Why Is FR/AR Compliance So Difficult?

Or are we just over-complicating things?

This presentation is for informational purposes only

Customers of Bulwark Protection are solely responsible for conducting their own Hazard Risk Assessment to identify safety hazards in their work environment.

Customers of Bulwark Protection are solely responsible for selecting appropriate garments and protective gear for their employees and ensuring wearers use the garments and protective gear properly and in conjunction with appropriate gloves and footwear. Because working conditions and other factors may vary, Bulwark Protection does not make any representation that these garments and protective gear will protect wearers from injury.

Premise – We receive a lot of questions around how to properly wear flame-resistant/arc-rated clothing, such as “What is better – task-based or daily wear?” and “How do we ensure our people will wear their FR/AR clothing?”

What you will take away….

- Why is there resistance to FR/AR?
- What are some best practices to improve “buy in” to your FR/AR program
- How FR/AR science is leading to compliance
- What are the pros and cons of daily wear vs. task-based programs
- FR/AR clothing is not complicated – culture is

Why is there resistance to FR/AR?

1. It’s TOOOOOOOOOO HOTTTTTTTT!!!!!
2. It’s heavy and uncomfortable
3. Doesn't fit well

Safety then trends too *“They can just put it on when they need it”* - correspondingly that strategy hits all 3 of the resistors above.

- Putting at a minimum a 7oz. Or 9 oz. coverall over top of 100% cotton work clothing
- Heavy: you just added an additional layer
- Coveralls don’t lend themselves to a flattering fit

Encouraging compliance when it's HOT

What is the best way to encourage compliance when it's HOT?

The short answer is: wear trials and training

Single-layer FR/AR clothing does not trap heat or restrict heat removal any more than regular non-FR clothing. May 1, 2019 OHS – The Truth about Heat Stress and FRC

Heat is shed primarily by evaporation of sweat restriction or loss of this function either due to physiological conditions such as dehydration and/or clothing that restricts this action (such as raingear or impermeable membranes, or multiple layers), which can definitely contribute to heat stress.

Encouraging compliance when it's HOT

How do I convince my people to tuck in shirts, roll down sleeves and button their garments up – they are always complaining it's too hot?

It is a challenge for many of our Safety folks to get their team members to understand that **"ALL"** the standards point to wearing shirts, pants and coveralls properly and by properly we mean sleeves rolled down, shirts tucked in and buttoned.

As mentioned, all the standards around FR/AR clothing state in one way or another to wear shirts, pants and coveralls properly – and by properly we mean sleeves rolled down, shirts tucked in and buttoned.

Our arc flash standards – NFPA70E and ASTM – 1506 state:

NFPA70E - In addition to correct fit and appropriate freedom of movement, **sleeves must be fastened at the wrists, shirts must be tucked in, and shirts, jackets, and coveralls must be closed up to the neck.**

ASTM 1506 - XI.2.I Clothing should cover potentially **exposed areas as completely as practicable. This should include proper interfacing of related items**. (The proper way pants and shirts (related items) interface is "tucked in.")

Our Flash Fire standard NFPA 2113 –

5.1.6 When a shirt and pair of trousers, both flame-resistant, are worn together, the shirt shall be tucked in.

New material options?

Yes, manufacturers of arc-rated and flame-resistant fabrics have been on a quest for over 25 years to develop new fiber combinations in the best ratios to take advantage of all their positives and minimize their negatives. Other manufacturers have looked to partner with fiber and fabric developers looking for new and innovative ways to achieve the balance of protection, comfort and value.

REMINDER:

Single fabric characteristics listed below in and of themselves do not relate to comfort – comfort is subjective.

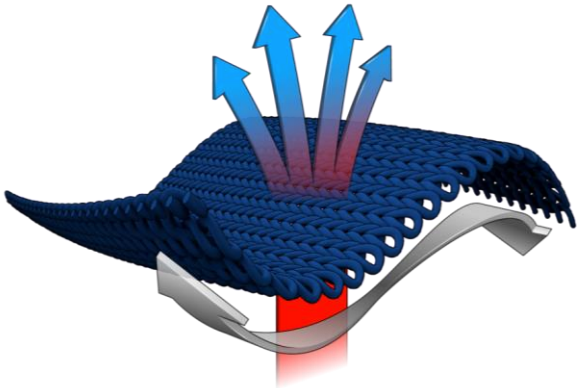
light weight, moisture wicking, high air permeability and moisture vapor transfer.

Meaning….

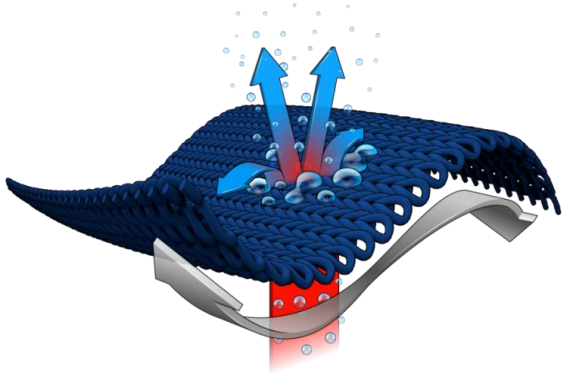
Comforts: 2 Key Elements!

Comfort is not weight dependent

AIRFLOW



WICKING



A unique combination of yarns
and an open weave construction
creates wicking and airflow
which drives comfort

How fiber and fabric evolution is enhancing compliance

- ✓ **Light weight** – Less insulating; allows more heat release (radiation)
- ✓ **Open Weave** – More air permeable; allows more air to move through the fabric to cool and evaporate moisture (convection)
- ✓ **Moisture Wicking** – Moves more moisture to the surface for the evaporative cooling (evaporation)

Compliance starts with the fabric

- **Open weave** driving increased **breathability**; also allows more water to get into the fabric to get the dirt out during cleaning
- **Durability:** superior **resistance to abrasion**
- Improved **moisture wicking:** dry almost twice as fast as cotton
- **Enhanced protection:** advanced FR chemistry and enhanced fiber blends
- Improved **thermal regulation:** combination of air permeability and moisture management.

Creating true performance workwear for the occupational athlete in the FR/AR market to defeat “comfort” objections to wearing my PPE

Look deeper than the brochure…

Fabric weight in and of itself is NOT an indicator of comfort

Make sure moisture wicking is a property of the fiber blend and not a finish (all wicking finishes are temporary)

High air perm alone is not an indicator of comfort (aka a screen door)

Moisture Vapor Transfer (MVT) is measurable and is a property of the fabric but not a finish

What we see….

- Very little or no resistance to FR/AR below the waist – many are used to wearing 12 and 14 oz. denim day to day – leads too
- Task based solutions – leads too
- Over protecting – the PPE Category Method (aka CAT) method or flash suits
- Wearing meltables underneath – lack of training
- Wearing non-compliant overtop - misunderstanding
- Stopping the hierarchy of controls at **ADMIN**

It hasn’t happened to us….

Just because NOTHING has gone BAD doesn’t make what you are doing right or safe

Compliance does not necessarily mean safe, though if you are safe you are most likely compliant. Being compliant doesn’t mean safe – think task-based vs. daily wear.

So where did it go wrong…. Tasked based

You have a program in place, and you gave everyone the necessary tools to get the job done. What happened?

- Someone takes a shortcut - saves them some time; set and repeat
- Others see this and start to emulate it
- New hires and transfers see this behavior and start to believe that:

"This is the way we do things around here."

Next thing, the unsafe practice becomes ingrained

When Doing Wrong seems Right: Normalization of Deviance

When people routinely perform repetitive yet dangerous tasks, it is very easy to become desensitized to the inherent risk of what could happen. There are even terms for it: it is called **“unintended blindness”** and/or **insensitivity to hazards** of the job. Even to go as far as calling it - **Normalization of Deviance.**

First coined by sociologist Diane Vaughan when reviewing the Challenger disaster.

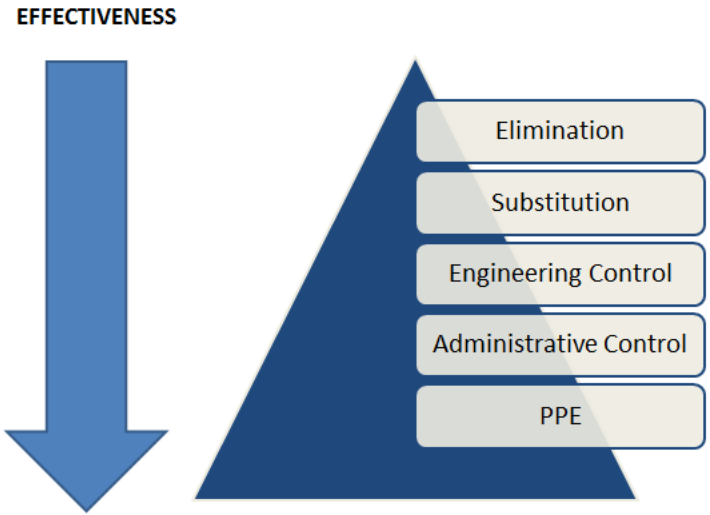
Vaughan noted that the root cause of the Challenger disaster was related to the repeated choice of NASA officials to **fly the space shuttle despite a dangerous design flaw with the O-rings**.

Insensitivity occurs insidiously and sometimes over years because disaster does not happen until other critical factors line up.

Deviation typically occurs because of **the barriers to using the correct process - time, cost, and peer pressure**.

Hierarchy of Controls

What Flame Resistant Clothing is Not!



PPE is your last line of defense…

But it doesn’t work unless you are wearing it and wearing it correctly

NFPA® 70E Annex Q: Human Performance and Workplace Electrical Safety

- Human performance addresses managing human error as a unique control that is complementary to the hierarchy of risk control methods.
- People are fallible, and even the best people make mistakes.
- The annex discusses the concept of human performance “to identify and address human error and its negative consequences on people, programs, processes, work environment, equipment or an organization.”

Task Demands

Time pressure (in a hurry)
High workload (memory requirements)
Simultaneous or multiple tasks

Work Environment

Distractions/interruptions
Changes/departures from routine

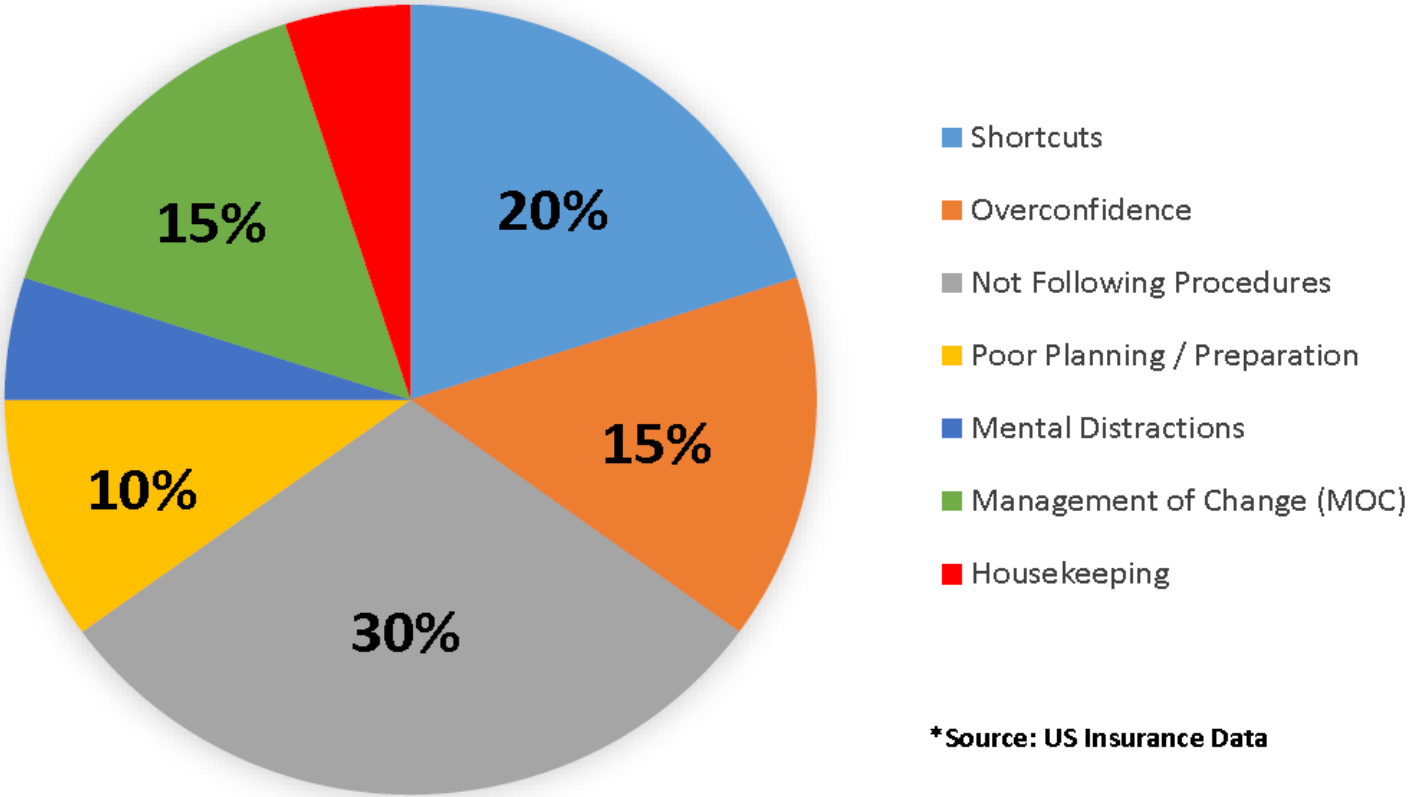
Individual Capabilities

Unfamiliar with, or first time performing task
Lack of knowledge (faulty mental model)

Human Nature

Stress (limits attention)
Habit patterns
Assumptions
Complacency/overconfidence

Where does “HUMAN” show up on the job…



*Source: US Insurance Data

Combating “HUMAN”

Daily wear is a baseline level of protection to combat not just human factors such as complacency, lack of sensitivity to the hazard and/or a normalization of deviance.

It also provides a last line of defense when - as exemplified in the hierarchy of controls - everything else fails.

Task-based vs. Daily Wear

Primary Protective Clothing

- Definition: “Clothing that is designed to be worn for work activities where significant exposure to molten substance splash, radiant heat, and flame is likely to occur.” Example- Firefighter Turnout Gear

Secondary Protective Clothing

- Definition: “Clothing that is designed for continuous wear in designated locations where intermittent exposure to molten substance splash, radiant heat, and flame is possible.” Example- Utility workers, Refinery workers

This is how it creeps into my world…..

Is this under shirt arc rated?
Is this shirt arc rated based on a reasonable estimate of the incident energy?

What is he wearing under his arc-rated shirt?
Is it potentially exposed based on the laws of thermodynamics?

Note: all the standards state shirts and pants must be tucked in!

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Bonus….

SOME STANDARDS ALONE ARE NOT ENOUGH; SOME ARE JUST WRONG

Noncompliant rainwear and vest can pose a serious problem to an otherwise solid FR/AR clothing program

- ASTM F2302 – NOT INTENDED AS A STAND ALONE
- ASTM D6413 –NOT A PERFORMANCE STANDARD
- NFPA® 701 - NOT A GARMENT STANDARD

Rainwear has specific standards for arc flash and flash fire

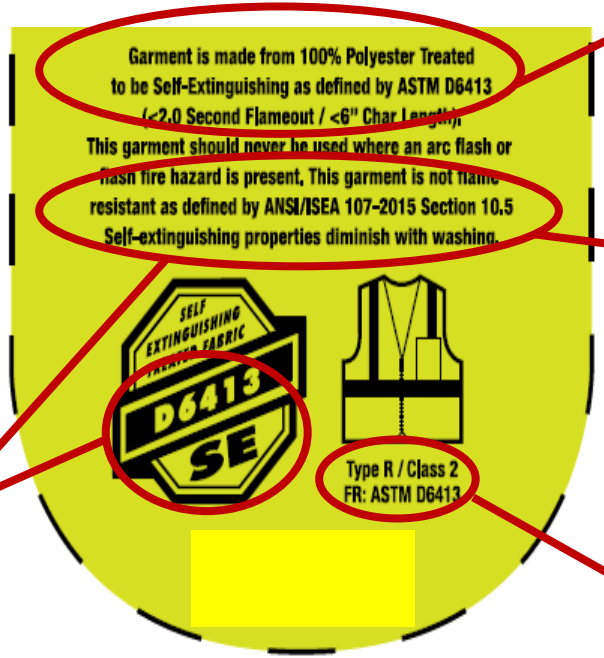
ASTM 1891 – for arc flash

ASTM 2733 – for flash fire

For vests – look for ASTM 1506 and an Arc rating in the label

Misleading Labels

This is misleading and potentially dangerous! How many contradictions can you have in one label?
Notice what is large and bold vs. in small, hard-to-read print. You have to ask, what is the purpose?



ASTM 6413 is **not** a performance standard

It has to state by ANSI 107-15 it is **non-FR** because it does not meet a performance standard for arc flash or flash fire

Self-extinguishing characteristic that they state **wears out**

How can you say FR when on the same label you say it is non-FR?

Don’t over complicate things…

Simplified:

- Daily wear
- AR/FR should be appropriate to hazard
- Base layers are important
- Upgrade to latest technology
- Do your homework
- Look to a SME you trust

How does that look for arc flash protection?

Wherever workers may be exposed to hazards associated with electrical energy, employers must make sure they are protected.

During an arc flash the amount of energy that could potentially be released is called Incident Energy or IE, and it is expressed in calories per square centimeter or cal/cm^2.

NFPA 70E® requires AR (or arc-rated) clothing for any potential exposure **above 1.2 cal/cm^2**

AR clothing must be **matched** to the degree of severity presented by the Incident Energy (IE).

This is called an arc rating, which can be an **ATPV** (Arc Thermal Performance Value) or an **Ebt** (Energy Break open Threshold); both measured in cal/cm^2.

AR>IE

Selection of arc-rated when the Incident Energy is known

Table 130.5(G)

Incident energy exposures equal to 1.2 cal/cm2 and up to 12 cal/cm2

Arc-rated clothing with **an arc rating equal to or greater than the estimated incident energy**
A - Long-sleeve shirt and pants or coverall or arc flash suit **(Selection of one in group is required)**
Arc-rated face shield and arc-rated balaclava or arc flash suit hood **(Selection of one in group is required)**
Arc-rated outerwear (e.g., jacket, parka, rainwear, hardhat liner) **(As needed)**

Incident energy exposures greater than 12 cal/cm2

Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy
A - Long-sleeve shirt and pants or coverall or arc flash suit **(Selection of one in group is required)**
Arc-rated arc flash suit hood
Arc-rated outerwear (e.g., jacket, parka, rainwear, hardhat liner) **(As needed)**
Arc-rated gloves or rubber insulating gloves with leather protectors **(Selection of one in group is required)**

Knowing the IE allows you to protect to the hazard vs. a range such as in the CAT Method

How does that look for flash fire protection?

Specify NFPA® 2112 Compliant garments:

What it is….

- A means of certifying fabrics & findings suitable for use in FR clothing to be worn as protection against possible flash fire exposure

Fabrics must :

- Retain flame resistance through multiple launderings
- Meet standards for heat transfer performance, thermal stability and heat resistance
- Result in less than 50% predicted body burn when tested on a thermal manikin over underwear in a flash fire of 3 seconds

What does 3rd-party certified mean to YOU?

- Based on what we know today – it gives you peace of mind that this garment meets or exceeds all the standards and tests available for the hazard
- You don’t need to choose NFPA® 2112-certified garments, but if you don’t, why didn’t you?
- If you are not going to use NFPA® 2112, what are you going to use?

Don’t over-complicate things…Team Buy-in

- ✓FR committee
- ✓Evaluate & select latest fabrics for garments
- ✓Tour the manufacturer/mills
- ✓Proper wear trial of garments
- ✓Include outerwear, rainwear and Hi Vis
- ✓Select: Choice, IL or Hybrid program
- ✓Roll out must include training

Thank You!

Questions & Discussion

Bulwark Protective Apparel

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