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Fibers and Fabrics

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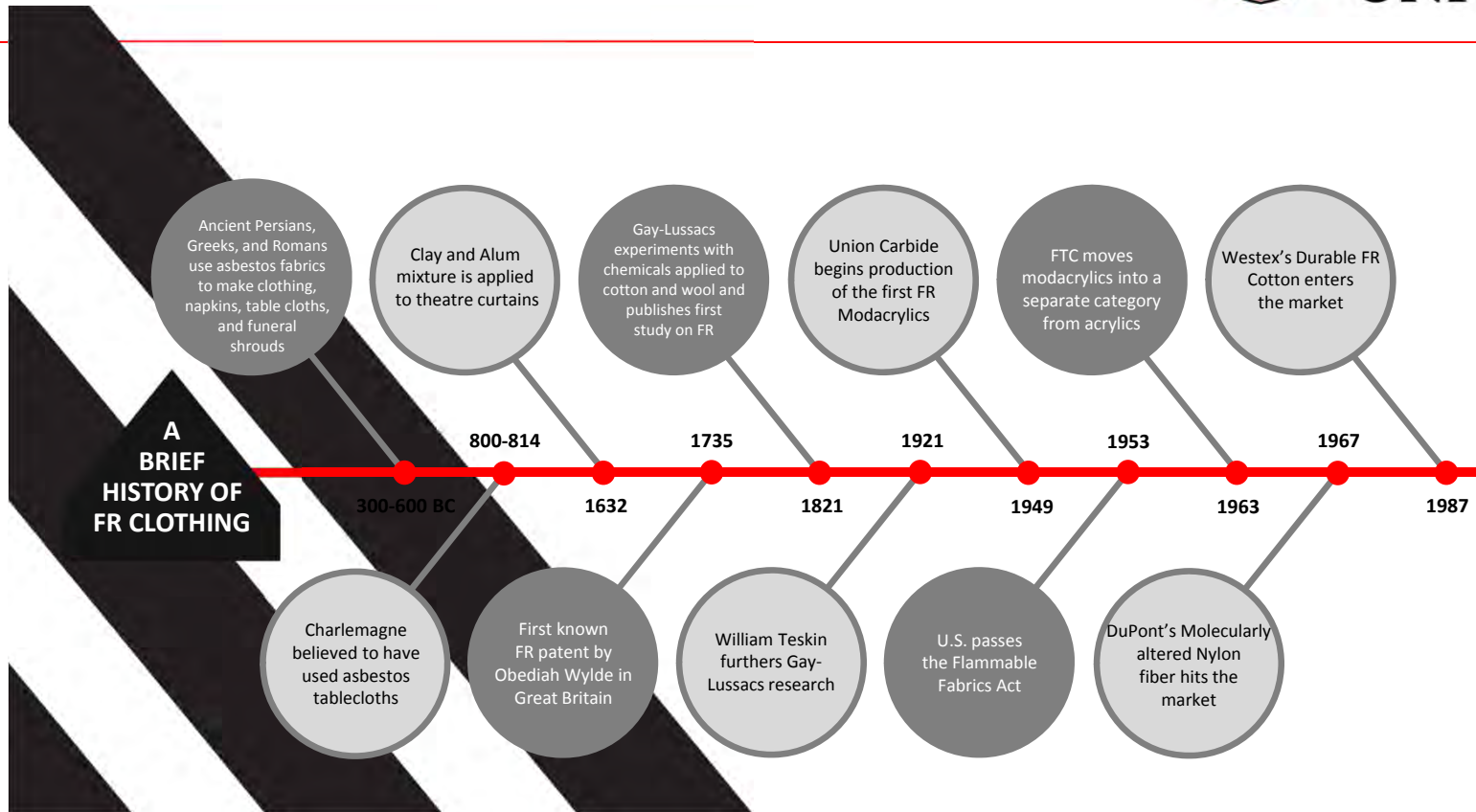
FR Fibers and Fabrics -
Past, Present and Future

“Inherent” vs. “Treated”
Or is it all Engineering?



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A Brief History of FR (PAST)





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The perfect fiber does not exist!



FR fabrics in common use today for arc flash and flash fire protection are **engineered** to have FR properties. (FR properties defined as the fabric will self extinguish when the ignition source is removed)

There are 3 levels at which those FR properties can be achieved:

- **The Molecular Level** – Synthetic derivatives are engineered at the molecular level to be FR (e.g., Nomex, Kermel, Twaron, Kevlar, etc.)
- **The Fiber Level** – At this level, flame retardant chemicals are added during fiber extrusion (e.g., FR Modacrylics, FR Rayons)
- **The Fabric Level** – Flammable fabrics are engineered at the fabric level through chemical and mechanical processes to permanently impart FR properties (e.g., FR Cotton, 88/12)

The State of FR Today



Even though the most popular FR garments worn today utilize a variety of the 3 **engineering** methods, the terms remain:

- **Inherent:** With slight variations, the consensus definition is “by its very nature, as a core property,” it’s FR without any additional finishing
- **Treated:** Refers to chemical engineering that imparts FR properties not previously present

Originally, these terms were meant to differentiate permanent FR properties from FR chemical applications that eventually wore out.



Common understanding of "the terms"...

“Inherent”

- Doesn't wash out
- Number of launderings doesn't matter
- FR properties remain for the life of the garment

“Treated”

- Depends on chemicals
- Eventually washes out
- Surface treatment
- Repeated launderings affect FR properties



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Optimized blending of the
right fibers is crucial....

Let's talk about fabrics.

100% FR Cotton



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Excel FR

- Amtex by Mt Vernon Mills
- Pyrosafe knits by Antex
- Indura by Westex

88/12 cotton/nylon



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Excel FR ComforTouch

- Amplitude by Milliken
- Amtex by Mt Vernon Mills
- Ultrasoft by Westex
- Others



CXP by Milliken

- Synergy by Springfield
- Freestyle by Tencate
- Others

Modacrylic blend fabrics



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Driven by emerging NFPA 70E market
Early research objectives included:

- Inherently FR
- HRC 2 Compliant
- Less expensive alternative to Nomex



Modacrylic blend fabrics

- Protera by DuPont/Springfield
- Glenguard by Glen Raven
- Tecasafe Plus by Tencate
- DriFire by Optimer Brands

Tecasafe Plus



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Garments marketed by Bulwark as Cool Touch 2
48/37/15 modacrylic/lyocell/aramid
4-fiber blend for Navy shade
Superior wicking performance
Abrasion resistance rivaling Nomex
HRC 2 compliant

The Future of FR Fabrics



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A lot of research/testing still being done:

- Focus on comfort; less emphasis on protection; retail inspired
- FR Clothing industry will benefit from work done for military
- Performance standards will only become more strict



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BE ASSURED!

Bulwark:

is **ALWAYS** looking for the next winning fabric
has the opportunity to evaluate all viable FR fabrics
adds fabrics to fill gaps in our line



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The future of fr is here!
Bulwark FR iQ Series



More than a single new product Line, iQ Represents A New Way Of Thinking

INTELLIGENT PROTECTION

This is an ongoing initiative to raise FR's "innovation Quotient." We are devoted to building better, smarter protective apparel that breaks FR's barriers – one by one. And solves problems for everybody.

- Safety Managers
- End Wearers
- Industrial Laundries
- Resellers
- Retailers



- The product OF a first of its kind partnership Bulwark and Milliken[®]
- 42 years of deep industry insight + 100 leading scientific minds
 - Devoted to building better, smarter FR that people *want* to wear – and not just while they're working



Milliken

- Specially engineered fiber and yarns make for high loft, low-density fabric construction. Less-dense construction moves mass away from body, creating lighter layer against the skin. And an entirely new chemistry (Dual Elemental Protection) breaks the “mass=protection” barrier.

Bulwark

- iQ Series™ garments are lighter than any other comparable FR garments available today. Yet they don't compromise protection.



Milliken

- An ingenious combination of yarn and open construction creates pathways that allow for maximum airflow through the garment. Plus, revolutionary Dual Elemental Protection guards the fabric (Milliken Amplitude G^{2™}), without blocking air passages within the fabric's construction.

Bulwark

- The iQ Series™ employs comfortably cool technology and design techniques that translate into an FR garment that's more breathable than anything comparable on the market. With greater comfort, comes greater compliance.



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Thank you –
From all of us at Bulwark



Bulwark Protective Apparel



Questions, Comments, Feedback?

