

Workplace Health and Safety Bulletin



Appropriate Workwear for Flash Fire and Explosion Hazards

What is the hazard?

Flash fires and explosions are common hazards at a variety of Alberta workplaces. These hazards are present in work areas where flammable materials are handled, processed, stored, or in any way present. In the petrochemical industry for example, flash fire can occur at well head sites, collection points, compressor stations, refineries, and petrochemical and plastic plants. In such areas, the potential exists for developing an explosive atmosphere capable of injuring or killing workers and causing extensive property damage.

Industrial flash fires and explosions result from the accidental release and ignition of flammable fuels. The size and duration of the flame that results from this ignition is determined by the amount of fuel available, the efficiency of combustion, and the environmental and physical characteristics of the site of the flash fire or explosion. The temperatures attained by flash fires have been estimated to range from 550 to 1050⁰C, although higher temperatures are believed to occur. Even the lowest estimated temperature exceeds the temperature at which most regular clothing fabrics burst into flames.

Where the burn happens

A worker can be far enough away from the fuel source that they are unable to smell the fuel yet still be engulfed by the flame and suffer burns. If the flash fire or explosion is sufficiently intense, the heat produced may cause regular clothing to melt or begin burning. This damage occurs with a burst of flame that rarely lasts more than 6 seconds —usually 3 seconds or less.

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Contrary to popular belief, workers not wearing fire retardant clothing who have survived flash fires and explosions do not suffer the most serious burns on their uncovered head and hands. Instead, the areas that *are* covered by their regular clothing are the most severely burned. The burning clothing, in contact with the skin and burning long after the flame has retreated, causes the most severe burns. Clothing that melts without burning can also cause significant damage.

Fire retardant clothing

Protection against burns due to flash fires can be provided by lightweight clothing made of materials that look, feel, and wear like regular work clothes. Worn as the outermost layer, such protective clothing reduces the severity of burn injuries and increases the likelihood of survival in the event of a flash fire or explosion. This specialized fire resistant or fire retardant (FR) clothing is intended to protect workers from exposure to intense heat and flame for short periods of time. An altogether different type of protective clothing is required for situations where exposure to intense heat is frequent, normal, and of extended duration.

FR clothing is unique because when exposed to high heat and flame for short periods of time, it does not burn, it does not melt, and it shields the clothing worn beneath it from the intense heat of the flame. FR fabrics are either inherently flame resistant — the fibres are of a material that itself does not burn — or are made of materials that undergo some type of treatment so that they are made non-flammable. Wool and leather are two naturally flame resistant materials that are appropriate in some work situations. While natural wool is not entirely non-flammable, it is self-extinguishing and therefore has some inherent flame resistance.

Other important performance characteristics

FR clothing must be properly selected for the tasks performed, the hazards associated with these tasks, and the work environment in which the tasks are performed i.e. hot, cold, clean, dirty.

The final selection of FR clothing is often based on properties or characteristics other than the clothing's fire resistance. These other factors include

- (1) resistance to chemicals;
- (2) resistance to abrasion;
- (3) ability to resist build-up of static charge;
- (4) ability to act as a barrier to liquids and soils encountered at the workplace;

- (5) worker comfort i.e. fit, feel, warmth, coolness — a particular trade name of fabric is often available in a variety of different thicknesses, affecting the clothing's fit, feel, breathability, and temperature characteristics. The clothing should cover as much of the body as possible. Clothing worn beneath FR clothing should not become exposed when bending, reaching, or crouching;
- (6) degree of use i.e. continuous, intermittent; and
- (7) frequency of washing and cleaning required to maintain clothing performance.

Inappropriate clothing materials

Most of the clothing fabrics traditionally used for outerwear are inappropriate for use around flash fire and explosion hazards. Untreated cotton, polyester, nylon, and polycotton blends are such examples. Untreated cotton has a very low ignition temperature of approximately 250°C and burns intensely and rapidly. Untreated polyesters and nylons ignite easily (250 - 350°C) and melt readily. Nylon is also particularly prone to static build-up and is a recognized ignition source. Polycotton blends combine the worst characteristics of both polyester and cotton.

Clothing worn beneath FR clothing and against the skin should be made of FR fabrics or natural fibres that do not melt. Appropriate natural fibres include wool, silk, and cotton.

Maintaining FR clothing

To retain the clothing's original FR characteristics, it should be cleaned as specified by the manufacturer. FR clothing loses its effectiveness if the fabric is soiled with dirt and oily residues. Cleaning helps to return the clothing to its original condition but must be done as recommended by the manufacturer. The build-up of detergent and mineral residues in and on the fabric can compromise the fabric's effectiveness. One of the most common ways to destroy the special properties of treated FR clothing is to use bleach during laundering.

Any tears or other damage must be repaired promptly so that the clothing maintains its protective qualities. FR fabric patches and FR thread must be used as repair materials. Once again, the manufacturer's recommendations should be followed when clothing is repaired.

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