

# **A Review of Flame Propagation and Quenching in Pipes and Ducts Handling Combustible Dusts**

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## **Abstract:**

Dust explosions are uniquely hazardous for modern industry as they can happen in multiple different industries (e.g. agricultural, chemicals, textiles, metal processing, pharmaceuticals), all typically with realization that such a catastrophic incident can occur. It is estimated that from 1980 to 2005 there have been over 3,500 combustible dust explosions with many more happening since then<sup>1</sup>. There are a number of National Fire Protection Association (NFPA) codes and standards (e.g. NFPA 652, 654) that address the hazard that dust poses in multiple different applications. These standards are written not only based on best practices, but also technical data. Currently one area in need of technical data to support the code requirement is the determination of when pipes or ducts are too small to permit propagation of combustible dust deflagrations. Additional technical information on the pipe and duct parameters that affect explosion propagation is also needed as there is also a lack of comprehensive knowledge around conditions influencing the explosion propagation through piping, especially small diameter piping. Different prior research works have evaluated these above conditions by considering the characteristics of the equipment system (pipe/duct diameter and length), properties of the combustible dust, and operating conditions (pressure, temperature, flow rate, etc.). The current literature review work aims to gather the available information and present it in a comprehensive manner so as to identify any potential correlation between the parameters. Literature will be gathered across a multitude of industries (e.g. manufacturers, insurance) to accomplish a more holistic review and this knowledge will permit rational protection requirements to be established for various combustible dust fire and explosion prevention standards. The industrial incidents in which duct work or piping played a role in explosion or deflagration propagation are also identified in this study. The review so far indicates that smaller pipe diameters will increase explosion propagation and intensity of the explosions, while at the same time potentially quenching certain types of dust deflagrations.

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<sup>1</sup> Distidar, Ashok. "Process Modernization – Process Safety: Dust Explosion Hazards". 2014. Presentation