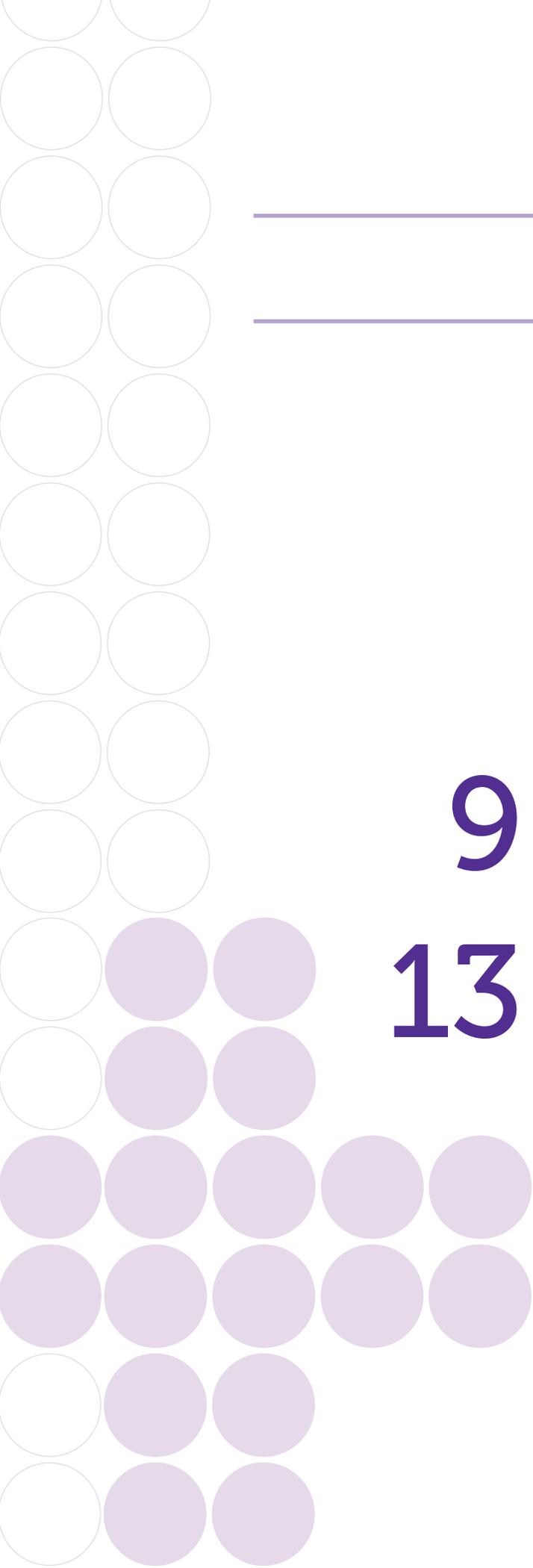




ARE REUSABLE  
LAUNDERED GARMENTS  
PUTTING YOUR CLEANROOM  
**AT RISK?**



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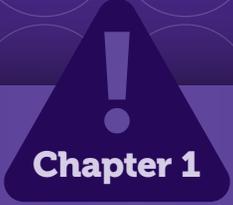
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Chapter 1

# CLEANROOM CONTAMINATION

What are the biggest threats?



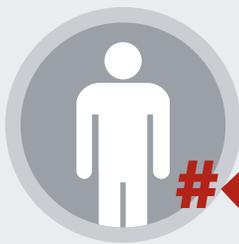
# Watch Out for



DIRTY  
LAUNDRY

There's no doubt about it. Contamination is bad for business. It can lead to shutdowns, recalls and loss of life. And it puts manufacturers in a negative spotlight.

To avoid contamination you have to understand its source: People.



#

1

People are the  
cause of  
contamination  
in the cleanroom



#

1

Cleanroom  
garments are the  
cause for  
alerts  
& actions

What stands between you and the risk of contamination? The personal barriers you choose to protect your process as well as your employees. When contamination occurs, the assumption is that the cleanroom operator didn't follow the right procedures when gowning. But it's not always the operator. Many times, the problem is with the gown itself.

# Understanding the Source

**1 in 3**  
**PEOPLE**



agree that donning coveralls is the most difficult part of the gowning process.

**1 in 3**  
**CLEANROOM OPERATORS**



report being unsure of garment sterility because of packaging.

**50%** of cleanroom operators reported poor fit of coveralls.

**87%** of operators would change to PPE that is **more comfortable** or helps to **reduce contamination risk**.

 **10,000**  
**MICROORGANISMS**  
per square inch on hand surface.

**40,000**  
NUMBER OF **SKIN CELLS**  
shed per minute.



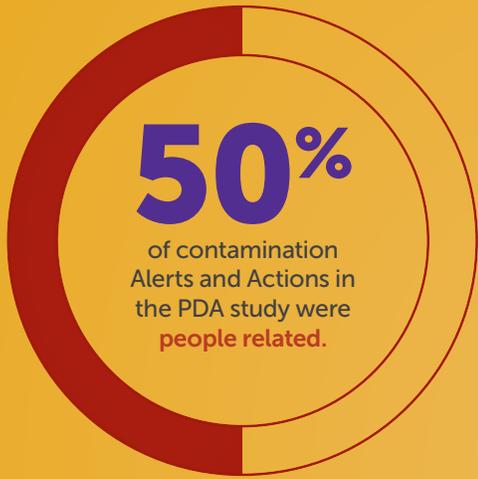
**100,000**  
Particles  $>0.3\mu\text{m}$  generated by people when stationary.



**5 million**  
**PARTICLES**  
 $>0.3\mu\text{m}$  generated by people when moving.



# Understanding the Impact



more than  
**\$250,000**

Spent per year on sterile PPE for a site with 100 entries per day.

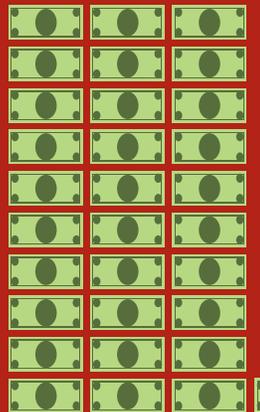
**18**

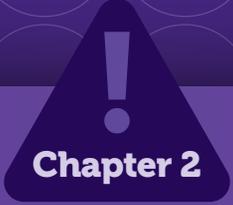
Average number of annual contamination action events per company, related to personnel gowning.



more than  
**\$3.1 million**

Average cost of dealing with contamination action events at a site, in the course of a year.

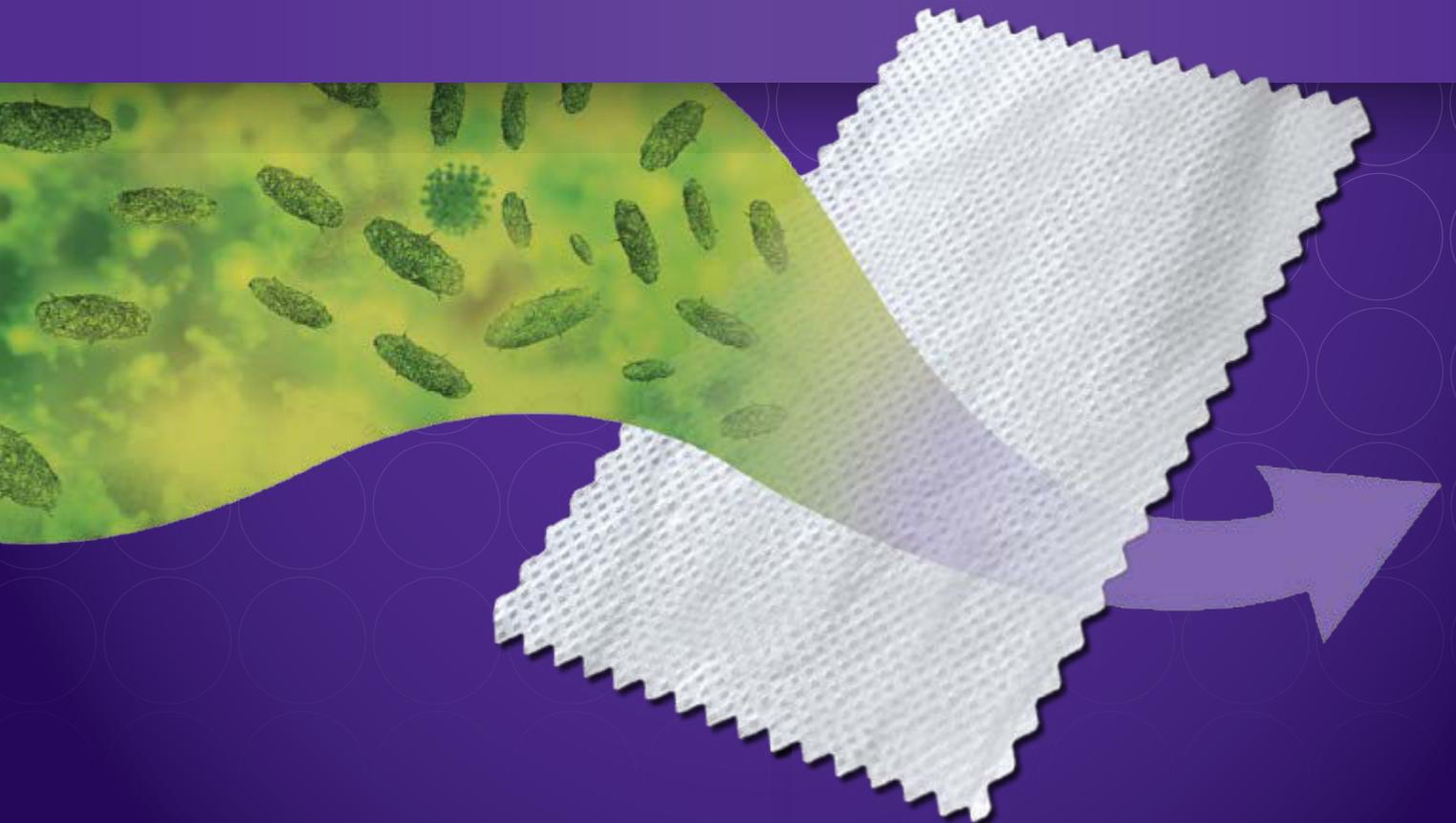




Chapter 2

# UNDERSTANDING THE DIFFERENCES BETWEEN RISK-MITIGATION CONTROLS

## Bacterial Filtration Efficiency



# All cleanroom garments are not created equal!

Cleanroom garments fall into two main categories:

1

how do they  
DIFFER

?

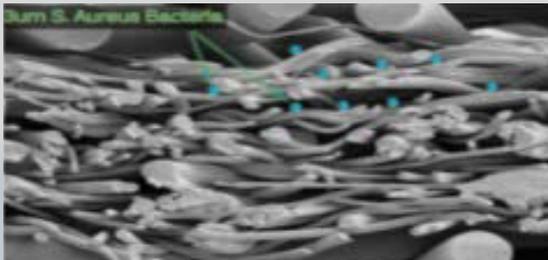
2

## Single-Use Disposable Garments

Single-use disposable garments are made from two types of fabric:

1) Flash-spun polyethylene fabric, which provides filtration efficiency for submicron sized particles and microorganisms, is suitable for light splash protection from non-hazardous liquids.

2) Spunbond meltblown spunbond (SMS) fabric, which has outer layers of spunbond polypropylene for strength and cloth-like comfort, and middle layers composed of a matrix of microfibers, which creates a strong barrier for fine particles and liquids. The three SMS layers have a maze-like quality that traps particles, while maximizing airflow to keep the operator cool and comfortable.



### Non-Woven Garment

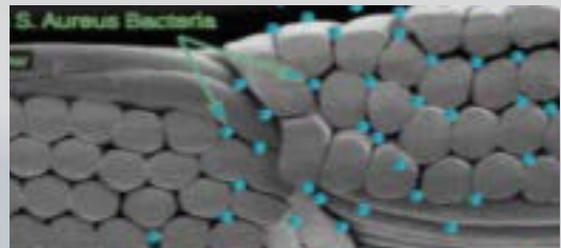
Tortuous pathway prevents bacteria from passing through

## Laundered Reusable Garments

Laundered reusable garments typically contain a single layer of woven polyester-blend fabric, which, coupled with the weave, may allow particles to pass through. The fabric also may degrade after multiple laundering and sterilization cycles – compromising the barrier built into the garment material.

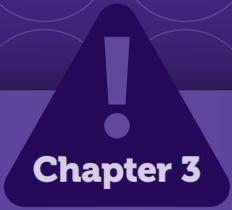
Kimberly-Clark Professional\* conducted testing on laundered reusable garments and found that the Bacterial Filtration Efficiency (BFE) declines more than 25% after an average of five washings. That's like 1 out of 4 workers not wearing sterile garments at all.

**This presents a real, yet invisible, contamination risk to cleanroom environments.**



### Woven Garment

Channels for bacteria to pass through



Chapter 3

# THE LAUNDERING PROCESS



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# The Laundering Process

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1. Inspection

2. Sort

3. Repair

4. Wash/Dry

5. Package

6. Transport

7. Sterilize

8. Transport

9. Inventory

10. Stock

11. Wear

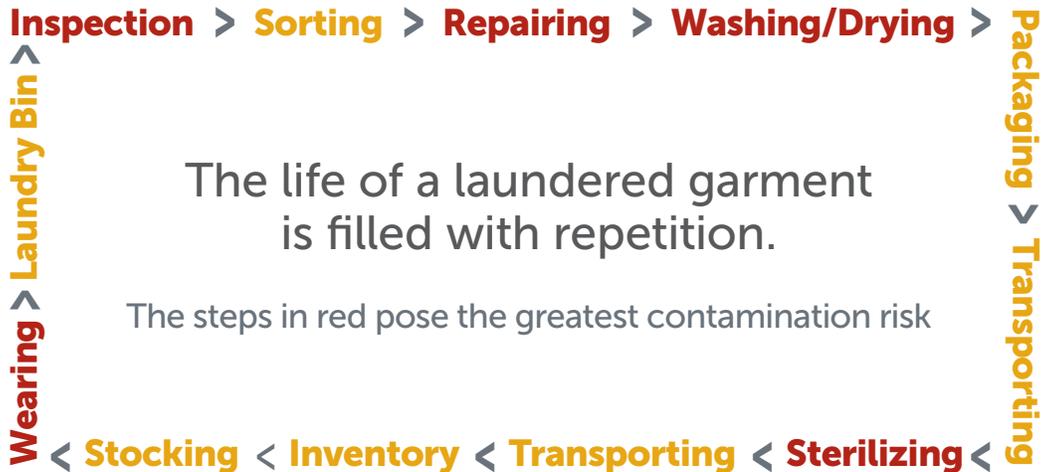
12. Laundry Bin

————— The steps in red pose the greatest contamination risk —————

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# Material Breakdown

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So, it's no wonder that the material barrier of the garments can break down.

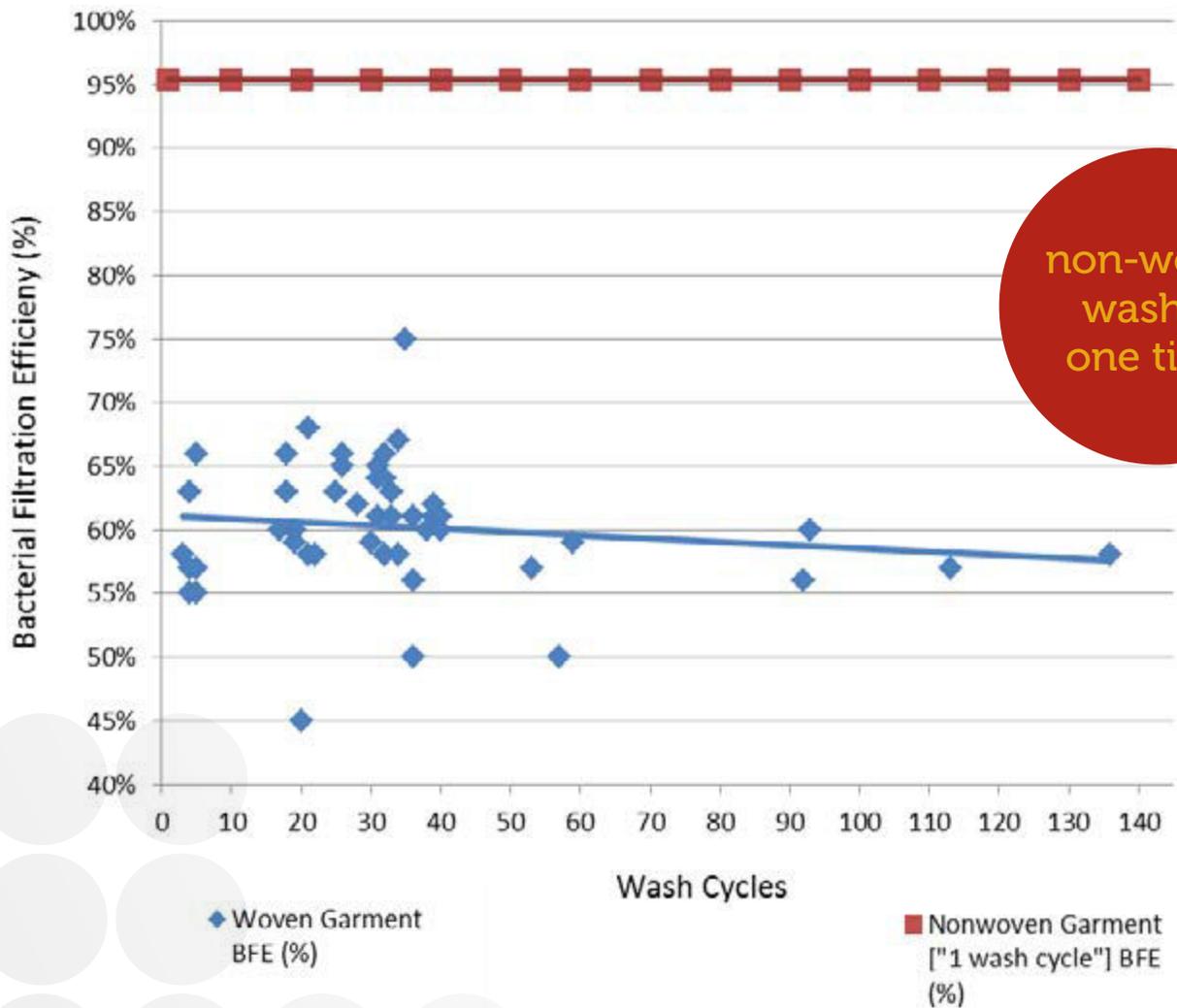
What is the useful life of these garments and when should they be retired? The answers vary – from 100 times, according to the material manufacturer, to 19, according to one pharmaceutical company.

What's the right answer? Our recommendation – and our testing – found that the Bacterial Filtration Efficiency (BFE) of a garment should determine its retirement date. Here is what our testing revealed:

- 100 percent of the worn sterile reusable garments tested showed a decline in BFE after washing.
- The filtration efficiency of the reusable garments was typically less than 70%.
- Fabric degradation was visible at the submicron level – enough to allow bacteria to penetrate the material.
- As the number of washes went up, the BFE went down.
- The average number of wash cycles was lower than expected.
- The total cost of ownership for reusable cleanroom apparel was much higher than projected.

# Compromised Barrier Integrity

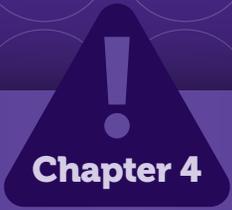
## BFE vs. Wash Cycles- Woven Garments



non-woven  
washed  
one time.

Filtration efficiency declined quickly after the first few initial washes.

If you're using laundered garments, can you afford the risk when so much is at stake?



# THE SINGLE-USE SOLUTION



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# A better, more reliable choice

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Sterile single-use garments offer a number of advantages over laundered reusable apparel, including:

## Consistent Performance

Kimberly-Clark Professional\* Kimtech Pure\* A5 Sterile Cleanroom Apparel offers a 95% BFE rating, vs. 68% for laundered apparel.

## Predictability

The garments are washed once to guarantee optimal, predictable performance.

## Ease of donning

Unlike reusable garments, single-use apparel from Kimberly-Clark Professional\* features advanced Clean-Don\* Technology to facilitate aseptic donning and lower contamination risk.

## Comfort

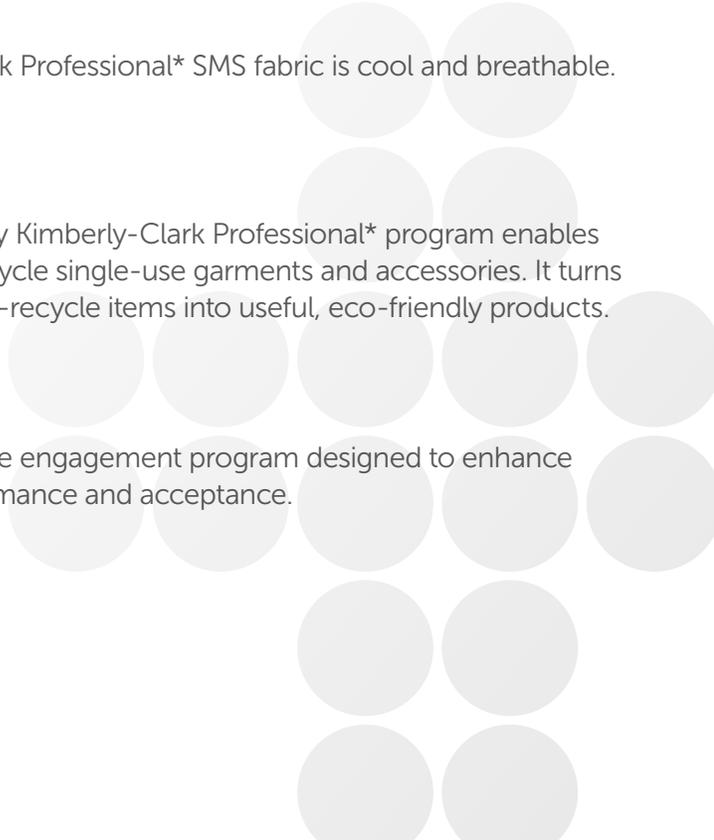
The Kimberly-Clark Professional\* SMS fabric is cool and breathable.

## Recyclable

The RightCycle\* by Kimberly-Clark Professional\* program enables cleanrooms to recycle single-use garments and accessories. It turns previously hard-to-recycle items into useful, eco-friendly products.

## APEX

A unique employee engagement program designed to enhance protection, performance and acceptance.



See how easy it is to keep your cleanroom safe.



Don't let your choice of apparel endanger your scientific process.  
To ensure its purity, select the most reliable protective apparel  
available. The risks of cleanroom contamination are simply too great.

  
**Learn  
More!**



Like this e-book? Spread the word by  
letting your network know about it!

  
**Tweet  
Now!**



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