Lakeland®

The Guide
to Chemical Suit Selection

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

Why choose Lakeland?

Lakeland Chemical Protective Clothing

Chemical Suit Selection Guide

This guide provides detailed descriptions and technical information on the range of chemical protective clothing and accessories offered by Lakeland.

This booklet also presents a simple guide to selection of the appropriate garment for your application, considering three types of factors in determining the best garment to use.

Selection of the most appropriate garment is important in ensuring that the best protection is provided, that the comfort level is optimised and that you don't pay for more protection than you need.

The option of PermaSURE® with Lakeland coveralls *(see page 9)* provides users for the first time access to genuine safe-use times for chemical suits incorporating temperature, exposure time and specific chemical toxicity.

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

Broadest range of products and fabrics

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.

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

CE standards represent MINIMUM performance levels.	Standards deal with generalities and cannot account for wide variations in real-world conditions.	Standards are commonly misunderstood or misinterpreted, or the detail of standards is not considered.
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.**	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 23°C. 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.**	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)*

Use the link to download our e-books on why CE certification does not make a product safe to use.

There is more to selecting a chemical suit than simply checking it meets a CE standard.

This guide provides users with a summary of the types of issues that need to be considered to ensure workers are adequately protected.

Introduction

The following pages provide a guide to the factors that should be considered when selecting the correct chemical protective garment for your specific application. Pages are colour-coded by section for ease of reference.

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. The **task/hazard type?**	What type of spray hazard does the application present? Determining which applies can have important consequences for garment options.
3. Physical/**environmental factors?**	What physical and environmental factors might be important in the application?

Which garment to use?

1.0 The chemical

- What does a permeation test breakthrough tell you?
- What is the difference between test breakthrough and first breakthrough?
- How can permeation test results be used?

The chemical 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.

'Normalised breakthrough' or 'breakthrough' is a figure suitable for fabric comparison only and should NOT be used to indicate safe-use time.

What is permeation 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.*

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!"

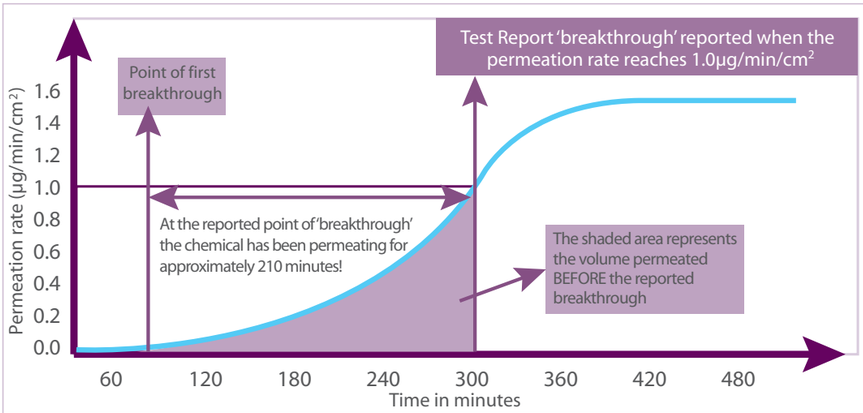
! However

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.

The permeation test breakthrough gives NO information about how long you are safe!

EN 6529 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'



The graph shows a classic permeation curve and indicates the point of reported 'breakthrough' compared with the point of first breakthrough.

(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.)

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

Which garment to use?

1.1 The chemical

- How do you know how long you are safe?
- 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?**

Safe-use time can be identified using a simple calculation in two stages:

1. Calculate **volume** permeated

Permeation Rate X Duration of Exposure X Area of suit Exposed = Volume Permeated

- Permeation Rate: As permeation rate varies over time an average can be calculated - or use the maximum rate for a wide safety margin.
- Duration of Exposure: The time the suit may be exposed to the chemical - how long the task will take.
- Area of suit Exposed: The total area of the suit that might be contaminated.

! However

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.

2. Compare with chemical **toxicity** limit

Is the volume permeated **greater** or **less than** the chemical toxicity limit?

If volume permeated < chemical toxicity **= SAFE**

If volume permeated < chemical toxicity **= NOT SAFE**

PermaSURE® is a smart-phone app that does this calculation for you on ChemMax® 3, ChemMax® 4 Plus and Interceptor® Plus garments

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.

PermaSURE®

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

And for over 4,000 chemicals

Contact Lakeland for more information

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 can can lead to users being 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.

Guide to Garment Selection - Permeation Test Comparison Tables

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 Dianaline	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

NT = Not Tested
NA = Not Available
Imm = Immediate

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.

1.2 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*.

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

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.

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

Protect Your People™

Guide to Garment Selection - Permeation Test Comparison Tables

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
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

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
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 Dianaline	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 (<10°C)	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
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

Guide to Garment Selection - Permeation Test Comparison Tables

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
10217-52-4	Hydrazine Hydrate (64% Hydrazine)	100%	Liquid	NT	6	6	NA	NA
7647-01-0	Hydrocloric 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

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
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
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-Diiso-cyanate	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

Table 3:

ChemMax® 4 Plus and Interceptor® 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.

PermaSURE® is an on-line app for use with ChemMax® garments. It provides users with safe-use times based on exposure times, temperature and chemical toxicity.

Guide to Garment Selection
PermaSURE® : Real Safe-Use Times for ChemMax® 3, 4 Plus and Interceptor® Plus

1.3 What is PermaSURE®

Permeation test breakthrough is NOT when the chemical first breaks through the fabric and provides NO information on how long you are safe.

Permeation test data can be used for comparison of fabric perfomance but does not indicate safe-use time.

Users that rely on permeation test data to indicate how long they are safe may be coming into contact with small amounts of the chemical. This could be critical in the case of highly toxic chemicals or chemicals with long term toxicity.

To be safe: users need to calculate a safe-use time.

To find a safe-use time, calculate volume permeated using permeation rate, exposed area and exposure time:-

Permeation Rate x Area of Contamination x Duration of Contamination = Volume permeated

Manual calculation of safe-use time is problematic because of the difficulty in accessing relevant information such as permeation rates and chemical toxicity.

If volume permeated < chemical toxicity **= SAFE**

If volume permeated < chemical toxicity **= NOT SAFE**

This can then be compared with published toxicity limits for chemicals:

PermaSURE® is a free downloadable smart-phone app.

that quickly calculates safe-use time for over 4,000 chemicals based on temperature and the specific toxicity of the chemical.

1 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)

2 Chemical Tab
- Choose the chemical from over 4,000 in the database

3 Assessment Tab
- click Calculate

4 & 5 If **safe**, go ahead.
If **not safe**, revise the task or upgrade to a higher level of protection.

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

EN 14325:2018

The 2018 version of EN 14325 supports the PermaSURE® principle!

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.

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.

PermaSURE®

works on any browser-enabled device

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

- 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.

Which garment to use?

2.0 The task/ hazard type?

What is the spray type?

- Light spray
- Liquid spray
- Jet spray
- Vapours/gases

? The task may suggest a choice of fabric and garment design.

CE Types are a good guide to the different types of chemical contact and a clear indication of garment choice.

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 Vapour TYPE 1**
Light spray / aerosol protection	Dry particle protection	General overall spray: no pressure but coverall soaked	Strong jet sprays - higher pressure	Surrounding gases or vapours
Type 6 garment MicroMax® / SafeGard®	Type 5 garment MicroMax® / SafeGard®	More comfortable design options? 2-piece ensemble? - ChemMax® 1 Cool Suit®	Single piece coverall with sealed seams and effective front fastening	Gas-Tight - fully enclosed / air-tight seams and closures; access to portable air
Design choices are subject to the chemical toxicity. eg: A Type 6 application may require sealed seams if the chemical is highly toxic.		ChemMax® 1,2,3 ChemMax® 4 Plus	ChemMax® 1,2,3 ChemMax® 4 Plus	Interceptor® Plus

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.

For a summary of typical physical factors affecting garment choice.
(see page 12).

Liquid or gas?

Liquid would normally suggest a Type 3 or 4 hazard. However, some chemicals have low boiling points, becoming vapour at low temperatures.

In such cases a gas-tight suit might be appropriate.

Such information can be obtained from *Material Safety Data Sheets.*

Type 5 & 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.

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.

The difference between Type 3 and 4?

Type 3 (jet spray)
single jet sprays of liquid at pressure.
Type test : the jet is aimed at weak areas of the suit.

Type 4 (liquid spray)
wider, lower spray over a wider surface area.

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

See next page for more information.

Garment Selection Guide …..Which Hazard Spray Type?

2.1 Which hazard /spray type? Types 3 & 4

? Why define the difference between Type 3 and 4 protection?

EN 14605

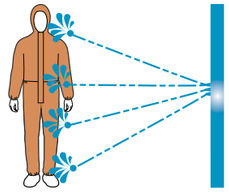
The EN 14605 standard defines two different levels of liquid spray protection: Type 3 & 4.

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

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

By identifying that your application is Type 4 only (rather than Type 3) allows more options for garment design choice and enables a greater level of comfort.

EN 14605 - Type 3 : "jet" sprays

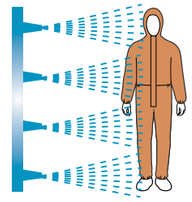


- Strong, directional jets of liquid spray
- Results in intense, local pressure on fabric, seams and joins.
- Back-spray will penetrate under, up or behind any loose flaps or joins
- Single nozzle spraying jets of liquid are sprayed at "potential" weak areas in suit(eg, seams, crotch, zip flap etc.)

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.

TYPE 4

- Allows more flexible and more comfortable design options.

Type 4 Lakeland garment options

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.

Lakeland's ChemMax® jackets and trousers are certified as an ensemble to EN 14605 Type 4.

Selection of a separate jacket and trousers can be more flexible, more comfortable and more cost effective.

In the 2014-15 Ebola Outbreak the UK Govt agreed with Lakeland that Front Line Ebola protection was a Type 4 and not a Type 3 application.

This allowed a simpler garment design which not only reduced cost but increased capacity and freight efficiency by 20%.

Lakeland supplied over 600,000 ChemMax® 1EB garments to Sierra Leone - facilitated by a rapid expansion of capacity - a benefit of Lakeland being the owner of its own manufacturing facilities.

Which garment to use?

3.0 Physical/environmental factors?

? What factors in the environment affect garment choice?

Can guide both fabric (eg. stronger options?) and design (eg. knee-pads required?) 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 kneepads 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 vapours? 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.

Contact lakeland for more information.

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 13 compare physical properties of Lakeland garments with main competitor options to assist selection.

Garment Selection Guide… Physical Properties Comparison Table

3.1 Physical properties/ comparison tables

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.

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	3	1	2
Tensile Strength	EN 13934	3	3	2
Puncture Resistance	EN 863	2	2	2
Surface Resistance	EN 1149-1	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)
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 Resistance	EN 1149-1	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)
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 Resistance	EN 1149-1	NT	NT	N/A	Pass* ($<2.5 \times 10^9\Omega$)
Seam Strength	EN 13935-2	449N	648N	607N	>300<500N

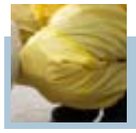
* According to EN 1149-5

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 2.5×10^9 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.

SUMMARY: Selection Process for Chemical Protective Clothing

The proceeding pages 4 to 13 detail a three step process for selection of chemical protective clothing. These steps are summarised below.

Chemical protection is defined by three key standards:

Type 4 EN 14605	Type 3 EN 14605	Type 1 EN 943-1&2
protection against sprays of hazardous liquids	protection against jet sprays of hazardous liquids	protection against hazardous vapours and gases
Type 4 Garments: ChemMax® 1 EB MicroMax® TS Cool Suit ChemMax® Cool Suits Pyrolon™ CRFR Cool Suit	**Type 3 & 4 Garments:** ChemMax® 1 and 2 ChemMax® 3 and 4 Pyrolon™ CRFR, CBFR	**Type 1 Garments:** Interceptor® Plus *Note: Type 2 has been removed in the 2015 version of EN 943 so no longer exists.*

Consider three key factors when selecting the most appropriate clothing for an application

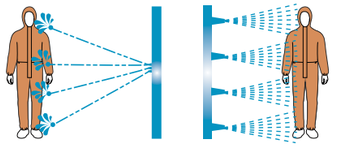
1. The chemical

- 'Breakthrough time' provided by (EN 6529 or ASTM F739) permeation tests can be used for comparison of fabrics but provides no information about how long you are safe.
- Consider the hazard presented by the chemical:
  How toxic is it?
  Is it harmful in very small quantities?
  Is it carcinogenic or causes long term harm in other ways?
- Is the application performed in a warm temperature? (permeation rates increase at higher temperatures). What effect does temperature have on the safe use time?
- Calculate a maximum safe use time using permeation rates, temperature & chemical toxicity.

Use **PermaSURE®** to calculate safe-use times for Lakeland chemical suits **ChemMax® 3**,**ChemMax® 4 Plus** and **Interceptor® Plus**

2. Which hazard / spray type?

- Protection against gases and vapours may require a Type 1 gas-tight suit such as Interceptor® Plus
- The type of spray in the application indicates whether a Type 3, 4 or 6 garment is required.
- However, with a highly toxic chemical even if the spray type indicates a Type 6 garment, a higher level of protection might be appropriate.



Type 3 Strong jet sprays — **Type 4** Shower sprays

Approximately 80% or more applications in the market are Type 4 and not Type 3.

Type 3 or Type 4?
Determining that the application is Type 4 rather than Type 3 means selecting more comfortable options such as a **ChemMax® Cool Suit.**

3. Physical / environment factors

- A variety of factors relating to the task and where it is performed can influence the choice of garment.
- Three groups of factors can be considered.

Factors relating to :		
The Task	**The Environment**	**Others**
For example: Kneeling / crawling? Climbing? Confined space? Mobility?	For example: Visibility?, Moving vehicles? Sharp edges?, Heat or flames? Warm conditions? Explosive atmosphere?	For example: Co-ordination with other PPE? Training required? Donning and doffing? Regulatory issues?
		

All such factors may influence the choice of fabric and garment design: (physical properties, colour, noise level and additional properties such as flammability).

CE Standard physical tests can be used to assess comparative performance in terms of durability using abrasion resistance, tear strength etc.

Download our **13 step guide** covering the selection, management and use of chemical protective clothing using the QR code.

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 whilst 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, whilst comfort is primarily defined by the air permeability of the fabric, even a garment that is breathable will be uncomfortable 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.

SUPER B-STYLE by Lakeland

Lakeland 'Super-B' Style
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 Three-piece hood with shaped centre-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.

2 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.

3 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.

** Many Lakeland garments are available in versions with thumb-loops where they are required for other reasons.*

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 Double zip and storm flap

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

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 centre 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® 1 Styles

428

Coverall with elasticated hood, cuffs,waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

L428

Coverall with elasticated hood, cuffs,waist & ankles. Double front zip fastening, cushioned kneepads. Thumb loops.
Size: SM - 3X

430

Coverall 'Plus' with hood and attached feet/boot flap Elasticated cuffs and waist. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

430G

Coverall 'Plus' with hood and attached feet and gloves using Push-Lock' connection. Elasticated cuffs,waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

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: MD - 2X

450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.
Size: MD - 2X

527

Smock / Gown with rear entry / ties and elasticated cuffs.
Size: MD - XL

025

Apron with ties
Size: MD - XL

024

Sleeves
Size: One size

023NS

Overboots with anti-slip sole
Size: LG - XL

021

Cape hood with rear inlet pigtail
Size: One size

Available in: Yellow

Not all styles are available from Local stock in this fabric. Please contact our sales office for information on stock items.

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	3	1	2
Tensile Strength	EN 13934	2	3	2
Puncture Resistance	EN 863	2	2	2
Surface Resistance	EN 1149-1	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)
Seam Strength	EN 13935-2	4	4	4

* According to EN 1149-5

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 www.lakeland.com/europe. 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
Tetrahydrafurane	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.

ChemMax® 2

Propriatory 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 centre 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 Styles

428

Coverall with elasticated hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

L428

Coverall with elasticated hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads. Thumb loops.
Size: SM - 3X

430

Coverall 'Plus' with hood and attached feet/boot flap Elasticated cuffs and waist. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

430G

Coverall 'Plus' with hood and attached feet and gloves using Push-Lock' connection. Elasticated cuffs,waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

400

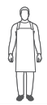
Encapsulated suit with flat back. To be worn with a breathing mask fed by compressed air hose. This can be fed through the air inlet hose to the mask worn inside the suit.
Size: MD - 2X

450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.
Size: MD - 2X

527

Smock / Gown with rear entry / ties and elasticated cuffs.
Size: MD - XL



025

Apron with ties
Size: MD - XL

024

Sleeves
Size: One size

023NS

Overboots with anti-slip sole
Size: LG - XL

021

Cape hood with rear inlet pigtail
Size: One size

Available in: White with grey seams

Not all styles are available from European stock in this fabric. Please contact our sales office for information on stock items.

Physical Properties

		ChemMax® 2	Brand C	Brand D
Property	**EN Standard**	**CE Class**	**CE Class**	**CE Class**
Abrasion Resistance	EN 530	6	6	6
Flex Cracking	ISO 7854	2	1	5
Trapezoidal Tear	ISO 9073	4	2	3
Tensile Strength	EN 13934	3	3	2
Puncture Resistance	EN 863	2	2	2
Surface Resistance	EN 1149-1	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)
Seam Strength	EN 13935-2	4	4	4

* According to EN 1149-5

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 www.lakeland.com/europe. 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
Tetrahydrafurane	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 23°c. It is NOT the point at which breakthrough first occurs.

ChemMax® 3

Powered by PermaSURE®

Stitched & Taped Seams | TYPE 3-B | TYPE 4-B | TYPE 5-B | TYPE 6-B | EN 1073-2 | EN 1149-5 | EN 14126

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 defence 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 centre 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® 3 Styles

SUPER B-STYLE

428

Coverall with elasticated hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

L428

Coverall with elasticated hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads. Thumb loops.
Size: SM - 3X

430

Coverall 'Plus' with hood and attached feet/boot flap Elasticated cuffs and waist. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

430G

Coverall 'Plus' with hood and attached feet and gloves using Push-Lock˚ connection. Elasticated cuffs,waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

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: MD - 2X

450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.
Size: MD - 2X

527

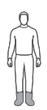
Smock / Gown with rear entry / ties and elasticated cuffs.
Size: MD - XL

025

Apron with ties
Size: MD - XL

024

Sleeves
Size: One size



023NS

Overboots with anti-slip sole
Size: LG - XL

021

Cape hood with rear inlet pigtail
Size: One size

Available in: Grey Orange

Not all styles are available from Local stock in this fabric. Please contact our sales office for information on stock items.

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	1	1	5
Trapezoidal Tear	ISO 9073	4	2	3
Tensile Strength	EN 13934	3	3	2
Puncture Resistance	EN 863	2	2	2
Surface Resistance	EN 1149-1	Pass* (<2.5 x $10^9\Omega$)	Pass* (<2.5 x $10^9\Omega$)	Pass* (<2.5 x $10^9\Omega$)
Seam Strength	EN 13935-2	4	4	4

* According to EN 1149-5

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 www.lakeland.com/europe. 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
Tetrahydrafurane	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®.

PermaSURE® Use PermaSURE® to quickly calculate safe wear times for ChemMax® 3

ChemMax® 4 Plus

Powered by PermaSURE®

Stitched & Taped Seams | TYPE 3-B | TYPE 4-B | TYPE 5-B | TYPE 6-B | EN 1073-2 | EN 14126

Superior multi-layer barrier films laminated to spunbond PP substrate - 210gsm.

- 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 defence operations.
- Works with PermaSURE® app to calculate safe-use times against over 4000 chemicals.
- Very soft and flexible materials for enhanced 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 centre 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

SUPER B-STYLE

428

Coverall with elasticated hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

L428

Coverall with elasticated hood, cuffs, waist & ankles. Double front zip fastening, cushioned kneepads. Thumb loops.
Size: SM - 3X

430

Coverall 'Plus' with hood and attached feet/boot flap Elasticated cuffs and waist. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

430G

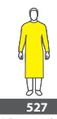
Coverall 'Plus' with hood and attached feet and gloves using Push-Lock˚ connection. Elasticated cuffs,waist & ankles. Double front zip fastening, cushioned kneepads.
Size: SM - 3X

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: MD - 2X

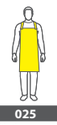
450

Encapsulated suit with expanded back. To be worn with self-contained breathing apparatus for breathing purposes.
Size: MD - 2X



527

Smock / Gown with rear entry / ties and elasticated cuffs.
Size: MD - XL



025

Apron with ties
Size: MD - XL

024

Sleeves
Size: One size

023NS

Overboots with anti-slip sole
Size: LG - XL

021

Cape hood with rear inlet pigtail
Size: One size

Available in: Yellow Tan

Not all styles are available from European stock in this fabric. Please contact our sales office for information on stock items.

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	4	5	3
Tensile Strength	EN 13934	3	2	3	4	4
Puncture Resistance	EN 863	2	2	2	2	2
Anti-static (Surface Resistance	EN 1149-1	Pass* (<2.5 x $10^9\Omega$)	Pass* (<2.5 x $10^9\Omega$)	Pass* (<2.5 x $10^9\Omega$)	Pass* (<2.5 x $10^9\Omega$)	Pass* (<2.5 x $10^9\Omega$)
Seam Strength	EN 13935-2	4	4	4	5	5

* According to EN 1149-5

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 www.lakeland.com/europe. 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
Tetrahydrafuran	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®.

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

ChemMax® Encapsulating Suits

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

- Rear entry encapsulating suit with 20mil PVC visor
- Flat and expanded back versions available (see styles below)
- Attached boots with boot overflaps
- 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: *see page 25*)
- 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 vapours

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	2	1	1
Trapezoidal Tear	ISO 9073	3	4	4	4
Tensile Strength	EN 13934	2	3	3	3
Puncture Resistance	EN 863	2	2	2	2
Surface Resistance	EN 1149-1	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)	Pass* ($<2.5 \times 10^9\Omega$)
Seam Strength	EN 13935-2	4	4	4	4

* According to EN 1149-5

ChemMax® Encapsulating Suit Styles

ChemMax® Encapsulating Suits are available in two basic styles:

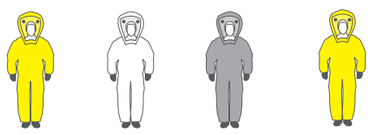
400 - Flat back with air inlet hose

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: MD - 2X

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: MD - 2X

Available in fabrics:



ChemMax® 1 ChemMax® 2 ChemMax® 3 ChemMax® 4 PLUS

Chemical Permeation Test Data

For permeation data on individual fabric refer to the permeation tables on pages 6, 7 and 8.

Or for the latest data available refer use the Chemical Search Page (accessible at **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.

See pages 4, 5 and 9 for more information on permeation test data and PermaSURE®

PermaSURE®

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

Interceptor® Plus

Powered by PermaSURE®

Type 1a gas-tight coverall. Use with internal BA for protection against hazardous gases & vapours

- 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.

For more information please request the separate Interceptor® Plus brochure.

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	6	5	5	6

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 / 37°c / 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.

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

Available in: Blue Yellow

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

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 www.lakeland.com/europe. Tested at saturation unless stated.

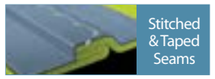
		Interceptor® Plus	Brand E	Brand F	Brand G
Chemical	**CAS No.**	**CE Class**	**CE Class**	**CE Class**	**CE Class**
Acetone	67-64-1	6	6	6	6
Acetonitrile	70-05-8	6	6	6	6
Carbon Disulphide	75-15-0	6	6	6	6
Dichloromethane	75-09-2	6	6	6	6
Diethylamine	209-89-7	6	6	6	6
Ethyl Acetate	141-78-6	6	6	6	6
n-Hexane	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
Tetrahydrafuran	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/cm^2 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 smart-phone app with quick access to safe-wear times for over 4000 chemicals.

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

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

Pyrolon®



TYPE 3 | TYPE 4 | TYPE 5 | TYPE 6 | EN 1073-2 | EN 1149-5 | EN ISO 14116 INDEX 1/0/0

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 (Index 1) with Type 3 & 4 chemical protection.
- Approved to the latest 2015 version of EN 14116 which requires vertical flammability testing on the zip front fastening as well as the fabric – and requires that the zip functions after the test.
- Primarily designed to be worn over Thermal Protective Garments (TPG's - garments certified to EN 11612) without compromising thermal protection - as standard chemical suits will do
- Outer FR PVC barrier film laminated to a proprietary nonwoven substrate of viscose rayon.
- Fabric will not ignite, burn or drip molten polymer - chars at a temperature lower than its ignition point.
- Stitched and taped seams.
- Available in orange and grey.

Physical Properties			
Property	**EN Standard**	**Result**	**CE Class**
Abrasion Resistance	EN 530	>2000 cycles	6
Flex Cracking	ISO 7854	>40,000 <100,000 cycles	5
Trapezoidal Tear	ISO 9073	48 / 34.3 N	2
Tensile Strength	EN 13934	168 / 110N	3
Puncture Resistance	EN 863	19.2N	2
Anti-static (Surface Resistance)	EN 1149-1	Pass* (<2.5 x $10^9\Omega$)	
Seam Strength	EN 13935-2	186.80	4
Flame Retardency	EN 14116	Index 1 : Should not be worn next to the skin	

* According to EN 1149-5

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, elasticated cuffs, waist and ankles. Double layer, cushioned kneepads for comfort and durability. Version with attached feet available.

Physical Properties		
Property	**EN Standard**	**CE Class**
Abrasion Resistance	EN 530	6
Flex Cracking	ISO 7854	3
Trapezoidal Tear	ISO 9073	3
Tensile Strength	EN 13934	3
Puncture Resistance	EN 863	2
Anti-static (charge decay) *	EN 1149-3	SF=0.1/HDT=0.24s)
Seam Strength	EN 13935-2	4

* 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

Why use Pyrolon® ?

- When should Pyrolon® FR chemical suits be used?
- Why do standard chemical suits compromise thermal protection?
- EN 14116 and Flame and Heat Protection

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!

Why?

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.

EN ISO 14116 INDEX 1/0/0

EN Standard - EN 14116

Protection against Heat and Flame
Limited Flame Spread

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.**

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

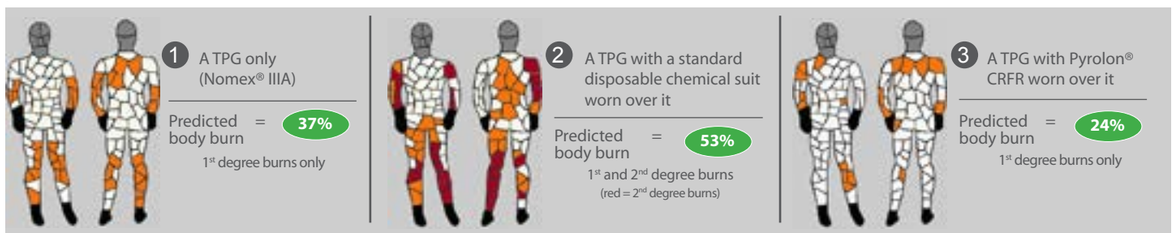
Index 1 requires that any flame should not propogate to the top or sides of the fabric, that there should be no flaming debris or drips and that there should be no spreading afterglow once burning has ceased. It does however allow the flame contact to form a hole in the fabric.

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.

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



The testing shows that wearing a standard chemical suit OVER a TPG will REDUCE thermal protection, whilst wearing a Pyrolon® chemical suit over a TPG will INCREASE thermal protection.

Chemical Splash Cool Suits

TYPE 4-B | TYPE 5-B | TYPE 6-B | EN 1073-2 | EN 1149-5 | EN 14126

ChemMax® and Pyrolon™ Cool Suits provides users with Type 4 liquid splash and spray protection in a coverall that allows breathability. The covered breathable rear panel allows air to circulate in and out of the suit, keeping the wearer cooler and more comfortable for longer.

The Cool Suit® Principle

How Does It Work?

The standard Type 5 & 6 MicroMAX® NS Cool Suit features a rear air-permeable rear made of SafeGard™ GP material to allow breathability and greater comfort.

To achieve Type 4 protection, the MicroMAX® TS, ChemMax®1 and 3 and Pyrolon™ CRFR Cool Suits feature the same breathable rear panel. The panel is protected by a cover made of the same material as the rest of the garment - sealed at top and sides and open at the bottom to allow circulation of air.

Users are more comfortable for longer, meaning better work rates, fewer rest breaks and improved productivity.

NOTE:
- The Pyrolon CRFR breathable panel is made from Pyrolon Plus 2 fabric so breathability and FR properties are maintained.
- Some applications, principally where splashes of sprays may occur up the rear of the coverall, may not be suitable for Cool Suits.

MicroMAX® NS Cool Suit - Type 5 & 6

MicroMAX® TS, ChemMAX® 1 *(shown above)*, ChemMAX® 3, Pyrolon™ CRFR Cool Suits - Type 4

The following Type 4 Cool Suits® are available:

MicroMAX® TS Cool Suit

ChemMax® 1 Cool Suit

ChemMax® 3 Cool Suit

Pyrolon™ CRFR Cool Suit

See individual Product Sheets for product properties.

The majority of applications are Type 4 rather than Type 3

Cool Suits® provide an opportunity for **chemical protection** with **greater comfort** - and greater comfort for users has positive effects on a business' bottom line.

Cool Suits® should be the default choice for many applications!

Push-Lock® Glove Connection System

TYPE 3

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

The Lakeland Push-Lock® Glove Connection System provides a secure alternative to using the traditional method of adhesive tape to seal the glove to the garment sleeve.

There are several advantages:-

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.

Unique system to connect chemical gloves to ChemMax® coveralls sleeves.

- Two concentric plastic rings clip together with glove and sleeve between.
- Provides liquid-tight seal tested and approved to Type 3 Jet Spray with ChemMax® 1, 2, 3 and 4 Plus garments.
- Multi-use so more cost effective.
- Simpler and quicker to use and fit compared to traditional taping of sleeve and glove.
- Available in cartons of 20 rings (to equip 5 garments)

How does it work?

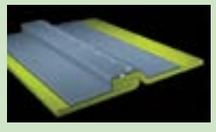
Cool Vest®

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 14°C for up to 3 hours* *(* Subject to work type, ambient temperature and environment)*
- 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 whilst one is used to allow continuous working.

Additional Information

Seams

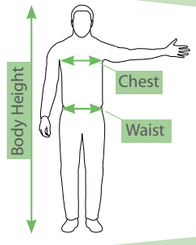


All ChemMax® coveralls feature **stitched and taped** seams for maximum strength and protection.

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

Technical data sheets for all Lakeland coveralls are available from: **www.lakeland.com**

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)
SM	164-170	84-92	82-88
MD	170-176	92-100	88-94
LG	176-182	100-108	94-100
XL	182-188	108-116	100-106
2X	189-194	116-124	106-112
3X	194-200	124-132	112-114

Selection of the appropriate sized garment is important in maximising 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.*

Additional Information

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. Whilst 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; de-contamination 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 -15°C .

Training

Training on selection, use and maintainance, 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 (-10°C to 50°C, dry and away from direct light) the expected shelf life can be 10 years or more. Some discolouration 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 vapours 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** 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 optimising comfort and minimising 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.

Detailed product information is also available from individual product sheets downloadable from **www.lakeland.com/europe**

Permeation & Chemical Toxicity - Further Information

Chemical safety data sheets are available from various sources:

- **European Chemicals Agency (ECHA)** (www.echa.europe.eu) – provides useful information cards on chemicals.
- **UK Government Compendium of Chemical Hazards** (www.gov.uk/government/collections/chemical-hazards-compendium) - Access to information sheets with useful general information on chemical hazards.
- **The Centre for Disease Control and Prevention (CDC)** (www.cdc.gov/niosh/ipcs/). Access to International Chemical Safety Cards (ICSC). Detailed information cards for a comprehensive range of chemicals.
- **Regulation (Ec) No 1272/2008 Of The European Parliament and of the Council** Classification, labelling and packaging of substances and mixtures. Useful information on hazard classification of chemicals.

Many of the data sheets available will indicate exposure limits in the form of:

- OEL's (Occupational Exposure Limit) - TLV's (Threshold Limit Value),
- TWA's (Time Weighted Average Exposure Limit) - STEL's (Short term Exposure Limit).

These can provide useful pointers to the exposure limits on specific chemicals for a risk assessment. However, these limits should not be taken as sharp dividing lines between "harm" and "no harm" for a variety of reasons - not least simply that information may not be available.

So it is important to build in wide safety margins in any risk assessment.

Lakeland provides no guarantees on the accuracy of safety information on any of the sites listed.

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.

Lakeland®

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