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# SKC Dermal Sampling Solutions

Lucinette Alvarado, CIH  
Corporate CIH/Technical Sales Manager



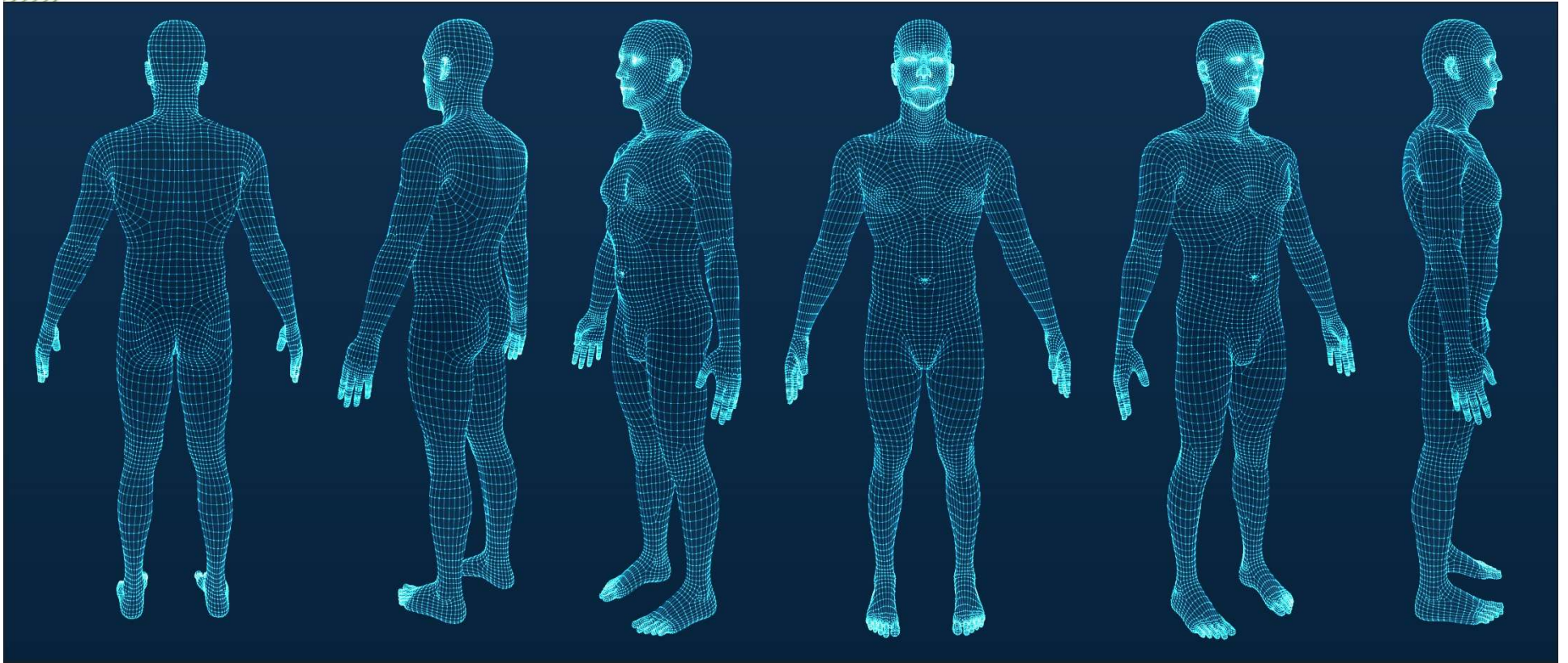
# Agenda

- Our Skin
  - Exposures
  - Hazards
  - Skin Notations
- CLI/SKC Products
- Applications and Studies
- Risk Assessment
- Dermal Exposures Potential





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**What is the largest organ in the human body?**

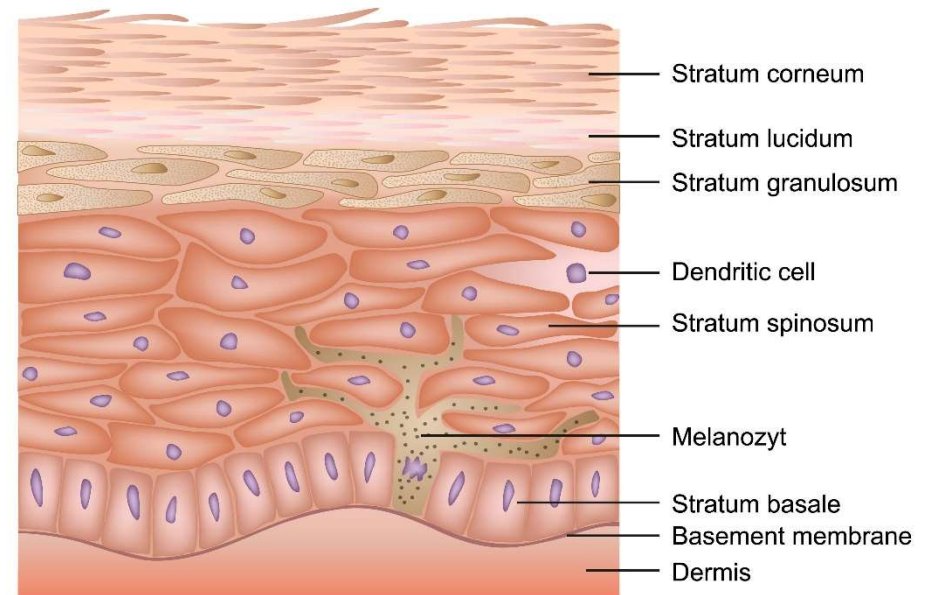
**Our Skin...**



# Our Skin...

- Accounts for more than 16 percent of body mass
- Provides
  - Protection
  - Water preservation
  - Shock absorption
  - Tactile sensation
  - Calorie reservation
  - Vitamin D synthesis
  - Temperature control
  - Lubrication
  - Waterproofing

## Structure of the Epidermis



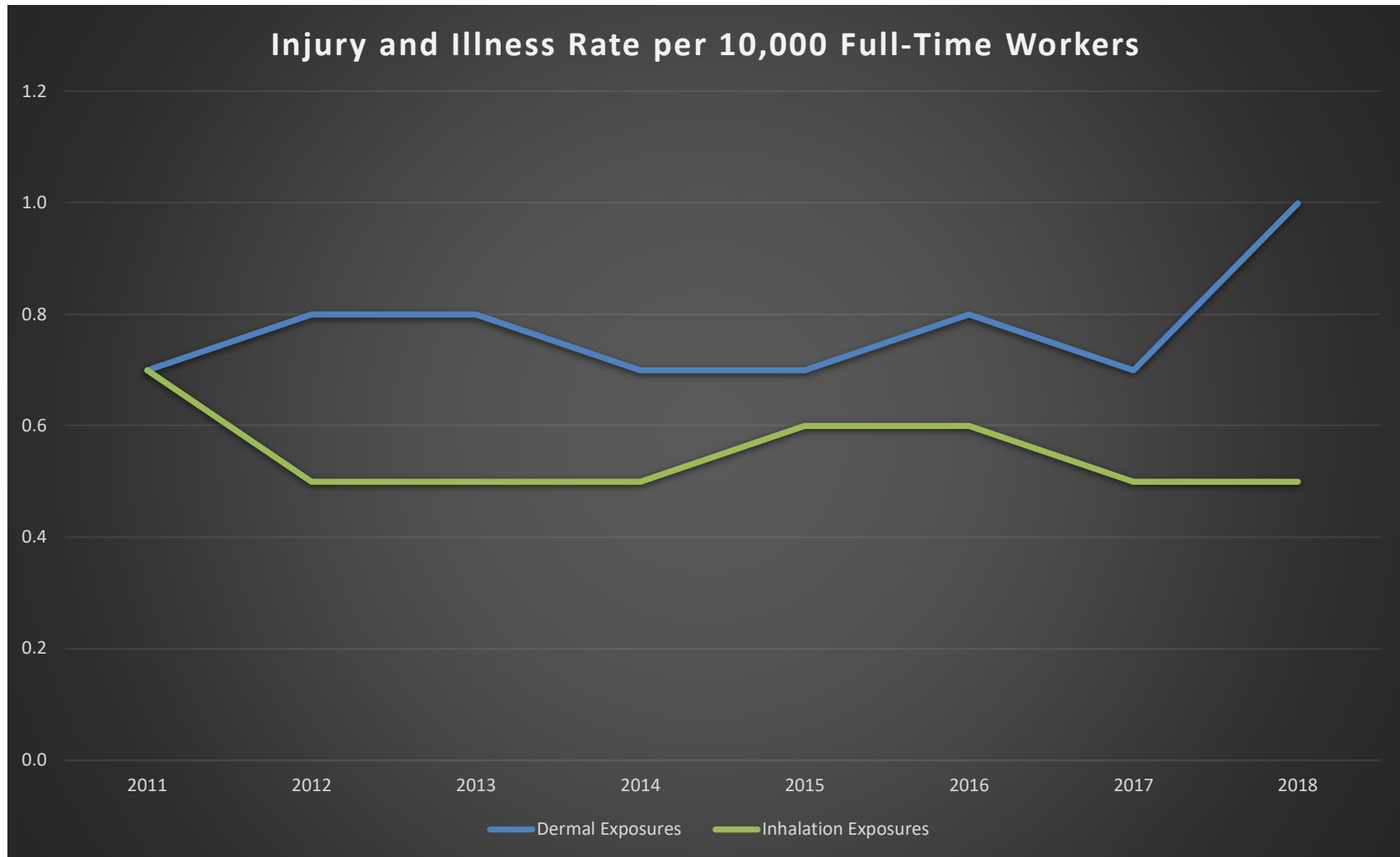
# Skin Exposure

- Skin diseases or disorders are illnesses involving the worker's skin that are caused by work exposure to the skin hazards.
  - Contact dermatitis
  - Eczema
  - Rash
  - Sensitizers
  - Oil acne
  - Friction blisters
  - Chrome ulcers
  - Inflammation of the skin





# Dermal Exposure Cases



<https://www.bls.gov/data/>

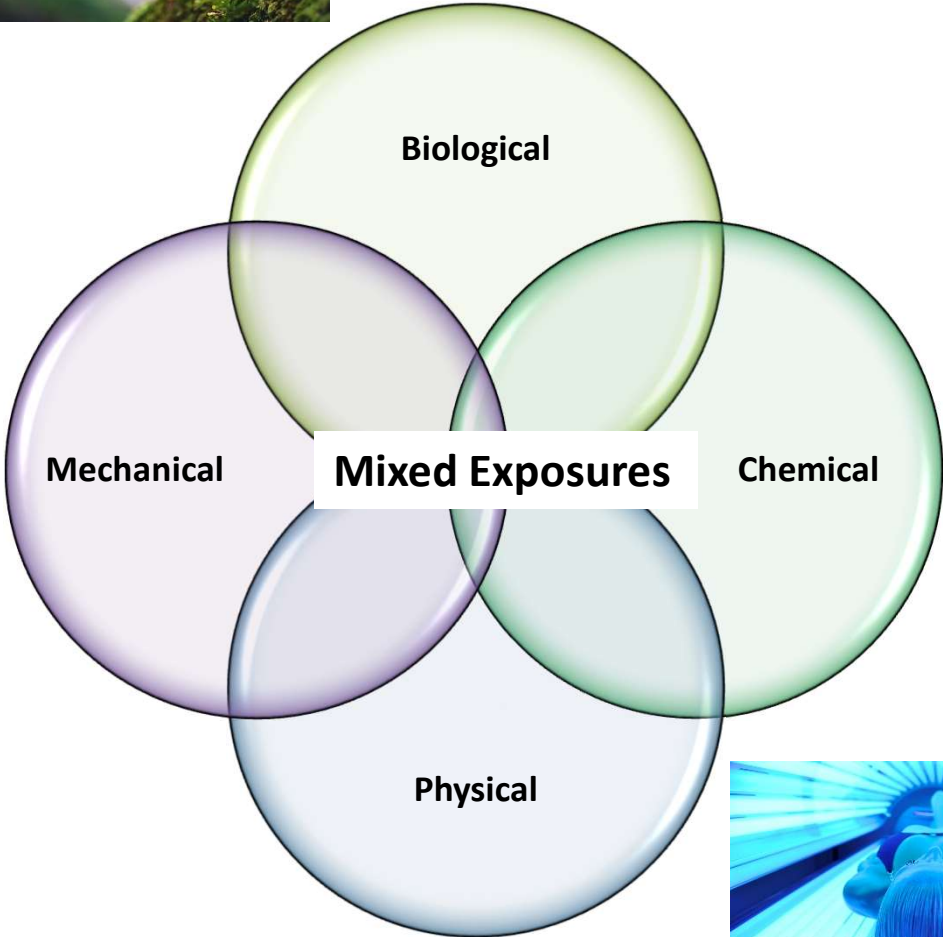


# Occupations at Risk

- Food service
- Cosmetology
- Health care
- Agriculture
- Cleaning
- Painting
- Mechanics
- Printing/lithography
- Construction
- Manufacturing



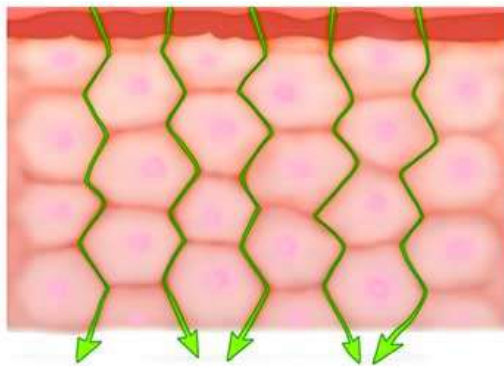
# Skin Hazards



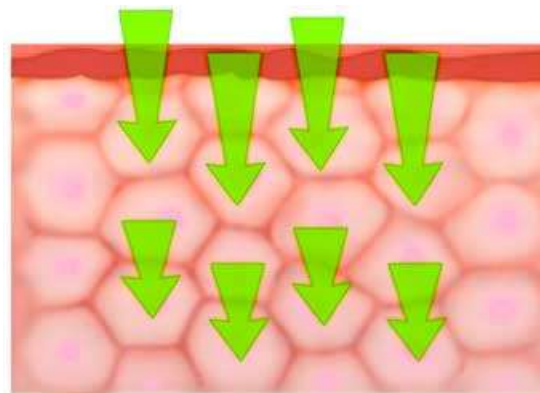


# Dermal Absorption

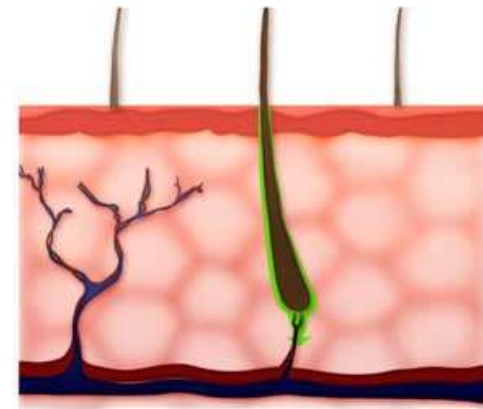
- Dermal absorption is the transport of a chemical from the outer surface of the skin both into the skin and into the body.



Intercellular lipid pathway



Transcellular permeation



Through the appendages



# Skin Notation Profiles

- OSHA
  - An alert, the means to evaluate the magnitude of dermal exposure, its importance relative to airborne exposure, and the effectiveness of preventive controls.
- ACGIH
  - Refers to the potential significant contribution to the overall exposure by the cutaneous route, including membranes and the eyes, by contact with vapors, liquids, and solids.
- NIOSH
  - The skin notation is based in theory on the potential contribution a chemical makes to systemic toxicity when it is absorbed by the skin.



# Skin Notation Examples

Chemical Name	Skin Notation		
	OSHA	ACGIH	NIOSH
Aniline	X	X	X
4,4'-Methylenebis(2-chloroaniline) (MOCA)	X	X	---
Toluene Diisocyanate (2,4 and 2,6- isomers)	---	X	---
Triethylamine	---	X	---
Phenol	X	X	X
Hydrogen Fluoride	---	X	X





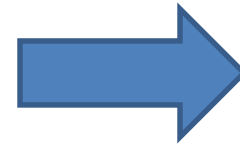
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# SKC Dermal Sampling Solutions



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# CLI to SKC



Then...

Now...



# Chemicals Detected

- Aromatic amines
- Aliphatic amines
- Aromatic isocyanates
- Aliphatic isocyanates
- Acids and bases
- Phenols





# Chemicals Detected

	Aromatic Amines	Aliphatic Amines	Aromatic Isocyanates	Aliphatic Isocyanates	Acid and Bases	Phenols
<b>Description</b>	Organic compound that contain a benzyl group and an amine group	Aliphatic amines constitute the largest group of epoxy curing agents.	Isocyanates contain a reactive N=C=O group which reacts with a polyol to form a polyurethane. The NCO groups is directly attached to the benzyl (aromatic) ring	Aliphatic isocyanates are isocyanates where the isocyanate (NCO) group is not directly attached to an aromatic ring	Chemical species that donates protons or hydrogen ions and/or accepts electrons.	Class of chemical compounds consisting of a hydroxyl group (—OH) bonded directly to an aromatic hydrocarbon group.
<b>Examples</b>	<ul style="list-style-type: none"> <li>• 4,4'-Methylenebis(2-chloroaniline) (MOCA)</li> <li>• Methylene dianiline (MDA)</li> <li>• Aniline</li> <li>• Toluidine</li> <li>• Naphthylamine</li> <li>• 2,5-diaminotoluene</li> </ul>	<ul style="list-style-type: none"> <li>• Triethanolamine, Diethanolamine</li> <li>• Triethylamine, Triethylenediamine</li> <li>• N-ethylmorpholine, N,N-dimethylcyclohexylamine</li> <li>• N,N-Dimethylaminopropylamine</li> </ul>	<ul style="list-style-type: none"> <li>• 2,4 and 2,6-toluene diisocyanate (TDI)</li> <li>• Methylene bisphenyl diisocyanate (MDI)</li> <li>• Naphthalene diisocyanate (NDI)</li> </ul>	<ul style="list-style-type: none"> <li>• Hexamethylene diisocyanate (HDI)</li> <li>• HMDI (4,4'-Diisocyanatomethylenedicyclohexane)</li> <li>• IPDI (Isophorone diisocyanate)</li> </ul>	<ul style="list-style-type: none"> <li>• Hydrogen fluoride</li> <li>• Hydrogen Sulfide</li> <li>• Hydrogen Chloride</li> <li>• Sodium Hydroxide</li> <li>• Potassium Hydroxide</li> <li>• Lithium Hydroxide</li> </ul>	<ul style="list-style-type: none"> <li>• Phenol</li> <li>• benzenol</li> <li>• Benzoquinones</li> <li>• Phenolic acids</li> <li>• Bisphenol A</li> </ul>
<b>Uses</b>	<ul style="list-style-type: none"> <li>• Polyurethane</li> <li>• Pharmaceuticals</li> <li>• Dyes</li> </ul>	<ul style="list-style-type: none"> <li>• Catalyst</li> <li>• Polyurethane</li> <li>• Plastics</li> <li>• Dyes</li> <li>• Textiles</li> </ul>	<ul style="list-style-type: none"> <li>• Polyurethane</li> <li>• Coatings</li> <li>• Elastomers</li> <li>• Foam</li> <li>• Insulation</li> </ul>	<ul style="list-style-type: none"> <li>• Sealants</li> <li>• Coatings</li> <li>• Adhesives</li> <li>• Elastomers</li> </ul>	<ul style="list-style-type: none"> <li>• Purification</li> <li>• Soil</li> <li>• Antacids</li> <li>• Fertilizers</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial synthesis</li> <li>• Hospitals</li> <li>• Antiseptics</li> </ul>

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# SKC Dermal Sampling Solutions



# SKC Surface SWYPE

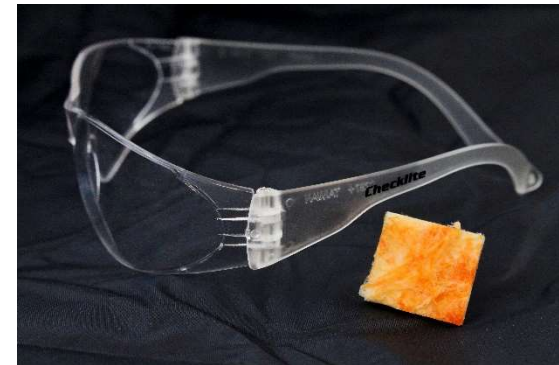
- Qualitative Analysis
- Results in 3 minutes
- Use on almost any surface
- Procedure:



Spray surface wait 30 seconds



Wipe with SWYPE



Check color after 3 minutes

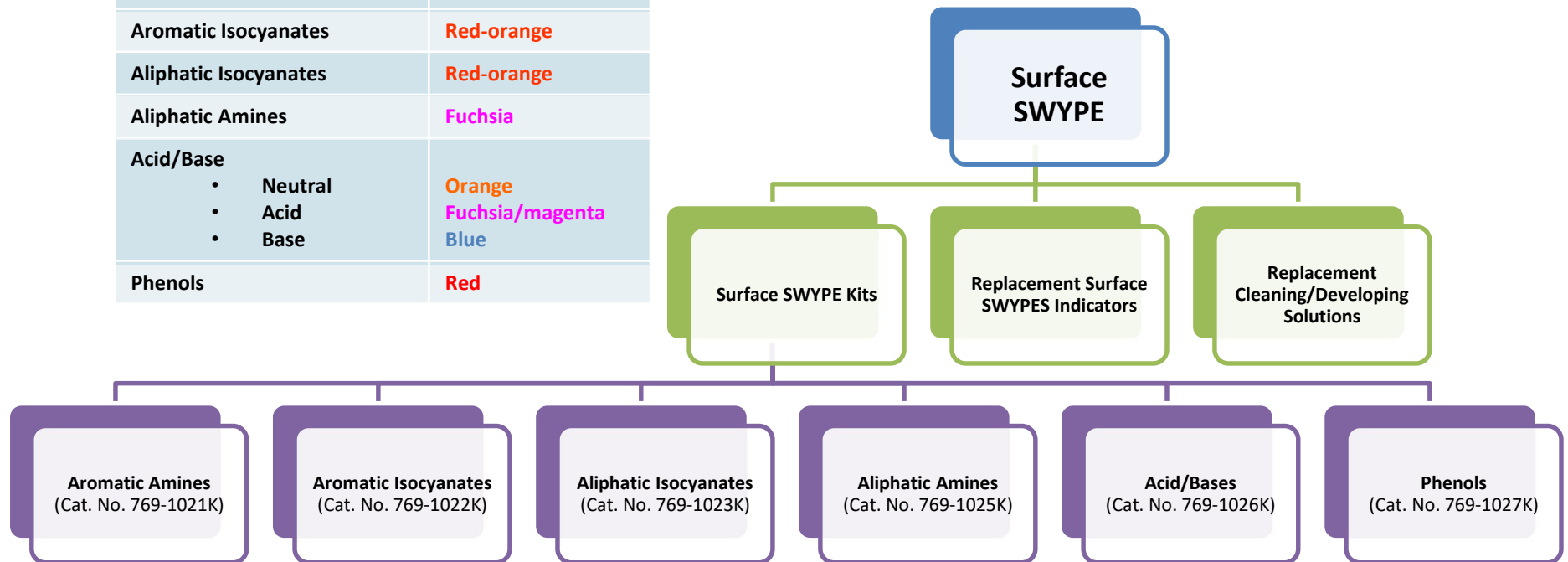
Each Surface SWYPE will have a specific color for the analyte.





# SKC Surface SWYPE

Chemical Group	Color
<b>Aromatic Amines</b> <ul style="list-style-type: none"> <li>• MOCA+MDA</li> <li>• Ethacure</li> <li>• Phenylene diamine</li> </ul>	Red-Orange Blue Purple
<b>Aromatic Isocyanates</b>	Red-orange
<b>Aliphatic Isocyanates</b>	Red-orange
<b>Aliphatic Amines</b>	Fuchsia
<b>Acid/Base</b> <ul style="list-style-type: none"> <li>• Neutral</li> <li>• Acid</li> <li>• Base</li> </ul>	Orange Fuchsia/magenta Blue
<b>Phenols</b>	Red

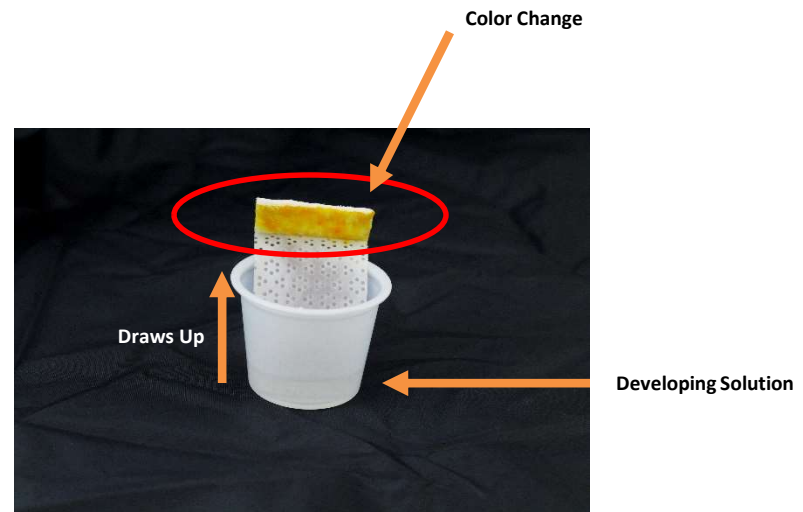


# SKC Skin SWYPE

- Designed for use on skin
- Qualitative analysis
- Procedure



Wipe skin with SWYPE

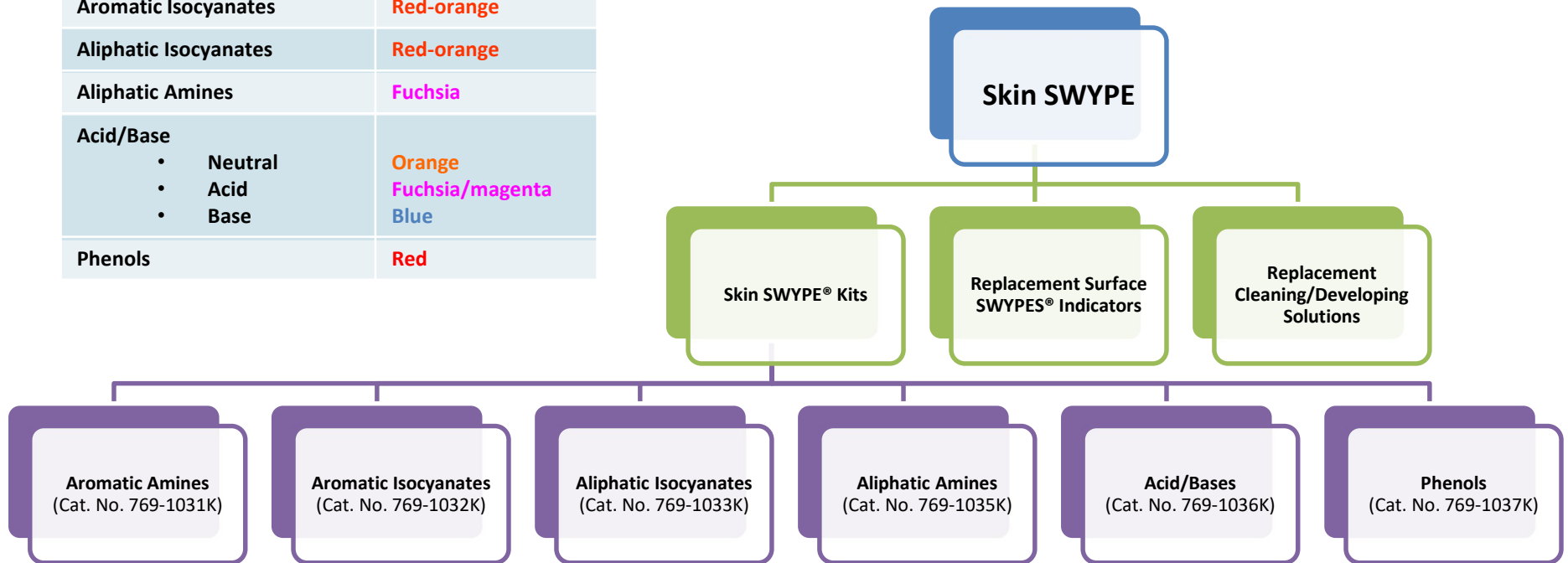


Develop SWYPE in solution



# SKC Skin SWYPE

Chemical Group	Color
<b>Aromatic Amines</b> <ul style="list-style-type: none"> <li>• MOCA+MDA</li> <li>• Ethacure</li> <li>• Phenylene diamine</li> </ul>	Red-Orange Blue Purple
<b>Aromatic Isocyanates</b>	Red-orange
<b>Aliphatic Isocyanates</b>	Red-orange
<b>Aliphatic Amines</b>	Fuchsia
<b>Acid/Base</b> <ul style="list-style-type: none"> <li>• Neutral</li> <li>• Acid</li> <li>• Base</li> </ul>	Orange Fuchsia/magenta Blue
<b>Phenols</b>	Red





# SKC PERMEA-TEC

- Qualitative Analysis
- Breakthrough detection for gloves/protective clothing
- Safe on skin
- Like wearing an adhesive bandage
- Procedure



PERMEA-TEC pre-exposure



During assessment

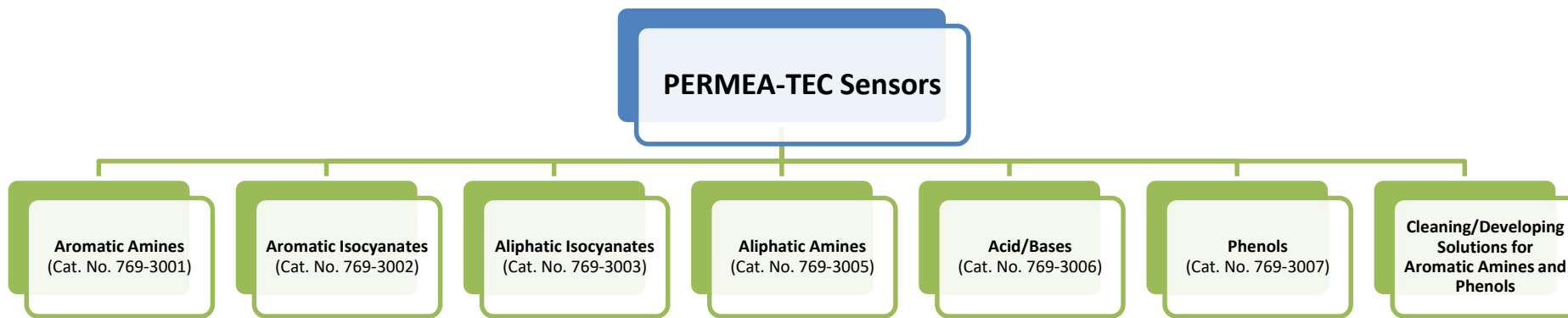


PERMEA-TEC post-exposure



# SKC PERMEA-TEC

## PERMEA-TEC Sensors



Chemical Group	Color
<b>Aromatic Amines</b> <ul style="list-style-type: none"> <li>• MOCA+MDA</li> <li>• Ethacure</li> <li>• Phenylene diamine</li> </ul>	Red-Orange Blue Purple
<b>Aromatic Isocyanates</b>	Red-orange
<b>Aliphatic Isocyanates</b>	Red-orange
<b>Aliphatic Amines</b>	Fuchsia
<b>Acid/Base</b> <ul style="list-style-type: none"> <li>• Neutral</li> <li>• Acid</li> <li>• Base</li> </ul>	Orange Fuchsia/magenta Blue
<b>Phenols</b>	Red



Cat. No. 769-3050

- PERMEA-TEC for solvents
- Charcoal pad included
  - GC lab analysis



# SKC D-TAM

- Formulated with non-toxic biodegradable solvents.
- Gently solubilize chemical contaminants on the skin.
- Two types: D-TAM Skin Cleanser and D-TAM Gold.
- Removes aromatic amines (MDA, TDA, MOCA, aniline, o-toluidine, and more), isocyanates and urethanes, pesticides, phenols, epoxy resins, paints, and sealants
- Procedure:
  - Apply D-TAM directly to the skin
  - Rub gently to work up a white lather
  - Rinse thoroughly with lukewarm H<sub>2</sub>O
  - Pat dry

D-TAM Gold  
Cat. No. 769-5021

D-TAM Skin Cleanser  
Cat. No. 769-5011 &  
769-5001



US Patent Nos. 7172,995 and 6,670,313

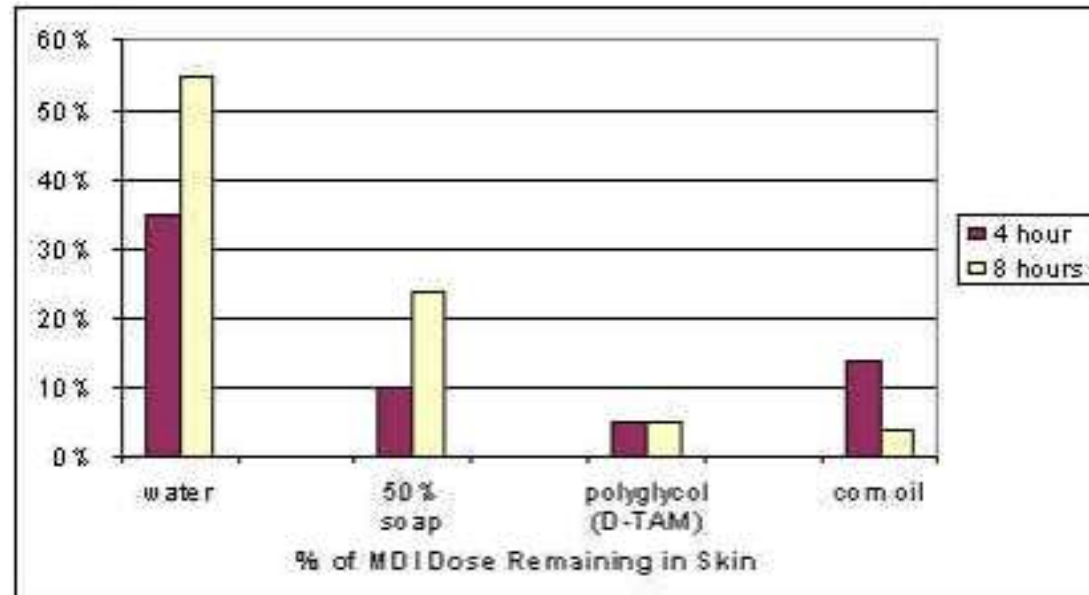


Log K <sub>o/w</sub>	0		3.5	8.0
<b>Water and Soap</b> For use with chemicals soluble in water		<b>D-TAM™ Skin Cleanser</b> For use with chemicals slightly soluble in water (semi-polar)		<b>D-TAM™ Gold</b> For use with chemicals NOT soluble in water (lipophilic)
Formaldehyde	Aniline	Phenol	Parathion	Aldrin
	Acrylonitrile		Lindane	Pentachlorophenol
Methanol		Di-nitro-toluene	TDI	
	Propanol	Benzene		MDI
Acetone		Malathion		
		Nitro-aniline	MBOCA	DDT
	Dichloroethane	Toluene		
		Captan		PCBs
Hydrazine		MDA		





# D-TAM Efficacy Studies



TOXICOLOGICAL SCIENCES 48, 1-4 (1999)  
Copyright © 1999 by the Society of Toxicology

*In Vivo* Skin Decontamination of Methylene Bisphenyl Isocyanate (MDI): Soap and Water Ineffective Compared to Polypropylene Glycol, Polyglycol-Based Cleanser, and Corn Oil

Ronald C. Wester,\*<sup>1</sup> Xiaoying Hui,\* Timothy Landry,† and Howard I. Maibach\*

\*Department of Dermatology, University of California, San Francisco, California 94143-0989; and †Health and Environmental Research Laboratories, The Dow Chemical Company, 1803 Building, Midland, Michigan 48674

Received August 17, 1998; accepted November 13, 1998



# SKC DECONtamination Surface Solutions

Comes in hazard assessment and spill DECON kits



DECON solutions are offered only for aromatic amines and aromatic/aliphatic isocyanates

These are used to clean up a surface once contamination is detected with the Surface Swype



A flexible hose applicator that can be used to spray floors or surfaces

Aromatic Amines  
Cat. No. 769-1071 & 769-1051

Aromatic Isocyanates  
Cat. No. 769-1072 & 769-1052



# The Future...

- Develop these products for more chemicals.
- Continue the validation studies.
- Expand the brand for more applications.



# Applications and Studies

## SKC Dermal Sampling Solutions





# Application Example



Setting: Polyurethane Foam Plant-Pour Line  
Chemical Used: Isocyanate (MDI)



- Situation: Skin irritation, reddening, itching, and swelling
- PPE: gloves





## Aromatic Isocyanate Surface Contamination Sampling and Evaluation Techniques

### Monitoring Inside Protective Equipment (gloves, suits)

Studies have shown that solvents containing chemicals may act as a vehicle allowing the chemicals to permeate gloves and protective clothing (7). The Permea-Tec® aromatic isocyanates detection system may be used for worksite evaluation of chemical protective PPE. For example, a negative result (no color change) of the Permea-Tec®, after being worn under a glove for a time period, in a work environment known to have contaminants present, demonstrates that the glove protection was effective for that time period, in those working conditions. The Permea-Tec® is an indicating pad is attached to a band-aid like adhesive strip.

1. Place one or more Permea-Tec® patches (pad side out) on the fingers, palms, wrist, lower arm (near cuff of glove), wherever there is likely to be permeation or contamination.
2. Worker then don their PPE and work for a time period as they normally would. (If the worker normally change gloves every two hours then the time period is two hours, for example).
3. After the shift, allow the workers to doff the gloves as they normally would, then collect, identify, and note the color of the pads.
4. In most cases the Permea-Tec® pad should not need any further treatment. If solvent (containing isocyanates) permeation has occurred, then this solvent should be sufficient to activate the pad.
5. If permeation or penetration of the PPE by the solvent containing aromatic isocyanates has occurred, a reaction turns the pad a pastel red-orange to pink. It is a reliable indicator to a detection limit of 3-5 µg aromatic isocyanates.

### Evaluating PPE for Dry Chemicals

1. There may be situations where the Industrial Hygienist may want to use Permea-Tec® pads for dry chemicals. (For example: unprotected handling of components that are assumed to be totally cured.) In this case, after the pads have been collected, 3 drops of solvent (methanol works well) needs to be placed directly onto the pad. Again gloves must be worn during sampling and solvent dispensing.
2. The methanol (or other solvent) wicks into the pad and enables a reaction that turns the pad a pastel red-orange to pink if aromatic isocyanate contamination is present. It is a reliable indicator to a detection limit of 3-5 µg
  3. Spray the area to be sampled lightly with the Developer Solution. Use as little as needed to ensure that the surface is wet. Excess solution will dilute contamination, possibly below the detection limit. When testing a vertical surface or knob, some of the solution may begin to "run-off" or drip. This "run-off" should be captured onto the pad to ensure that any contaminant present has not been lost. The Developer Solution contains a proprietary component which activates the Swype® pad.
  4. Wait approximately 30 seconds for any aromatic isocyanate to dissolve, then wipe the surface with a surface Swype® pad.
  5. Allow 2 to 3 minutes for the color to develop. A pastel red-orange or pink color indicates aromatic isocyanate contamination. The color varies depending

[https://www.osha.gov/SLTC/isocyanates/mrl\\_inte.html](https://www.osha.gov/SLTC/isocyanates/mrl_inte.html)





# PERMEA-TEC Studies

J Environ Monit. 1999 Dec;1(6):545-8.

## Determination of alkylamine permeation through protective gloves using aliphatic amine pads.

Vo E<sup>1</sup>, Berardinelli SP.

⊕ Author information

### Abstract

A quantitative study of alkylamine permeation through a glove material using **Permea-Tec aliphatic amine pads** used for the detection of chemical breakthrough of protective clothing, was performed for triethylamine following a microwave-extraction process and gas

AIHAJ. 2000 Nov-Dec;61(6):837-41.

## A quantitative study of aromatic amine permeation through protective gloves using amine adsorptive pads.

Vo E<sup>1</sup>, Berardinelli SP, Hall RC, El Ayouby N.

⊕ Author information

### Abstract

A quantitative study of aromatic amine permeation through a glove material using **Permea-Tec aromatic amine pads** used for the detection of chemical breakthrough of protective clothing, was performed for aniline following the microwave extraction process and gas chromatographic analysis. Aniline exhibited >99% adsorption on the pads at a spiking level of 1.94 mg (1.9 microL). Aniline showed recoveries from 65 to 89% (RSD < or =5.6%) over the range 1.1-1.9 microL (1.12-1.94 mg) of aniline applied to pads. The modified ASTM F739 and direct permeability testing procedures were used to determine breakthrough times for five protective glove materials using aniline as a challenge chemical. Breakthrough times for six protective gloves were determined, ranging from 182 sec to 82 min. The quantitative concentration of aniline on the pads following permeation through the gloves also was determined, ranging from 0.53 to 0.55 mg/cm<sup>2</sup> (1.79-1.88 mg/pad).

PMID: 11192217 DOI: 10.1080/15298660008984595

<https://www.ncbi.nlm.nih.gov/pubmed/11192217>



# D-TAM™/SWYPE® Studies



Journal of Occupational and Environmental Hygiene



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## Airborne Methylene Diphenyl Diisocyanate (MDI) Concentrations Associated with the Application of Polyurethane Spray Foam in Residential Construction

Jacques Lesage , Jennifer Stanley , William J. Karoly & Fran W. Lichtenberg

To cite this article: Jacques Lesage , Jennifer Stanley , William J. Karoly & Fran W. Lichtenberg (2007) Airborne Methylene Diphenyl Diisocyanate (MDI) Concentrations Associated with the Application of Polyurethane Spray Foam in Residential Construction, Journal of Occupational and Environmental Hygiene, 4:2, 145-155, DOI: [10.1080/15459620601133779](https://doi.org/10.1080/15459620601133779)

To link to this article: <https://doi.org/10.1080/15459620601133779>



Published online: 30 Oct 2007.





# Risk Assessment

- Determined from the degree of hazard associated with a material, together with the degree of exposure.
  - The risk of chemical splash.
  - Significant differences in work practices between individuals.
  - Use of gloves versus hand tools when in direct contact with chemicals.
  - Use of shared tools.
  - Cleaning frequencies for tools and equipment, including doorknobs, telephones, light switches, keyboards and actuators on control panels.



# Dermal Exposure Potential

- Frequency and duration of skin contact.
- The amount of skin in contact with the chemical.
- The concentration of the chemical.
- The likely retention time of the material on the skin.
- The potential for dermal absorption.



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# THANK YOU FOR YOUR ATTENTION!

[skctech@skcinc.com](mailto:skctech@skcinc.com)



A collage of images featuring a woman in a hard hat and safety vest on the left, and a man in a white lab coat on the right. Overlaid on these images are several screenshots: a Facebook post with a thumbs-up icon, a YouTube video player with a red 'Subscribe' button, and a website page titled 'Air Sampling Solutions & Expertise'. A green square with the SKC logo and a mouse cursor is also present.

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