

## Dust Explosion feature at MCA Charleston 2007 Seminar Applied to Georgia Disaster

The presentation was given by Professional Engineer John Cholin, who had chaired the subject NFPA technical committee for 10 years, has written four chapters for the NFPA Fire Protection Handbook, and regularly instructs at NFPA seminars.

Mr. Cholin distilled a lifetime's knowledge and experience into an hour's technical instruction on dust explosions. Among the lessons we took away from the session were these:

1. For a dust explosion, 4 things are needed:
  - a) sufficient quantity of airborne particles, generally less (depending on the substance) than about 400 microns in their longest dimension
  - b) stored chemical energy in particles, carbonaceous (process resin, flour, sugar) or metallic (aluminum)
  - c) ignition source (machine friction, electric arcing, open lights, snap switches, etc.)
  - d) containment (a building, silo, tank, vault) to accumulate explosion pressure
2. Dust explosions are extremely physically destructive, for 2 reasons:
  - a) Concentrated suspension of dust has more mass than comparable volume of vapor
  - b) building construction (with roofs and interior flooring, held in place largely by weight) virtually guarantees destructive implosion when walls are deformed by even a relatively low-energy (5-10 psi) impulse
  - c) A unique destructive feature of dust explosions is their sequential nature, wherein a relatively small and localized "pop" dislodges gross amounts of dust from overhead structure. This gross suspension then explodes in an extremely destructive "secondary" event.
4. Dust explosions cause the most horrific and gruesome of injuries. Mr. Cholin opined that there are two types of victims in a dust explosion; the lucky and the unlucky. And the lucky ones are those who die immediately. Badly burnt survivors are condemned, he said, to lives of pain, disfigurement, disability, and isolation, not only socially, but even from sunlight.
5. Vaporous explosions, as in the petroleum industry, often give warning by meter readings, smells, etc. Dust explosion warnings are exclusively visual: If your finger can write in dust (assume layer of ~1/8 inch), that dust, when airborne, can make an explosive cloud ~10 feet deep
6. Preventing dust explosions is not a new technology. Electrical safety, baghouses, ventilation, flexible vent louvers; all are decades old. But all can be futile in the face of gross neglect of that most basic remedy: housekeeping.

7. Often, housekeeping is synonymous with money: Plants must be programmed for routine “down-time,” wherein workers, (often in respiratory protection,) remove accumulations of dust from overhead structure such as rafters, from ventilation ducting, from storage shelving, etc.

With Mr. Cholin’s lessons in mind, Marine Chemists had an enlightened interest in last February’s Imperial Sugar Refinery fire. Cursory research reveals:

- Photographs taken years before the explosion showed piles of sugar dust on overhead structure and upper floors of the refinery.
- In the “mill” area, where granular was ground to confectionary sugar, powdered sugar had accumulated on the floor to “mid-leg” height.
- Airborne sugar made it difficult for workers to see each other.
- The vice-president in charge of operations said, of the refinery, “I was surprised we hadn’t killed anybody already because the plant was so dangerous.”
- Worker training can be extremely important. There was a 5-minute interval between primary and secondary explosions in the Imperial disaster. Many people, later injured or killed, could have easily self-rescued had they been properly trained.

Larger lessons:

1. In 2005 The Chemical Safety Board, noting that in the previous 25 years 280 dust explosions that had killed 120 workers and injured 700, recommended that OSHA replace the patchwork industry approach with a dust explosion standard. (A similar effort decades earlier had been highly effective in the grain industry.) OSHA has not taken action.
2. Between the CSB’s call for regulation and the Imperial Sugar explosion another 70 explosions killed 14 more people and caused another 68 injuries.
3. Only OSHA is capable of a nation-wide standard on the hazards leading to dust explosions.