G104 Mass Fatality Investigation Due to Combustible Dust Related Industrial Explosion and Fire

J.C. Upshaw Downs, MD, and Edmund R. Donoghue, MD, Regional Medical Examiner, Georgia Bureau Investigation, 925 A Mohawk Street, Savannah, GA 31419-1796*

After attending this presentation, the attendee will recognize the dangers of combustible dusts and their relation to industrial deaths, and better understand unique features of mass fatality investigation in an industrial setting and an active fire scene.

This presentation will impact the forensic community by exposing practitioners to the under-recognized dangers of combustible dusts and the complexities involved in mass fatality in an industrial/fire setting.

Combustible dust is an under-recognized industrial hazard. The United States Chemical Safety Board identified over 280 events with 837 casualties (including 119 deaths) in the period 1980 to 2005. The industries involved are varied and include organic dusts (wood, sugar, grains, etc.), metal powders (magnesium, aluminum), chemical manufacturing, plastic production, pharmaceutical production, and coal handling/processing. In fact, "any industrial process that reduces a combustible material and some normally noncombustible materials to a finely divided state presents a potential for a serious fire or explosion" (NFPA's Industrial Fire Hazards Handbook). In fact, sugar may seem harmless but is recognized as a strong explosion hazard (Bureau of Mines – "The Explosibility of Agricultural Dust"). In addition to the usual fire-triangle components (fuel, fire, and oxygen), a combustible dust explosion requires sufficient quantity and concentration of dust in a confined space. A major risk in such settings is the rapid dispersion of previously quiescent depots of dust particles follows a lesser primary explosion. With a significant fuel reservoir abruptly literally shaken loose and into the ambient air, a more devastating secondary explosion can be anticipated if the reservoir ignites. Safety procedures can reduce the risks associated with combustible dusts, especially related to the fuel, dispersion, and ignition but are less effective in controlling the confinement and ambient oxygen.

Shortly after 9 p.m., a series of explosions rocked the second largest cane sugar refineries in the United States (responsible for ~15% of total national production). The fires took days to extinguish due to the nature of the incident – a large depot of molten sugar remained ablaze in one of three storage silos despite significant efforts to put it out. Up to an estimated 100 personnel (of 472 total) were reported working in the affected plant area at the time of the blast. Of these, upwards of 40 individuals were seriously injured and a total of eight individuals were eventually reported missing and presumed dead. Recovery efforts, including law enforcement and medical examiner staff, to locate the presumed deceased proceeded while the silo fire was actively burning and scene stability was questionable. Over the ensuing days and weeks, the bodies of the dead were recovered and identified. The extensive thermal damage to those who remained in the burning plant longest posed identification challenges due to fragmentation and calcination. At the conclusion of the medicolegal investigation, all eight dead on scene were identified and the remains were re-associated with the appropriate individual. An additional five fatalities occurred related to extensive burn injuries, for a total 13 deaths. The case resulted in extensive media scrutiny and eventually the third-largest fines in OSHA history.

This presentation reviews the nature and dangers of combustible dust related fires. Specific issues related to the death investigation process and body recovery are addressed. The investigative outcomes, including recognized risks and identified cause are presented.

Combustible dust, Explosion, Sugar

 ** Presenting Author*