

A dramatic, high-contrast image of an explosion or fire, with bright orange and yellow flames and smoke billowing against a dark background. The texture is turbulent and intense, filling the top half of the page.

# Accounting for PPE in Combustible Dust Hazard Assessments

While potentially destructive, combustible dust hazards tend to be one of the least understood hazards facing the industrial workforce. A number of factors contribute to the prevalence of combustible dust, and its conceivably catastrophic impact can be seen across a breadth of industries.

Seemingly simple in nature, combustible dusts are fine particles that can present both explosion and deflagration hazards. When combustible dusts are concentrated and dispersed in sufficient quantities, that dust, along with oxygen and heat, can lead to rapid combustion known as deflagration. This pressurized fire can then lead to combustible dust explosions. Five key conditions must be present to lead to a combustible dust explosion – with combustible dust acting as the fuel, an explosion manifests with four other

factors of oxygen, heat, dispersion and confinement. Because explosions like these can further disperse combustible dust throughout the plant, multiple secondary deflagrations can propagate and further exacerbate an already serious incident.

In the last few decades, there have been high-profile accidents with substantial injuries and mortalities, which led OSHA to reissue the National Emphasis Program (NEP) in March 2008.



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Many believed that the NEP would be followed by a formal OSHA rule around the combustible dust hazard. While the NEP aggressively inspects facilities and enforces existing regulations where frequent or catastrophic combustible dust events occur, employers must use a number of existing rules and consensus standards to mitigate combustible dust hazards. Because there is no formal rule, and no comprehensive body of knowledge surrounding combustible dust, compliance is much lower than expected. Many feel the issue of compliance can be pushed off until a formal OSHA rule is in place.

Nothing, in fact, could be further from the truth. The hazards are still present, regardless of if a formal rule is in place. OSHA points to its General Duty Clause, 5 a 1, mandating that employers provide a workplace where workers are protected against recognized hazards, as the means to achieve combustible dust compliance.

With the General Duty Clause as the primary regulatory driver, employers must pull from consensus standards, usually NFPA 652, to understand how to assess the dust hazard and determine if the dust is combustible. Using DHA-Dust Hazard Analysis, employers should use the results to mitigate the impending risks of dust by utilizing the hierarchy of controls.

Hazard mitigation can be accomplished through various preventative methods, such as:

- Engineering controls, to monitor and reroute pressure increases, to mitigate explosion impacts, and to suppress deflagration and combustion factors;
- Thorough cleaning and housekeeping procedures, to stop dust accumulation; and
- Ventilation installations, to lower the potential for pressure and heat build-up.

While these important steps are part of the hierarchy of controls, employers should know that additional mitigation is needed to further shield employees. Employees are protected from combustible dust-related deflagrations through the use of appropriate flame resistant (FR) PPE along with ongoing training programs and procedural updates.

It is important to know that flash fires – a hazard not previously mentioned in this article – are yet another serious threat to employee safety. Flash fires have a rapidly spreading front, similar to deflagration, without the pressure component of deflagration and explosion. Combustible dust is again the fuel for flash fires, and often, flash fires provide a more tangible and more prevalent risk than deflagration and explosion. All three are incredibly serious hazards, and the preventative risk controls mentioned address the deflagration and explosion hazards, but there is yet another control set available to mitigate the flash fire

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hazard.

PPE, the last control, can help close the risk gap and mitigate the potential for injury or loss of life presented by flash fires. PPE, and especially FR clothing, works to protect workers in two major ways – FR clothing will not continue to burn after a flash fire is over, and FR clothing provides sufficient insulation from second-and third-degree burns. When specified and worn correctly, FR clothing helps to provide escape time, so that employees can quickly and safely retreat from a hazard. While FR clothing will not prevent burns entirely, it can help drastically reduce the severity of burn injuries resulting from short-duration thermal exposure and significantly increase the probability of survival.

Between 1980 and 2005, the U.S. Chemical Safety Board identified 281 combustible dust incidents, causing 119 fatalities and 718 injuries. Injuries, primarily resulting from burns, occurred at roughly a 7:1 ratio over fatalities during that timeframe. FR PPE, if it was worn at the time, would likely have reduced not only fatalities from catastrophic burn injury, but reduced burn injuries overall. FR PPE will not protect against the concussive force of the explosion, but it will certainly mitigate burn injury caused by deflagrations and flash fires.

National Fire Protection Association's (NFPA) *Standard on Flame-Resistant Clothing for*

*Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire* (NFPA 2112) provides the minimum performance requirements and test methods for FR fabrics and components, along with design and certification requirements for garments used in areas with short duration thermal exposures risks. This standard is used by many organizations to select quality, third party-certified FR apparel.

NFPA 652, another important standard governing PPE use in combustible dust environments, states employers “shall address PPE, including flame resistant garments” for operating and maintenance procedures as required by an appropriate workplace hazard assessment outlined in NFPA 2113. NFPA 2113, *Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire* (NFPA 2113-2012), provides direction on selection, care and maintenance of FR clothing, and also provides guidance on workplace flash fire hazard assessments.

Armed with these three NFPA standards, (NFPA 652, 2112 and 2113), and after completing a thorough PPE hazard assessment, employers can create and implement a PPE program best suited

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***Keeping in mind that combustible dust can cause flash fires, deflagration and explosions, a comprehensive safety program, with trusted, branded PPE serving as a foundation, can help reduce this ever-present risk***

By approaching combustible dust from a well-rounded viewpoint utilizing the hierarchy of controls, employers can alleviate the property and safety hazards their employees are facing. Keeping in mind that combustible dust can cause flash fires, deflagrations and explosions, a comprehensive safety program, with trusted, branded PPE serving as a foundation, can help to reduce this ever-present risk found throughout the industrial community.

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<https://www.ishn.com/articles/108200-fr-clothing-reduces-flash-fire-harm>*