4. Cushioned Knee-Pads

ChemMax® garments and some Cool Suits® feature double-layer cushioned knee-pads which add comfort and durability in applications where crawling or kneeling is required.



5. Three-piece hood with shaped center piece

Some cheaper garments feature a simple 2-piece hood. Such hoods do not fit the head properly, restrict head movement and generally have a poor fit to respirator masks.

Lakeland garments not only feature a 3-piece hood which creates a more 3-D fit and resolves these problems, in addition the centre piece is a 'pointed oval' shape resulting in an even better fitting hood.

6. Higher neck line

For improved neck protection and better respirator mask fit.

7. CE Chest Label

Lakeland CE coveralls feature a chest label containing all the legally required marking for CE certification, so users and supervisors can easily identify the correct garment is being worn.

8. Push-Lock® glove connection system

All Lakeland chemical suits feature cuffs designed to work with the Push-Lock® glove connection system (see page 25) which provides a fully sealed, Type 3 tested connection with most chemical gloves.



ChemMax® 1



Lightweight coverall for Type 3 & 4 protection against a wide range of chemicals - 87gsm.

- Very lightweight, soft and flexible fabric.
- Low noise level - improved comfort and safety.
- Very cost effective Type 3 & 4 chemical protection.
- Infectious Agent Barrier - passes at highest classes in all four EN 14126 bio-hazard tests (version used extensively by UK Government health workers in 2015 West African Ebola Crisis).
- Cushioned double-layer knee pads for increased comfort and safety.
- Improved Super-B style coverall: superior fit, wearability and durability.
- Three-piece hood, inset sleeves and diamond crotch gusset results in best fitting garment on the market.
- New design three-piece hood with tapered center piece for superior face and respirator mask fit.
- New higher neck and zip flaps for improved face/neck protection.
- Double zip & storm flap front fastening for safe and secure protection

Physical Properties				
		ChemMax® 1	Brand A	Brand B
Property	EN Standard	CE Class	CE Class	CE Class
Abrasion Resistance	EN 530	2	5	3
Flex Cracking	ISO 7854	1	3	6
Trapezoidal Tear	ISO 9073	4/3	1	2
Tensile Strength	EN 13934	3	3	2
Puncture Resistance	EN 863	2	2	2
Surface Resistivity	EN 1149	Pass	Pass	Pass
Seam Strength	EN 13935-2	170N	>125N	>125N

Permeation Test Data *				
Liquid chemicals from EN 6529 Annex A. For a full list of chemicals tested see Permeation Data Tables or Chemical Search at <a href="http://www.lakeland.com/europe">www.lakeland.com/europe</a> . Tested at saturation unless stated.				
		ChemMax® 1	Brand A	Brand B
Chemical	CAS No.	CE Class	CE Class	CE Class
Acetone	67-64-1	NT	NT	1
Acetonitrile	70-05-8	NT	NT	Imm
Carbon Disulphide	75-15-0	NT	NT	Imm
Dichloromethane	75-09-2	NT	NT	Imm
Diethylamine	209-89-7	3	NT	Imm
Ethyl Acetate	141-78-6	NT	NT	Imm
n-Hexane	110-54-3	Imm	NT	Imm
Methanol	67-56-1	Imm	NT	6
Sodium Hydroxide (30%)	1310-73-2	6	6	6
Sulphuric Acid (96%)	7664-93-9	6	6	6
Tetrahydrofuran	109-99-9	NT	NT	Imm
Toluene	95-47-6	NT	NT	Imm

\* NB = normalised breakthrough. This is the time taken for the PERMEATION RATE to reach 1.0µg/minute/cm² in controlled laboratory conditions at 23°C. It is NOT the point at which breakthrough first occurs. For safe use times see Selection Guide and PermaSURE®.

Areas shaded green indicate where ChemMax® 1 is either equal to or better than the equivalent brand A and B products.



ChemMax® 1 is available in Yellow



ChemMax® 1 Styles



**428**  
Coverall with elasticized hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



**430**  
Coverall 'Plus' with hood and attached feet/boot cuffs. Elasticized cuffs and waist. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



**C1S27Y**  
Smock / Gown with rear entry / ties and elasticized cuffs.  
Size: One Size



**C1S650**  
Apron with ties  
Size: M - XL



**400**  
Encapsulated suit with flat back. To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit.  
Size: M - XXL



**450**  
Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.  
Size: M - XXL



**C1S860**  
Sleeves  
Size: One size



**C1S903**  
Overboots with anti-slip sole  
Size: L-XL



ChemMax® 2



Proprietary established chemical barrier film laminated to spunbond PP substrate -135gsm

- Extremely soft and flexible compared to coveralls offering similar protection level.
- White with grey seams for easy identification & high visibility.
- Low noise level - improved comfort and safety.
- Low price compared to other coveralls offering similar protection.
- Permeation testing achieves similar or better result on 66% of 100 chemicals tested compared to more expensive competitors.
- Cushioned double-layer knee pads for increased comfort and safety.
- Improved Super-B style coverall: superior fit, wearability and durability.
- Three-piece hood, inset sleeves and diamond crotch gusset results in best fitting garment on the market.
- New design three-piece hood with tapered center piece for superior face and respirator mask fit.
- New higher neck and zip flaps for improved face/neck protection.
- Double zip & storm flap front fastening for safe and secure protection



ChemMax® 2 is available in White with gray seams



ChemMax® 1 Styles



428

Coverall with elasticized hood, cuffs,waist and ankles. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



430

Coverall 'Plus' with hood and attached feet/boot flap. Elasticized cuffs and waist. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



C2T730

Smock / Gown with rear entry / ties and elasticized cuffs.  
Size: M - XL



C2T735

Apron with ties  
Size: One Size



400

Encapsulated suit with flat back. To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit.  
Size: M - XXL



450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.  
Size: M - XXL



C2T740

Overboots with anti-slip sole  
Size: L-XL

Permeation Test Data *				
Liquid chemicals from EN 6529 Annex A. For a full list of chemicals tested see Permeation Data Tables or Chemical Search at <a href="http://www.lakeland.com/europe">www.lakeland.com/europe</a> . Tested at saturation unless stated.				
	ChemMax® 2	Brand C	Brand D	
Chemical	CAS No.	CE Class	CE Class	CE Class
Acetone	67-64-1	6	6	6
Acetonitrile	70-05-8	6	6	6
Carbon Disulphide	75-15-0	Imm	6	Imm
Dichloromethane	75-09-2	Imm	Imm	Imm
Diethylamine	209-89-7	NT	6	Imm
Ethyl Acetate	141-78-6	6	6	6
n-Hexane	110-54-3	6	6	6
Methanol	67-56-1	6	6	6
Sodium Hydroxide (30%)	1310-73-2	6	NA	6
Sulphuric Acid (96%)	7664-93-9	6	6	6
Tetrahydrofuran	109-99-9	3	6	6
Toluene	95-47-6	Imm	6	6

\* NB = normalised breakthrough. This is the time taken for the PERMEATION RATE to reach 1.0µg/minute/cm2 in controlled laboratory conditions at 23oc. It is NOT the point at which breakthrough first occurs.

For safe use times see Selection Guide and PermaSURE®.Areas shaded green indicate where ChemMax® 2 is either equal to or better than the equivalent brand C and D products.

ChemMax® 3

POWERED BY PERMASURE



Superior multi-layer barrier films laminated to spunbond PP substrate - 170gsm

- Extruded fabric construction. Results in smoother and more consistent fabric than bonded or glued competitors.
- Superior softness and flexibility and more consistent chemical barrier (no 'pinching' or thinner bond points as seen in competitor fabrics).
- European manufactured fabric, tested against a full range of chemical warfare agents for anti-terror and civil defense operations.
- Very low noise level. Safer and improved comfort.
- Cushioned double-layer knee pads for increased comfort and safety.
- Improved Super-B style coverall: superior fit, wearability and durability.
- Three-piece hood, inset sleeves and diamond crotch gusset results in best fitting garment on the market.
- New design three-piece hood with tapered center piece for superior face and respirator mask fit.
- New higher neck and zip flaps for improved face/neck protection.
- Double zip & storm flap front fastening for safe and secure protection.

Physical Properties				
		ChemMax® 3	Brand C	Brand D
Property	EN Standard	CE Class	CE Class	CE Class
Abrasion Resistance	EN 530	6	6	6
Flex Cracking	ISO 7854	4	1	5
Trapezoidal Tear	ISO 9073	5/4	2	3
Tensile Strength	EN 13934	3	3	2
Puncture Resistance	EN 863	2	2	2
Burst Strength	EN 13938	2	NA	2
Seam Strength	EN 13935-2	4	4	4

Permeation Test Data *				
Liquid chemicals from EN 6529 Annex A. For a full list of chemicals tested see Permeation Data Tables or Chemical Search at <a href="http://www.lakeland.com/europe">www.lakeland.com/europe</a> . Tested at saturation unless stated.				
	ChemMax® 3	Brand C	Brand D	
Chemical	CAS No.	CE Class	CE Class	CE Class
Acetone	67-64-1	6	6	6
Acetonitrile	70-05-8	6	6	6
Carbon Disulphide	75-15-0	6	6	Imm
Dichloromethane	75-09-2	6	Imm	Imm
Diethylamine	209-89-7	NT	6	Imm
Ethyl Acetate	141-78-6	6	6	6
n-Hexane	110-54-3	6	6	6
Methanol	67-56-1	6	6	6
Sodium Hydroxide (30%)	1310-73-2	6	NA	6
Sulphuric Acid (96%)	7664-93-9	6	6	6
Tetrahydrofuran	109-99-9	6	6	6
Toluene	95-47-6	6	6	6

\* NB = normalised breakthrough. This is the time taken for the PERMEATION RATE to reach 1.0µg/minute/cm² in controlled laboratory conditions at 23°C. It is NOT the point at which breakthrough first occurs. **For safe use times see Selection Guide and PermaSURE®.**

Areas shaded green indicate where ChemMax® 3 is either equal to or better than the equivalent brand C and D products.



ChemMax® 3 is available in Gray



ChemMax® 3 Styles



428

Coverall with elasticized hood, cuffs,waist & ankles. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



430

Coverall 'Plus' with hood and attached feet/boot flap Elasticized cuffs and waist. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



400

Encapsulated suit with flat back. To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit.  
Size: M - XXL



450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.  
Size: M - XXL

ChemMax®4 Plus



ChemMax® 4 Plus is available in Military Green

Multi-layer barrier films laminated to spunbond PP substrate - 170gsm

- Extruded fabric construction. Results in smoother and more consistent fabric than bonded or glued competitors.
- Superior softness and flexibility and more consistent chemical barrier (no ‘pinching’ or thinner bond points as seen in competitor fabrics).
- European manufactured fabric, tested against a full range of chemical warfare agents for anti-terror and civil defense operations.
- Very low noise level. Safer and improved comfort.
- Cushioned double-layer knee pads for increased comfort and safety.
- Improved Super-B style overall: superior fit, wearability and durability.
- Three-piece hood, inset sleeves and diamond crotch gusset results in best fitting garment on the market.
- New design three-piece hood with tapered center piece for superior face and respirator mask fit.
- New higher neck and zip flaps for improved face/neck protection.
- Double zip & storm flap front fastening for safe and secure protection.

ChemMax® 4 Plus Styles



428

Coverall with elasticized hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



430

Coverall ‘Plus’ with hood and attached feet/boot flap Elasticized cuffs and waist. Double front zip fastening, cushioned kneepads.  
Size: S - XXXL



400

Encapsulated suit with flat back. To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit.  
Size: M - XXL



450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.  
Size: M - XXL

Physical Properties						
		Brand C	Brand D	ChemMax®4 Plus	Brand E	Brand F
Property	EN Std	CE Class	CE Class	CE Class	CE Class	CE Class
Abrasion Resistance	EN 530	6	6	6	6	6
Flex Cracking	ISO 7854	1	5	1	1	1
Trapezoidal Tear	ISO 9073	2	3	MD 5 / CD 4	5	3
Tensile Strength	EN 13934	3	2	3	4	4
Puncture Resistance	EN 863	2	2	2	2	2
Burst Strength	EN 13938	NA	2	2	NA	NA
Seam Strength	EN 13935-2	4	4	4	5	5

Permeation Test Data *						
Liquid chemicals from EN 6529 Annex A. For a full list of chemicals tested see Permeation Data Tables or Chemical Search at <a href="http://www.lakeland.com/europe">www.lakeland.com/europe</a> . Tested at saturation unless stated.						
		Brand C	Brand D	ChemMax®4 Plus	Brand E	Brand F
Chemical	CAS No.	CE Class	CE Class	CE Class	CE Class	CE Class
Acetone	67-64-1	6	6	6	6	6
Acetonitrile	70-05-8	6	6	6	6	6
Carbon Disulphide	75-15-0	6	Imm	6	6	6
Dichloromethane	75-09-2	Imm	Imm	6	6	6
Diethylamine	209-89-7	6	Imm	6	6	6
Ethyl Acetate	141-78-6	6	6	6	6	6
n-Hexane	110-54-3	6	6	6	6	6
Methanol	67-56-1	6	6	6	6	6
Sodium Hydroxide (50%)	1310-73-2	NA	6	6	6	6
Sulphuric Acid (98%)	7664-93-9	6	6	6	6	6
Tetrahydrofuran	109-99-9	6	6	6	6	6
Toluene	95-47-6	6	6	6	6	6
Chemical- gas						
Ammonia 99%	7664-41-7	6	6	6	6	6
Chlorine 99.5%	7782-50-5	6	6	6	6	6
Hydrogen Chloride (99%)	7647-01-0	6	6	6	6	6
* NB = normalised breakthrough. This is the time taken for the PERMEATION RATE to reach 1.0µg/minute/cm² in controlled laboratory conditions at 23°C. It is NOT the point at which breakthrough first occurs. For safe use times see Selection Guide and PermaSURE®.						

\* NB = normalised breakthrough. This is the time taken for the PERMEATION RATE to reach 1.0µg/minute/cm2 in controlled laboratory conditions at 23oc. It is NOT the point at which breakthrough first occurs. For safe use times see Selection Guide and PermaSURE®.

Areas shaded green indicate where ChemMax® 4 Plus is either equal to or better than the equivalent brand C , D, E and F products.



Use PermaSURE® to quickly calculate safe wear times for ChemMax® 4 Plus

ChemMax® Encapsulated Suits

ChemMax® Encapsulating suits use a fully encapsulating design including full hood with face visor and attached boots

- Rear entry encapsulating suit with 20mil PVC visor
- Flat and expanded back versions available (see styles below)
- Attached boots with boot over-flaps
- Rear mounted zip with storm flap
- One hood-mounted exhaust port with protective shroud to allow escape of exhaled air
- Elastic wrists (use with push-lock connection system - not supplied - optional extra)
- Spacious and generous design for comfort and freedom of movement
- Available in ChemMax® 1, 2, 3 and 4 Plus fabrics.
- Certified to Types 3 & 4. These are not gas-tight suits and are not suitable for protection against hazardous gases and vapors

Physical Properties					
		ChemMax® 1	ChemMax® 2	ChemMax® 3	ChemMax® 4 PLUS
Property	EN Standard	CE Class	CE Class	CE Class	CE Class
Abrasion Resistance	EN 530	2	6	6	6
Flex Cracking	ISO 7854	1	6	4	1
Trapezoidal Tear	ISO 9073	4/3	4	5/4	MD 5 / CD 4
Tensile Strength	EN 13934	3	3	3	3
Puncture Resistance	EN 863	2	2	2	2
Burst Strength	EN 13938	2	2	2	2
Seam Strength	EN 13935-2	170N	4	4	4

Chemical Permeation Test Data

For the latest data available refer use the Chemical Search Page (accessible at [www.lakeland.com](http://www.lakeland.com))

ChemMax® 3, ChemMax® 4 Plus and Interceptor® Plus fabrics work with the PermaSURE® smart-phone app for calculation of real world safe wear times according to temperature and the toxicity of the specific chemicals - with over 4000 chemicals in the database.

Permeation test data should not be used as an indication of safety or safe wear time and if used so can give a false impression of safety. Users may be coming into contact with a chemical without realising it.

Safe-wear times should be calculated taking into account permeation rate, temperature and chemical toxicity.



**WARNING!** These coveralls are not gas tight and are not suitable for protection in environments where hazardous gases and vapors may be present but will provide superior protection in more hazardous liquid chemical environments.



Expanded Back

Flat Back

ChemMax® Encapsulating Suit Styles



400

**Flat back with air inlet hose**  
To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit. The exhaust valve allows escape of exhaled air.  
Size: M - XXL



450

**Expanded back for internally worn self-contained breathing apparatus**  
To be worn with self-contained breathing apparatus for breathing purposes. The exhaust valve allows escape of exhaled air.  
Size: M - XXL



ChemMax® Encapsulated Suits are available in these fabrics



ChemMax® 1



ChemMax® 2



ChemMax® 3



ChemMax® 4



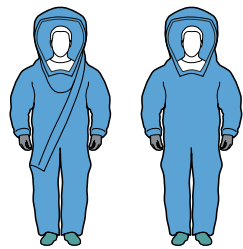
Interceptor® Plus  
POWERED BY PERMASURE



Type 1a gas-tight coverall  
Use with internal BA for protection  
against hazardous gases and vapors

- Multi-layer film technology creates light and flexible high barrier against a wide range of high hazard chemicals. Weight 365gsm.
- Certified to EN 943-1:2015+A1:2019 Type 1a (Note: Excluding clause 5.4)
- Superior design featuring double-taped seams (inside & out).
- Standard or wide-vision visor options; two-layer visor with unique sealing technology for high chemical barrier.
- Double layer chemical glove system.
- European manufactured fabric. Tested against a full range of chemical warfare agents for anti-terror and civil defence operations.
- Very soft and flexible material for enhanced comfort.
- Front and rear entry design options.
- Inner chemical glove with outer 27mil butyl glove.
- Two rear mounted exhaust valves.
- Attached sock boot with boot overflaps.

Interceptor® Plus Styles



- Basic Style Options**
- ICP 640**  
Front entry/standard width visor
  - ICP 650**  
Rear entry / standard width visor
  - ICP 640W**  
Front entry / wide vision visor
  - ICP 650W**  
Rear entry / wide vision visor

- Fully encapsulated suit featuring double layer visor, gas-tight zip and attached boots and gloves:
- Expanded back, attached sock boots with boot flaps
  - Seams sealed inside and out
  - 122cm gas tight zipper with outer storm flaps
  - Neoprene double layer attached gloves
  - 2 exhaust valves
  - Inside waist belt
  - Storage bag included

**PermaSURE®**  
Use PermaSURE® to quickly calculate  
safe wear times for Interceptor® Plus



Physical Properties					
		Interceptor® Plus	Brand E	Brand F	Brand G
Property	EN Standard	CE Class	CE Class	CE Class	CE Class
Abrasion Resistance	EN 530	6	6	6	6
Flex Cracking	ISO 7854	2	1	1	5
Trapezoidal Tear	ISO 9073	6	5	3	3
Tensile Strength	EN 13934	4	4	4	6
Puncture Resistance	EN 863	2	2	2	3
Burst Strength	EN 13938	4	NA	NA	NA
Seam Strength	EN 13935-2	TBA	5	5	6

Permeation Test Data					
Liquid chemicals from EN 6529 Annex A. For a full list of chemicals tested see Permeation Data Tables or Chemical Search at <a href="http://www.lakeland.com/europe">www.lakeland.com/europe</a> . Tested at saturation unless stated.					
		Interceptor® Plus	Brand E	Brand F	Brand G
Chemical	CAS No.	CE Class	CE Class	CE Class	CE Class
Acetone	67-64-1	6	6	6	6
Acetonitrile	70-05-8	6	6	6	6
Carbon Disulphide	75-15-0	6	6	6	6
Dichloromethane	75-09-2	6	6	6	6
Diethylamine	209-89-7	6	6	6	6
Ethyl Acetate	141-78-6	6	6	6	6
n-Hexane	110-54-3	6	6	6	6
Methanol	67-56-1	6	6	6	6
Sodium Hydroxide (30%)	1310-73-2	6	6	6	6
Sulphuric Acid (96%)	7664-93-9	6	6	6	6
Tetrahydrofuran	109-99-9	6	6	6	6
Toluene	95-47-6	6	6	6	6
Chemical- gas					
Ammonia 99%	7664-41-7	6	6	6	6
Chlorine 99.5%	7782-50-5	6	6	6	6
Hydrogen Chloride (99%)	7647-01-0	6	6	6	6
* NB = normalised breakthrough. This is the time taken for the PERMEATION RATE to reach 1.0µg/minute/cm² in controlled laboratory conditions at 23°C. It is NOT the point at which breakthrough first occurs. For safe use times see Selection Guide and PermaSURE®. Powered by PermaSURE® easy-to-use smartphone app with quick access to safe-wear times for over 4000 chemicals.					

Chemical Warfare Agents				
Interceptor® Plus has been tested independantly against permeation by common chemical warfare agents according to the FINABEL test method. (1 x 50 µg / 370c/ 24H)				
Agent	Acronym	No of tests	Fabric result hours:min	Seam result hours:min
Sulfur mustard	HD	3	>24:00	>24:00
Lewisite	L	3	>24:00	>24:00
V-Agent	VX	3	>24:00	>24:00
Sarin	GB	3	>24:00	>24:00
Tabun	GA	3	>24:00	>24:00
Soman	GD	3	>24:00	>24:00
Note: that testing has been conducted against the Interceptor® Plus fabric and the seam. In the tests, the challenge was made against the seam with 50% of the fabric only and 50% on the seam. As can be seen no permeation was recorded in 24 hours across 3 tests on each agent.				

Areas shaded green indicate where Interceptor® is either equal to or better than the equivalent brand E, F and G products.

Interceptor® Plus is available in Blue

Pyrolon®



Lakeland Pyrolon® Coveralls combine Type 3 & 4 chemical protection with unique FR properties. Pyrolon® fabrics will not ignite and burn so can be safely used where contact with flame may be a hazard.



Pyrolon® CRFR  
(chemical repellency / flame retardency) - 144gsm

- Combines Flame Retardency to EN 14116 with Type 3 & 4 chemical protection (approximately equivalent to ChemMax® 1).
- Outer FR PVC barrier film laminated to proprietary nonwoven substrate of viscose rayon (exceptionally soft and flexible fabric)
- Fabric will not ignite or burn: chars at temperature lower than its ignition point.
- Can be worn over woven FR garments without compromising flame and heat protection.
- Available in orange and grey

Physical Properties					
Flame Retardency EN 14116		Index 1 : Should not be worn next to the skin			
Property	EN Standard	CE Class	Property	EN Standard	CE Class
Abrasion Resistance	EN 530	6	Tensile Strength	EN 13934	3
Flex Cracking	ISO 7854	5	Puncture Resistance	EN 863	2
Trapezoidal Tear	ISO 9073	3/2	Burst Strength	EN 13938	2
Seam Strength	EN 13935-2	4	Permeation test data on Pyrolon® available separately.		



Pyrolon® CBFR  
(chemical barrier / flame retardency) - 235gsm

- Coverall with high level chemical barrier for protection against a wide range of hazardous chemicals
- Certified as primary FR workwear to EN 11612 (A1/C1) - will provide protection against heat and flame without wearing an FR garment underneath.
- Meets the requirements of FR standard EN 14116 – to Index 3 (as tested according to EN 15025 - not Index 1 as other FR disposables). Note that Index 3 is the same requirements as detailed for FR garments in EN 11612 for thermal protective garments
- Single zip and double storm flap front fastening with hook & loop seals enabling re-use where appropriate (chemical suits should ONLY be re-used if uncontaminated and undamaged. Decision on re-use is the users’ responsibility)
- Coverall with hood, elasticized cuffs, waist and ankles. Double layer, cushioned kneepads for comfort and durability. Version with attached feet available.

Physical Properties					
Property	EN Standard	CE Class	Property	EN Standard	CE Class
Abrasion Resistance	EN 530	6	Puncture Resistance	EN 863	2
Flex Cracking	ISO 7854	3	Anti-static (charge decay) *	EN 1149-3	SF=0.1/ HDT=0.24s
Trapezoidal Tear	ISO 9073	3	Seam Strength	EN 13935-2	4
Tensile Strength	EN 13934	3			
* Anti-static tested according to EN 1149-3 (Charge decay). Requirements in EN 1149-5 are: SF (Shielding Factor) >0.2 or Half Decay Time < 4s, so HDT of 0.24s is well within the requirement					



Pyrolon® TPCR



Lakeland Pyrolon® Coveralls combine Type 3 & 4 chemical protection with unique FR properties. Pyrolon® fabrics will not ignite and burn so can be safely used where contact with flame may be a hazard.



Pyrolon® TPCR  
(thermal protection / chemical repellency) - 330gsm

- Unique combination of thermal protection to standard EN 11612 and chemical protection to Type 3 & 4.
- Can REPLACE woven FR garments in areas where FR protection and chemical protection is required or in very dirty / stressed environments - can reduce wastage of FR coveralls.
- Excellent arc flash protection - tested to 21 cal/cm<sup>2</sup>.
- Tough & durable fabric - may be used multiple times if uncontaminated, clean and undamaged.
- Available in orange

Flame and Heat Protection EN 11612		A1 : Class 1 & 2 / A2 : Class 1 & 2 / B1 / C1/ D1/ E1/ F1			
Electric Arc Protection EN 61482-1-2		Class 1 / ASTM F1959M-06A : 21.9 cal/cm2			
Physical Properties					
Property	EN Standard	CE Class	Property	EN Standard	CE Class
Abrasion Resistance	EN 530	6	Tensile Strength	EN 13934	3
Flex Cracking	ISO 7854	5	Puncture Resistance	EN 863	2
Trapezoidal Tear	ISO 9073	2	Seam Strength	EN 13935-2	4
Permeation test data on Pyrolon® available separately.					

Why use Pyrolon® ?

Many applications require both thermal protection and chemical protection. How do you provide both?

Currently users often wear a Thermal Protective Garment (TPG) for flame protection and wear a standard chemical suit OVER it for chemical protection.

This creates a hazard!

Standard chemical suit fabrics are based on polypropylene/polyethylene and in contact with flames will ignite and burn.

Being thermoplastic they will melt and drip, adhering to the TPG fabric below,

transferring heat energy to the skin beneath and to other surfaces, thus potentially spreading the fire.

In a flash fire situation this will dramatically increase the heat energy contacting the skin and thus the incidence of body burn.

Even in the case of contact with a small flame, a standard chemical suit fabric may ignite and cause burns.

Wearing a standard chemical suit over a TPG can dramatically compromise thermal protection.

Lakeland Pyrolon® garments use a unique, viscose-based fabric which will not ignite (certified to EN 14116 Index 1).

Pyrolon® TPCR offers full thermal protection to EN 11612 and can replace a standard thermal protective garment.



EN Standard -EN 14116 Protection against Heat and Flame, Limited Flame Spread



This standard measures the tendency of a fabric to ignite and propagate a flame, using the vertical flame test method EN 15025 which applies a flame to the center or bottom edge of a fabric sample.

Index 1 requires that any flame should not propagate to the top or sides of the fabric, that there should be no flaming debris or drips and that there should be no spreading afterglow once burning has ceased. It does however allow the flame contact to form a hole in the fabric.

Thus certification to EN 14116 Index 1 indicates a fabric that will not ignite in contact with a flame.

However it provides NO protection against flame and should not be worn next to the skin.

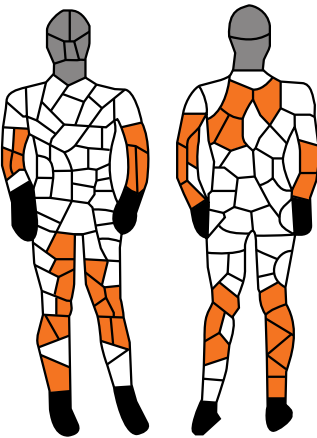
Thermal Mannequin Testing: Predicted Body Burn

Thermal Mannequin Testing is optional in EN 11612 for thermal protective garments and provides a method of predicting percentage body burn in a flash fire situation and therefore the effectiveness of the protection provides.

The body maps below show the predicted body burn in three tests.

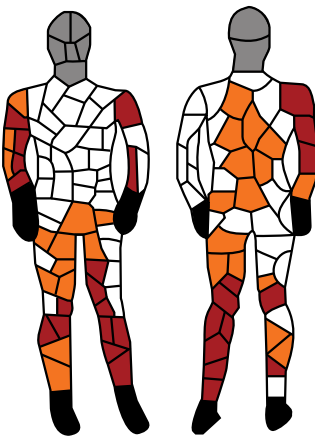
- A TPG only (Nomex® IIIA).
- A TPG with a standard disposable chemical suit worn over it.
- A TPG with Pyrolon® CRFR worn over it.

Thermal Protective Garment (Nomex® IIIA)



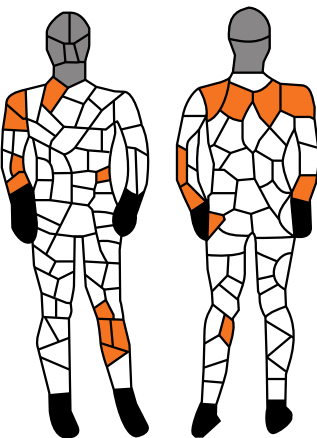
37%  
PREDICTED BODY BURN  
1st degree burns only

Standard Disposable Chemical Suit Worn Over a Thermal Protective Garment



53%  
PREDICTED BODY BURN  
1st and 2nd degree burns

Pyrolon® CRFR Worn Over a Thermal Protective Garment



24%  
PREDICTED BODY BURN  
1st degree burns only

The testing shows that wearing a standard chemical suit over a Thermal Protective Garment will reduce thermal protection, while wearing Pyrolon® CRFR chemical suit over a Thermal Protective Garment will increase thermal protection.



Push-Lock® Glove Connection System



Tested to Type 3 with ChemMax® 1, 2, 3 and 4 Plus suits



WATCH OUR VIDEO!



See how quick and simple the installation process is. Watch the instructional video by scanning the QR Code or visiting [www.lakeland.com/blog/cat/technicalvideos](http://www.lakeland.com/blog/cat/technicalvideos)

Quickly Install Or Remove Chemical Gloves On Lakeland ChemMax® or Interceptor® Suits!

The Lakeland ChemMax® Push-Lock® Glove System is a simple method of attaching most types of chemical gloves to the garment sleeve through the use of two concentric rings. The system has been fully tested to a CE Type 3 Jet Test and is certified for use with all Lakeland ChemMax® and Interceptor® chemical protective coveralls. Lakeland's Push-Lock® Glove System is reusable and may need decontamination before reuse.

Lakeland item number JFR2 contains one set of Push-Lock® rings, and will secure one pair of gloves to any Lakeland chemical protective coverall.

The Advantages of the Push-Lock System

Adhesive Tape	Push-Lock® Glove Connection
Haphazard - no control or knowledge as to whether the tape actually creates a seal.	Tested to the Type 3 Jet test with ChemMax® 1,2, 3 and 4 Plus
Two operatives needed - the tape must be applied by another operative after the suit is donned.	The user attaches the gloves before donning the suit.
Cost - correct chemical tape for gloves sealing is expensive.	The Push-Lock® glove connection system can be used repeatedly - the more uses the more cost effective it becomes.
Cost control - very difficult to control how much tape is used.	Cost is known precisely and gets less with re-use.
Uncomfortable - tape MUST be applied tightly to the wrist if it is effective.	The Push-Lock® system sits loosely and comfortably on the wrist.
Must be removed by another operative and damages the suit sleeve, making it unusable in the process.	Suit is removed by the user with the gloves attached. Suit can be re-used if undamaged and uncontaminated.

How the Push-Lock Glove System Works

1. Pull the cuff of the glove over the white ring - insert the narrower end of the ring first.
2. Pull the cuff over the full length of the ring
3. Push the glove with ring into the garment sleeve.
4. Ensure the correct glove is used for each sleeve and that the palm of the glove faces the front of the garment.
5. Holding the sleeve behind the inner ring slide the black ring over the glove and on to the garment sleeve.
6. Push tightly over the inner ring and ensure the sleeve hem remains hooked over the lip of the inner ring.
7. Ensure both rings are attached securely and correctly to each sleeve

Cool Vest®



Cool Vest® is designed to be worn underneath any chemical suit to keep the wearer cool and comfortable in warm environments

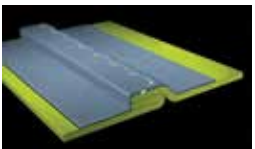
- Uses phase change material pouches to maintain a cooling temperature of 14oC for up to 3 hours\*
- Four pouches are inserted into pockets inside the vest; two in the back and two in the front.
- Pouches gradually absorb heat from the body so the wearer stays cool, resulting in improved work rates and productivity.
- Phase-change pouches are easily 'charged' by placing in a refrigerator, in cool water or simply in a cool area overnight.
- Cool Vest® fabric is 100% 180gsm cotton with pockets made in 100gsm polyester mesh.
- Available in two sizes : S-L and XL-XXL
- Available as a single vest with one set of cooling phase-change pouches.
- Sets of cooling pouches available separately so that one set can be charged while one is used to allow continuous working

(\* Subject to work type, ambient temperature and environment)

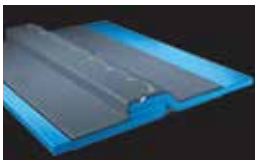


Seams and Sizing

Seams



All ChemMax® coveralls feature **stitched and taped** seams for maximum strength and protection.



Interceptor® Plus features **stitched seams with taping applied to both sides** of the seam for superior gas-tight security.

Garment Sizing

Lakeland garments are cut and sized generously and according to the Super-B style for maximum freedom.

Size	Body Height (cm)	Chest (cm)	Waist (cm)
S	164-170	84-92	82-88
M	170-176	92-100	88-94
L	176-182	100-108	94-100
XL	182-188	108-116	100-106
XXL	189-194	116-124	106-112
XXXL	194-200	124-132	112-114

Selection of the appropriate sized garment is important in maximizing comfort, protection and durability.

\* Competitor brand results are from competitors' own websites and were correct at the time of publication. Users are recommended to check up to date information with competitors before making any assessment based on specific chemicals. Other chemical test results may be available from competitors.



# Selection, Use, Storage, Shelf-Life and Disposal

Selection of the correct protective clothing for the task is important in ensuring adequate protection, optimum comfort and minimal cost. While ensuring certification to the appropriate standards related to the application is a good starting point, CE standards represent MINIMUM required performance and selection may depend on a combination of factors relating to the hazard, the task and the environment, many of which may NOT be addressed by standards. Furthermore, standards generally deal with hazards in isolation whereas in the real world users often face multiple hazards at the same time; if more than one item of PPE must be used it may be important to consider how they work together and whether use of one compromises effectiveness of another (e.g. if both chemical and FR protection is required, you cannot simply wear a standard chemical suit over a thermal protective garment (see Pyrolon®, page 22).

## Use

Before use, all suits should undergo a thorough visual inspection to ensure there are no tears, wear or other damage evident and that zips and elastic are intact and function correctly. Do not use any garment with apparent damage or wear as this will compromise protection.

Donning and doffing (especially the latter during which suits may be contaminated) is a critical part of the application; correct donning is vital in ensuring correct protection is provided. Lakeland recommends written donning and doffing procedures are established and that a “buddy” system, in which a colleague assists in both donning and doffing and conducts the final check, should always be used. Detailed advice on donning and doffing is available from Lakeland separately and a video on donning and doffing of chemical suits is available on the web site.

During use where possible monitor suits for damage, wear or contamination. Damaged or heavily contaminated suits should be removed, disposed of and replaced as soon as possible.

## Re-Use

Most Lakeland garments are designed as single use and disposal is advised after one use. However, regardless of age, or whether a garment is classed as “disposable” or “re-usable”, if a garment is undamaged and uncontaminated by any chemical, it may be re-used if appropriate.

Note however that any fabric that has been previously contaminated by a chemical may have a lower breakthrough

time than when new. Contaminating chemicals may permeate into the fabric and cannot be removed by a decontamination shower or other cleaning method; decontamination may remove chemical on the surface but will not remove chemical that has permeated into the fabric. Thus we do not advise re-use of contaminated suits (whether ‘disposable’ OR ‘re-usable’) that have been contaminated by a hazardous chemical.

## Packaging

Most chemical and Type 5 & 6 coveralls are supplied in individual, sealed, vacuum packed polyethylene bags. (Vacuum packing saves 20 to 30% of freight and storage cost) and in outer cardboard cartons. Larger garments such as ARC® 43, Interceptor Plus® and ALM® are supplied individually.

## Storage

Most Lakeland chemical suits are manufactured from polymers which are inert materials and are unaffected by normal temperatures and conditions. They can be stored in normal storage facilities. Keep dry and avoid strong light or sunlight or temperatures below -15oC .

## Training

Training on selection, use and maintenance, include pressure testing of gas-tight suits is available on request from Lakeland staff.

## Shelf-life

Lakeland chemical and Type 5 & 6 suits are generally constructed from inert polymers that are unaffected by normal storage conditions. In unopened bags and in such conditions (-10oC to 50oC, dry and away from direct light) the expected shelf life can be 10 years or more. Some discoloration of fabrics may occur over time, but this merely relates to seepage of dyes and does not affect fabric performance.

However some specific properties of fabrics MAY alter over time. In particular anti-static properties result from a topical treatment which will degrade over time and in use

It is vital that all garments, regardless of age, but especially after a longer shelf life, are thoroughly checked for damage or wear immediately before use. Do not use any garment that appears worn or damaged. It is always the end user’s responsibility to ensure any garment is fit for purpose.

## Interceptor Plus®

Interceptor Plus® is a EN 943 Type 1a gas-tight garment that fully seals the wearer against harmful gases and vapors in the environment. Leak tightness is confirmed through the use of an internal pressure test which inflates the suit and then ensures it does not lose pressure over time.

Because damage may occur during freight we recommend that Interceptors® are pressure tested on receipt to ensure leak-tightness. For suits in storage we also recommend that a regular maintenance procedure should be established with checks every 6 to 12 months maximum that includes both an internal pressure test and a detailed visual check.

We also recommend that if possible Interceptor® suits should be pressure tested before use and after each use before being stored for re-use. Any suit that fails a pressure test should not be used in any hazardous area but may be downgraded for training purposes and should be clearly marked ‘Training Suit Only’.

All chemical suits should as a minimum undergo a thorough visual inspection before every use. Look for abrasion, tears, wear and any damage that might compromise protection. If in doubt do not use a suit in a hazardous area. Training and instructions on conducting pressure tests are available on request.

Note: that it is entirely the user’s responsibility to determine if re-use of a garment is safe.

## Disposal

Uncontaminated garments can be disposed of as standard waste according to local regulations. However, contaminated garments may require decontamination before disposal and must be disposed of according to regulations relating to the chemical concerned.

## CE Certification

All garments presented are certified to relevant CE standards. Lakeland’s policy is to ensure where possible garments are certified to the latest versions of standards. As required by the new PPE Regulation EU 2016\_425 Declarations of Conformity for all products are downloadable from [www.lakeland.com/europe](http://www.lakeland.com/europe) and copies of CE certificates are available on request.

Selection of protective clothing means choosing the best garment for the task in hand. This is important not only in ensuring adequate and effective protection, but also in optimizing comfort and minimizing cost.

CE certification ensures garments meet minimum performance requirements and is a good starting point for selecting the best suit for the job. However, every application is different and meeting CE minimum performance requirements does not mean a suit is perfect for all or that operators are adequately protected. There are many factors relating to the hazard, the task and the environment that may affect garment choice and these should be assessed as part of a selection procedure.





**In Canada****Toll Free:** 800-489-9131**Voice:** 519-757-0700**Fax:** 519-757-0799**Email:** sales-canada@lakeland.com**[www.lakeland.com/ca](http://www.lakeland.com/ca)**

The Lakeland range of chemical suits provides a wide choice of options for users requiring protection against hazardous liquid and gaseous chemicals.

This guide provides detailed technical information on the product range along with useful comparison charts allowing easy comparison with common alternative brands.

Comparisons show in most cases, whether considering physical properties or permeation barrier performance, Lakeland products offer the best combination of protection durability and comfort, and the unique garment designs and features make the best option for users in a variety of industries requiring protection from liquid and gaseous chemicals.

The guide also contains useful information on the factors and considerations that might affect the selection of garments

Lakeland Industries is the Global Leader in the design and manufacture of industrial clothing for protection against chemicals, flames and heat.