

 Protect Your People®

Guide to **PermaSURE**®

Version 4

The Future of Chemical Protection

Be Safe. Be Sure. Be Permasure...



 **Lakeland**®

ChemMax®

| Interceptor®

What is PermaSURE® V4?

PermaSURE V4 is a smartphone app for use with Lakeland chemical suits ChemMax 3, ChemMax 4 Plus, and Intereceptor Plus. It provides never-before-available, easy access to Safe-Wear Times - the time until possible contamination by a chemical might reach the point when harm may be caused.

Using established three-level toxicological data on chemicals, it enables users of chemical suits to more effectively manage tasks where contact with chemicals is a risk. Used as part of a comprehensive risk assessment it helps to ensure that workers never remain in contact with a chemical long enough to cause harm.

How does PermaSURE® V4 work?

Once a user is registered, a few clicks on three tabs are all that is required to select the lowest cost option that provides the required protection.

TAB 1: Select Garment

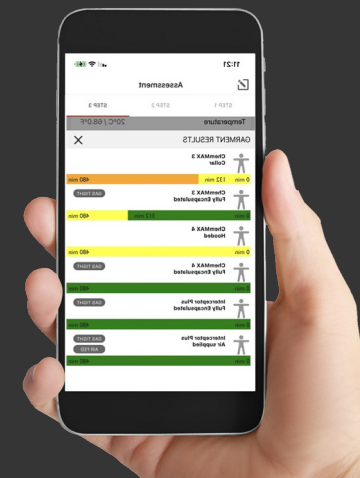
TAB 1: Select the preferred chemical suit then input the suit temperature during the task.

TAB 2: Use the intuitive search engine to select the required chemical from over 2,400 in the database, review its hazard details, then input the likely chemical temperature during the task.

TAB 2: Select Chemical

TAB 3: Calculate

TAB 3: A single click calculates the Safe-Wear Time for the selected garment, with results displayed using easy-to-interpret colour graphics. A further click displays the results for all suits in the system, allowing selection of the lowest cost safe option.



Limitations of current, common methods of chemical suit selection

Selection of a chemical suit is often focused on a permeation resistance test "Breakthrough Time". This test, whether the US or EN version, measures resistance of the garment fabric to permeation of the chemical. The result is a "breakthrough" in minutes (more correctly termed a "Normalised Breakthrough"). Most users interpret this as both a confirmation of "safe-to-wear" and as a Safe-Wear Time.

However, whilst useful comparison data, permeation test breakthrough is inadequate for prediction of safety. The limitations of the test are summarised by four key points.

Why is permeation test breakthrough inadequate to indicate sufficient protection?



It is a fabric test only

Permeation through the fabric is only one route by which a chemical may enter a protective suit.

The greater risk is the possibility of penetration via more obvious routes. Poorly constructed seams, the zipper, unsealed interfaces between the suit and other PPE - hood and face-mask, sleeves and gloves, and ankles and boots - are all possible routes of ingress.

The permeation test ignores this greater risk.

It is a lab test and ignores key environment factors

Lab tests are conducted under controlled temperature (in this case 23°C) and other conditions. Yet temperature affects permeation rate. In fact a 10°C rise in temperature will commonly double the rate of permeation.

So in the real world the permeation resistance suggested by the test is likely to be wrong!

Limited accuracy

Assuming that the permeation test is a reflection of the real world is risky.

We like to think lab tests are always accurate. In this case, challenges with identifying molecular levels of a chemical and with generally controlling conditions mean the permeation test has limited accuracy.

In fact, we know from experience that five different test labs will commonly produce five different results!

It is commonly mis- interpreted

Breakthrough time is commonly assumed to mean "time until the chemical breaks through the fabric", and therefore used as proof a suit is safe to wear.

The reality is that "breakthrough" in this context means the time until the permeation rate reaches a particular speed.

So, the chemical must permeate through the fabric, and may have contaminated the wearer, before the breakthrough time.

PermaSURE® V4 addresses all these limitations of current chemical suit selection. The following pages provided a step-by step guide to how it works and how to use it.

The Importance of Taping of Garment-to-PPE Interfaces

When wearing the commonly used coverall with hood style for chemical protection, some penetration of liquid and especially vapour through an unsealed zipper, or through joins between the garment and other PPE worn is inevitable.

This is a greater risk than permeation through the fabric, so, short of switching to a more expensive gas-tight suit, sealing of these potential routes can be vital, and makes a big difference in the level of protection. This is proved by Inward Leakage testing.

For this reason PermaSURE assumes taping of the coveralls in the system at two levels, BASIC and FULL.

Failure to tape the suits as indicated will result in lower Safe-Wear Times than indicated by the app.

It is important to use a good quality, strong, liquid-proof tape, and that care is taken to ensure there are no folds, creases or gaps in the taping.

Basic Taping ●



Full Taping ●



Chemical suit donning, and especially taping up of joins can only be done effectively by a partner.



Garment Choice & Selection

PermaSURE® selects from a range of Lakeland garment options. A critical issue in protection is how joins with other PPE are sealed to prevent liquid or vapour ingress, so, two levels of taping for coveralls is defined:

Basic Taping ●

Connections with mask, gloves and boots should be securely taped. The zipper can be closed and sealed using the system provided with the suit.

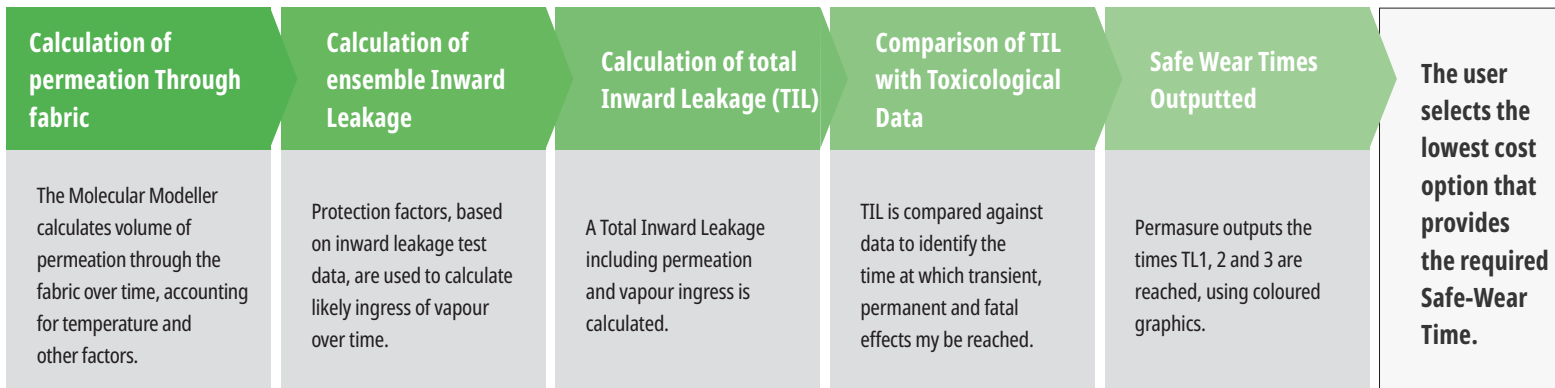
Full Taping ●

Connections with mask, gloves and boots should also be securely taped. In addition the zipper should be sealed with adhesive tape for additional protection.

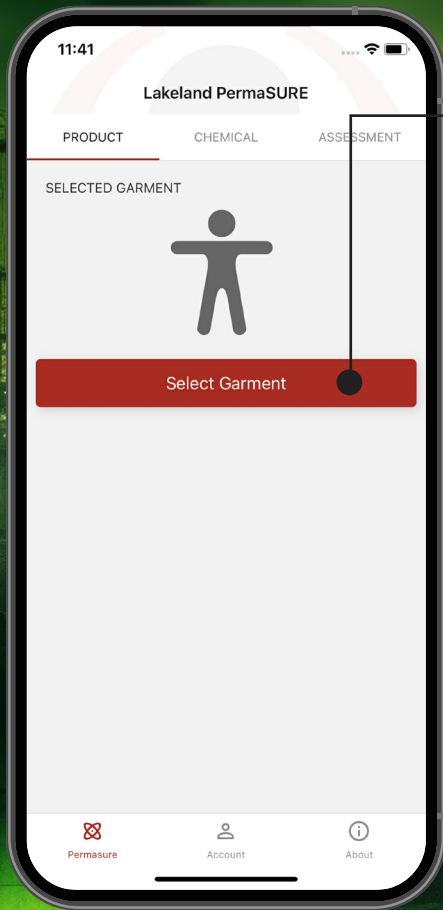
Garment Options listed in PermaSURE®

EN Type	CE TYPE 3 & 4 PROTECTION / OSHA LEVEL B						CE Type 1 OSHA Level A
	ChemMax® 3 Coverall with Hood Basic Taping	ChemMax® 3 Coverall with Hood Full Taping	ChemMax® 3 Encapsulating Suit - Expanded back for SCBA	ChemMax® 4 Plus Coverall with Hood Basic Taping	ChemMax® 4 Plus Coverall with Hood Full Taping	ChemMax® 4 Encapsulating Suit - Expanded back for SCBA	Interceptor® Plus Gas-tight Encapsulating Suit
Gas Tight?	✗	✗	✗	✗	✗	✗	✓
Taping Required	●	●	-	●	●	-	-
Protection Factor	51	332	16,666	51	332	16,666	100,000

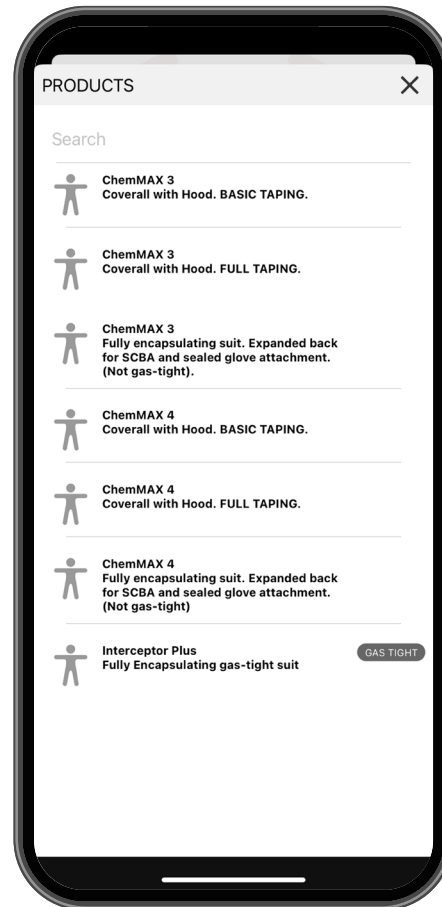
How does PermaSure identify Safe- Wear Times for each garment?



TAB 1: "Product": Select the Preferred Garment



Touch the red "Select Garment" button and choose your preferred garment from the list.



List of Suit Options in the System

Suit	Description	Gas Tight?
ChemMax® 3 Coverall with Hood Basic Taping	Connections with other PPE - mask, boots and gloves should be taped using an effective liquid resistant adhesive tape. The zipper can be fastened without additional taping.	✗
ChemMax® 3 Coverall with Hood Full Taping	Connections with other PPE - mask, boots and gloves should be taped using an effective liquid resistant adhesive tape. The zipper should also be securely taped over to ensure an effective seal.	✗
ChemMax 3® Encapsulated Suit	Fully encapsulating suit with full hood with visor, attached gloves and socks. Requires SCBA and sealed glove attachment.	✗
ChemMax 4® Plus Coverall with Hood Basic Taping	Connections with other PPE - mask, boots and gloves should be taped using an effective liquid resistant adhesive tape. The zipper can be fastened without additional taping.	✗
ChemMax 4® Plus Coverall with Hood Full Taping	Connections with other PPE - mask, boots and gloves should be taped using an effective liquid resistant adhesive tape. The zipper should also be securely taped over to ensure an effective seal.	✗
ChemMax 4® Plus Encapsulated Suit	Fully encapsulating suit with full hood with visor, attached gloves and socks. Requires SCBA and sealed glove attachment.	✗
Interceptor® Plus Fully Encapsulating gas-tight suit	Fully Gas tight suit with full visor and gas-tight zip.	✓



The "preferred garment" might be the suit you have available or may be suitable based on permeation resistance test data www.lakeland.com/chemical-search/. If your preferred suit does not provide sufficient Safe-Wear Time, the final tab includes a Calculate for all option to identify the lowest cost garment that offers the required protection.

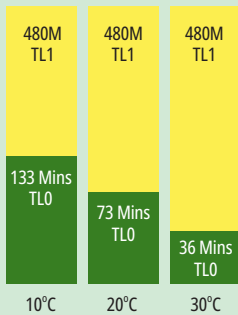
When you select your preferred garment, the app will switch to the task parameters input screen.

TAB 1: "Product": Input Key Task Parameters



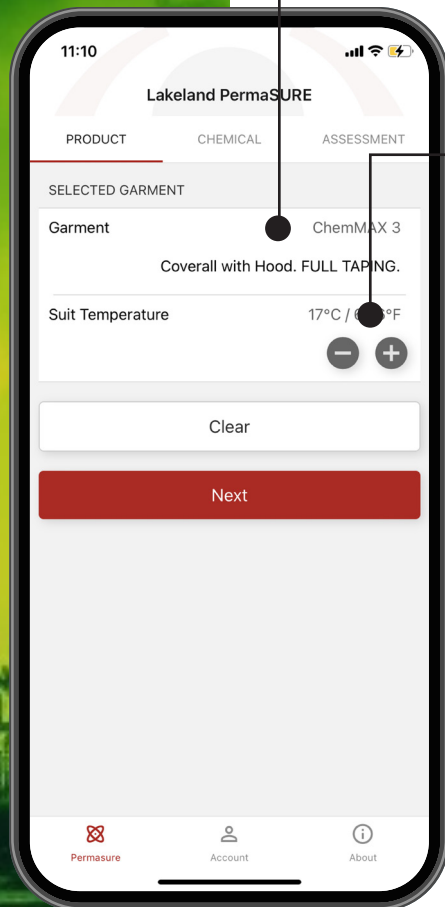
Using PermaSURE® for Task Planning

A benefit of PermaSURE® is the ability to make calculations for a range of task parameters and quickly assess the effect on Safe-Wear Time. The example below for Dichloromethane, shows the effect of increasing the suit temperature from 10°C, to 20°C, and 30°C.



The result is a decrease in Safe-Wear from 133 to 73, and 36 minutes. This is because at higher temperatures more of the chemical vapourises and permeation through the fabric is faster.

This shows using PermaSURE® to calculate Safe-Wear Times with different parameters can be an invaluable planning tool, enabling adjustment of tasks to allow for changing conditions.



Confirms chosen preferred garment

Input the 'Suit Fabric Temperature'

The likely temperature of the fabric during the task. This can radically affect the rate of permeation. It can be easily measured using an infra-red thermometer, or an estimate can be used based on ambient temperature. "However, consider that temperature may change over the duration of exposure.

Bear in mind that body temperature is 37°C / 97°F, and as the wearer works heat energy will be generated, so suit temperature may rise during the task. Higher ambient temperatures or warmer conditions or climates will also result in rising temperature.



PermaSURE is especially useful when dealing with the many chemicals that have only chronic effects. These chemicals have no immediate effect so you won't notice if your skin is contaminated.

They may absorb through the skin however and cause serious health problems months or years later.

PermaSURE allows identification of the Safe-Wear Time. The maximum time of contact until possible health consequences might occur. And adjusting the temperature of suit and chemical indicates how the safe-wear time changes as conditions of the task change.

Understanding Protection Factors (PF)

PermaSURE uses suit Protection Factors based on inward leakage testing to assess the risk of a chemical getting inside the suit.

The Protection Factor of a chemical suit is a measure of its ability to resist inward leakage of contaminants. It is based on testing to identify the percentage of a contaminant that is likely to leak into the suit during movement and exercise. This percentage is converted into a Protection Factor by dividing 1 by the percentage ingress.

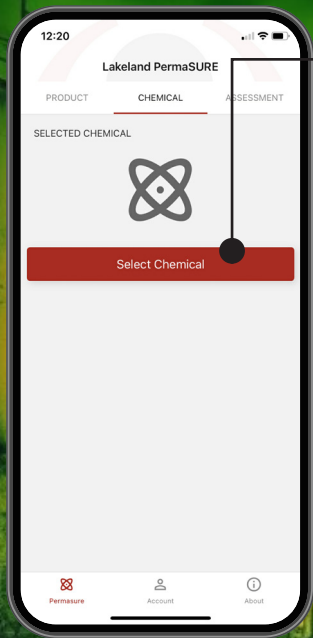
Since PF is related to percentage ingress, the actual volume of penetration is variable and related to the external concentration. The higher concentration of contaminant outside the suit, the greater the actual volume of ingress.

For reference, a list of protection factors along with related tested percentage ingress of external contaminant are shown in the table below.

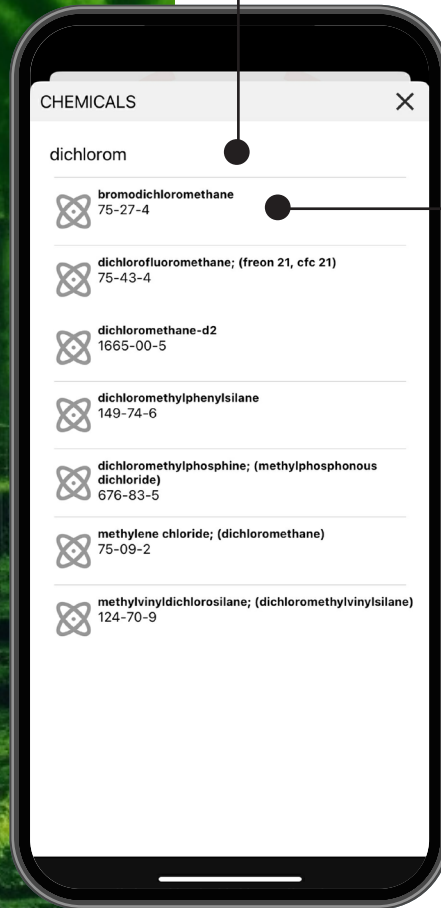
Percentage Penetration	Protection Factor (1/% Penetration)
0.001%	100,000
0.01%	10,000
0.1%	1,000
0.2%	500
5%	20
20%	5
50%	2

Testing proves much higher rates of inward leakage occur during more strenuous movement because of the "bellows" effect. This makes effective sealing of PPE interfaces with adhesive tape even more important.

TAB 2: "Chemical": Select chemical and input Chemical temperature



Click on the red button to select the chemical



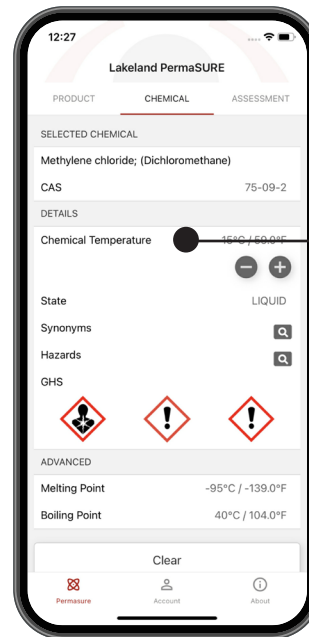
Enter the first few letters of the chemical name or CAS number

The search engine will identify a drop down list of matching chemicals from which you can make the selection.



Many chemicals have several and sometimes confusing synonyms, and different chemicals can have very similar names. So searching by inputting the CAS number is more accurate and will bring up the specific chemical you require.

Select the chemical. The screen switches to the chemical information page



Input the chemical temperature

The known or likely temperature of the chemical during the task. This affects the rate of permeation and vapourisation.

Consider that the temperature may change over time.

The chemical name and CAS number, along with state and melting and boiling points are confirmed, with known hazards indicated by universally accepted pictograms.

For more information on synonyms and hazard details touch the magnifier symbols.



PermaSURE® is a useful tool to manage tasks involving hazardous chemicals. Because it allows adjustment for garment and chemical temperature, why not create tables of Safe-Wear Times for different conditions such as higher temperatures in summer months or warmer areas.

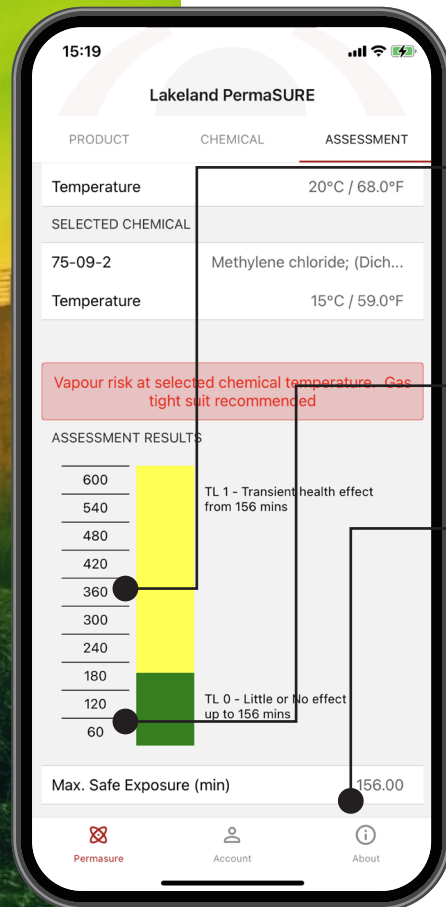
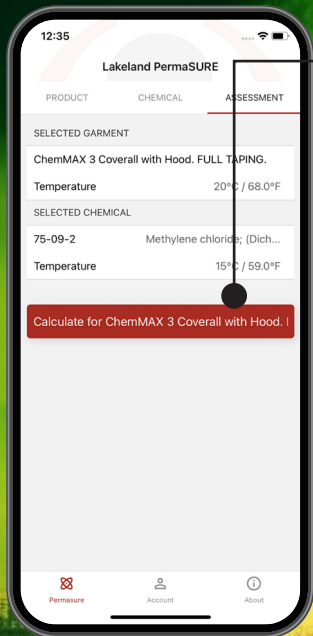
This can create a tool to indicate the maximum Safe-Wear Time under different conditions.

Once chemical is selected and temperature input, scroll down and click on the 'next' button

TAB 3: "Assessment": Calculate Safe-Wear Times

Click on the red calculate button

Permasure models permeation of liquid chemical and ingress of any vaporized chemical into the suit over time and compares it with known toxicological data to identify how long it takes to reach three key levels of harm. These are identified by a simple colour scheme.



Toxicity levels achieved are indicated by coloured bars, along with the time in minutes until each threshold is reached.

Yellow Bar

The yellow bar indicates that from 156 minutes there may be health effects but they will be temporary.

Green Bar

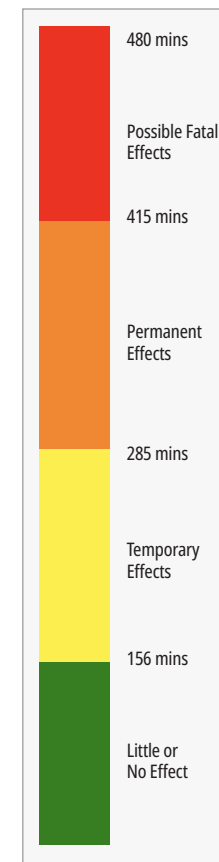
The green bar indicates there will be little or no effects before 156 minutes. This is the Safe-Wear Time.

Maximum Safe-Wear Time

The Maximum Safe-Wear Time is indicated by the green bar - the time until health effects - if temporary (TL1) may occur. In emergencies a user may enter the yellow TL1 time period as effects will be temporary. But in no circumstances should a user be exposed for longer than the TL1 period into the TL2 period, when permanent effects may result.

Further Information

Scroll down to find the "Calculate for All" button and assess Safe Wear Times for all garments in the system.



Safe-Wear Time

Safe-Wear Times are based on times until the volume of chemical ingress may result in transient, permanent and possibly fatal effects.

These Toxicity Levels (TL's) or thresholds are based on published, known toxicological data widely used for planning emergency civil response to incidents that involve hazardous chemicals.

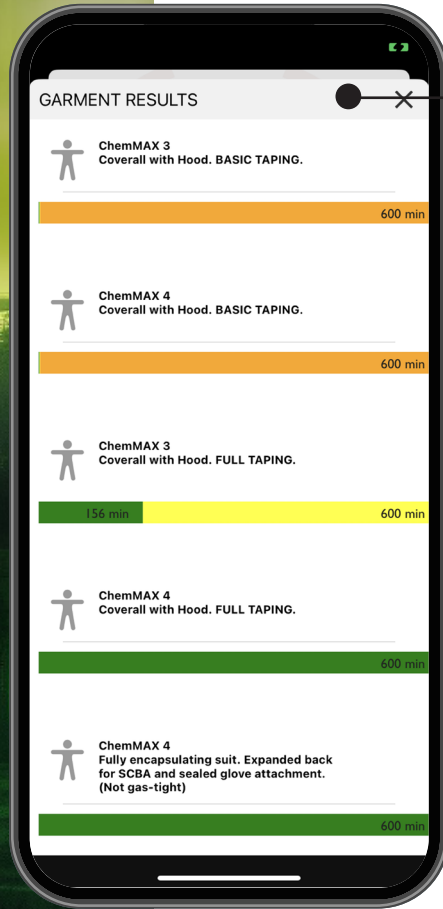
Permasure defines these levels for each chemical as:

- **Red Bar**
TL3 Possible life-threatening effects.
- **Orange Bar**
TL2 Permanent, more serious effects.
- **Yellow Bar**
TL1 Temporary, transient effects.
- **Green Bar**
TL0 No Effects.

The aim should be to ensure that workers are never exposed for longer than the green TL0 Safe-Wear Time or in emergencies beyond the yellow TL1 period.

TAB 3: "Assessment": Calculate Safe-Wear Times for all garments in the system and select the lowest cost safe option

"A science and data-based tool allowing assessment of Safe-Wear Times based not only on permeation through the fabric, but on the whole suit ensemble and how it is worn, has never before been available."



Scroll down and click the "Calculate for all Garments" option

The final screen shows the Safe-Time Wear Results for all the garments in the system

In this example the suits with only BASIC taping result in immediately entering the TL2 period when permanent health effects may result.

Both the Coveralls with full taping achieve better results

This shows the importance of taping up of garments and why the zipper is an important area to seal up, especially for a chemical that will vaporise easily.



The calculate for all option enables the user to quickly select the lowest cost option that provides the required Safe-Wear Time.



PermaSure V4 is a tool designed to contribute to effective assessment and selection of chemical protective clothing. It should only be used as part of a full risk assessment and task management process which should also incorporate relevant local, national or regional safety standards and regulations, and consider all environmental factors and conditions that may affect the outcome. Used in isolation it does not imply or guarantee any level of protection or safety.

PermaSURE® V4
is a first!!

Notice: This document contains general use information of the products and services described. All products should be used only by trained and qualified personnel who have examined all relevant cautions and warnings. Always review all applicable laws and regulations, as well as your company's procedures before use. Consult your company's safety/health officer for more information.



Lakeland Industries
1525 Perimeter Parkway NW
Suite 325
Huntsville, AL 35806

Phone: 1-256-350-3873
Toll Free: 1-800-645-9291

Customer Service: info@lakeland.com

Europe: 44-1430-478140
Canada: 519-757-0700
Toll Free: 800-489-9131
Argentina: 5411-4767-9484
Chile: 562-29980545
Uruguay: 5411-4767-9484
Asia-Pacific: 86-10-64379226
Australia: 61-0-437075686
India: 91-120-4249261 / 62

August 2023
© Lakeland Industries Inc. 2023

Protect Your People®