

## NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids

David E. Kaelin Sr., Senior Process Safety Specialist

NFPA 654, “Standard for the Prevention of Fire and Dust Explosions, from the Manufacturing, Processing and Handling of Combustible Particulate Solids” was first adopted by NFPA in 1945 and covered dust explosion hazards in the plastics industry. In 1982 the scope of this document was expanded to include to include chemical, dye, and pharmaceutical dusts. Over the years, the standard has been modified and updated to its present form, intended to cover essentially the all handling and processing of combustible solids with the exception of those specialized materials that are covered by other NFPA standards such as sulfur (NFPA 655), wood (NFPA 664), and foodstuffs (NFPA 61).

In 1997, new technologies for explosion protection were added and, in 2000, portions of the *Standard for Pneumatic Conveying Systems for H handling Combustible Solids*, NFPA 650, were included and that standard was withdrawn. Specific chapters within NFPA 654 include: Facility and Systems Design, Process Equipment, Fugitive Dust Control and Housekeeping, and Fire Protection. This standard is an excellent summary of good practices for the control of dust explosion hazards in industry. The most recent edition of this standard is the 2006 edition approved 8/18/05. This edition introduces the performance-based approach for protecting facilities processing combustible particulate solids processing facilities. New or substantially modified facilities processing explosible dusts are covered by this standard, where required by state or local legislation codified.

As a direct result of three serious fatal dust explosion accidents in 2003 the USA in 2003, many states will likely codify NFPA 654., In addition, many state building codes and fire codes, as well as the International Fire Code (IFC), reference, and require compliance, to NFPA 654.

One of the repeated issues of the three 2003 fatal dust explosion incidents, as that resulted in fatalities, pointed out by the Chemical Hazard and Investigation Board, CSB was: “existing codes and standards, although comprehensive, are inconsistently applied and, as a result, are ineffective”.

Several important areas of concern, when the hazards of processing powders and explosible dusts are assessed, are addressed and guidance is provided in NFPA 654, including:

- o **Recycle of Air-Material Separator Exhaust:**  
Many sites recycle air from dust collector exhaust to the operating building in order to conserve energy, without consideration of the hazard that can be created if the dust collector fails to remove the explosible dust. NFPA 654 allows recycle if certain safety precautions are taken, such as a design capable of removing 99.9% of particles larger than 10 microns and only if the system is free of flammable gas or vapor.
- o **Explosion Isolation of Protected Equipment:**  
Where an explosion hazard exists in one piece of equipment, isolation devices shall be provided to prevent deflagration propagation between connected equipment. Devices can be: chokes; rotary valves; fast-acting automatic valves; flame-front diverters; or chemical isolation systems.
- o **Indoor Bucket Elevators:**  
These devices shall be protected by explosion containment, explosion relief venting, explosion suppression, or inerting.
- o **Cyclones (Air-Material Separators):**  
If larger than 8 cubic feet, ft<sup>3</sup> these devices shall be protected from explosion by explosion containment, explosion relief venting, explosion suppression, or inerting.
- o **Housekeeping and Dust Deposit Management:**  
Guidance is provided to limit deposits to a minimum., layers 1/32 inch in thickness are sufficient to warrant immediate cleaning. Use of air jet streams to “relocate” explosible dusts should be discouraged.

Other key codes and standards associated with dust fire and explosion hazard management include:

### Other Important Combustible Solids

#### Codes & Standards

- NFPA 61, “Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Products Facilities”
- NFPA 85, “Boiler and Combustion Systems Hazards Code”
- NFPA 484, “Standard for Combustible Metals, Metal Powders, and Metal Dusts”
- NFPA 499, “Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas”
- NFPA 655, “Standard for the Prevention of Sulfur Fires and Explosions”
- NFPA 664, “Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities”

### General Fire and Explosion Hazard Codes & Standards

- NFPA 1, “National Fire Protection Code.”
- NFPA 13, “Standard for the Installation of Sprinkler Systems.”
- NFPA 45, “Standard on Fire Protection for Laboratories Using Chemicals.”
- NFPA 68, “Guide for Standard on Explosion Protection by Venting Deflagration Ventings”
- NFPA 69, “Standard on Explosion Prevention Systems”
- NFPA 70, “National Electrical Code.”
- NFPA 77, “Recommended Practice on Static Electricity”
- NFPA 91, “Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.”
- NFPA 101, “Life Safety Code.”
- NFPA 704, “Standard System for the Identification of the Hazards of Materials for Emergency Response.”
- API Recommended Practice 2003, “Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents”

Many serious incidents have been caused by explosions of what might be normally thought of as benign materials such as plastics, rubber, foodstuffs (see NFPA 61) and wood dust (see NFPA 664). Companies processing and handling finely divided particulate solids need to be aware of the potential for fire and explosion events and how industry best practice and existing Codes and Standards can minimize/manage the risk.

## How can Chilworth Technology, Inc. help you with Codes & Standards Issues involving Combustible Dusts, Flammable Liquids and Vapors?

Chilworth Technology has a group of highly qualified Process Safety Specialists, who can help you with all aspects of codes and standards including, application, interpretation, and auditing process operations. If you have any questions regarding this article or any other process safety concern, please contact us at (609) 799-4449 or email us at [safety@chilworth.com](mailto:safety@chilworth.com).

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