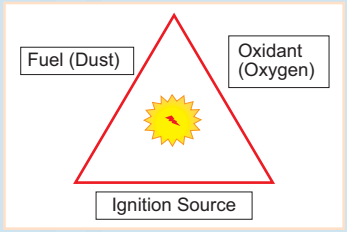
Dust Explosion Protection

On February 15, 2006, Mr Felipe Ong, Regional Sales Manager of BS& B Systems, gave a talk on a subject that is of interest to people in many industries that on first sight are not related eg. flour milling and pharmaceutical manufacturing. Where is the connection? It is in the presence of dust particles suspended in air that may explode under the right conditions.

Many of the powders and dusts found in industry and even in the home can explode when they are mixed in the right proportion with oxygen in the air. An ignition source is all that is required to set off an explosion. In industry, such materials are often processed, conveyed and stored in equipment of light construction that are not designed to contain an explosion.Hence safety measuresare are required to protect equipment handling combustible particulate solids.

The conditions for a dust explosion to occur is best illustrated by the well known 'Dust Explosion Triangle' shown on the right.



Substances that could explode under the right conditions include common materials such as plastics, inks, dyes and toners, pesticides, carbonaceous dusts, pharmaceutical products, grains, sugars, cocoa, flour, milk powder, starch and wood dust. The risk level is represented by an 'explosive index' or 'Kst' value. This index is a measure of the explosive power of a dust and is used to determine the appropriate protection measures for dust explosion protection and prevention.

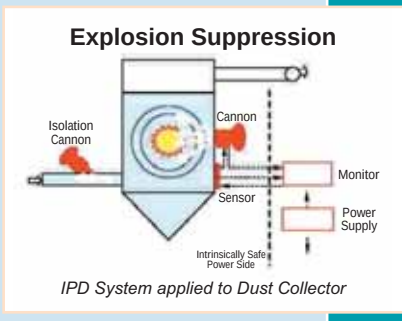
Typical types of process equipment at risk when handling combustible dusts are: reactor vessels, blenders, mills, ovens, screens, grinders, mixers, pulverizers, dryers, filters, dust collectors, and cyclones. Material handling equipment such as pneumatic or screw conveyors and bucket elevators must be included in protection and prevention strategies as well as storage equipment such as low pressure tanks, bins, and silos. Laboratory and pilot plant equipment such as hoods, glove boxes and test cells are also at risk when handling combustible dusts.

Mr Ong emphasised that connected pieces of process equipment must be considered when deciding on explosion prevention and protection strategies. This is because a dust explosion travels at high speed and requires fast detection and response in order to mitigate the risks from a fully developed overpressure.

He gave examples of the devices used by BS&B for explosion prevention and protection. Frequently these are used in combination. Examples of these are Explosion Vents for process equipment protection, Explosion Vents for building protection, Explosion Suppression Systems for process equipment protection, Fast Acting Pinch Valves for mechanical isolation of connecting ductwork and chemical isolation systems. These latter provide a barrier to flame transmission through connecting ductwork.

We not only feed the intellect we also feed the body

Explosion venting techniques are well known in industry. In this regard, it is important that calibrated vents are employed with a low set pressure and that these vents are appropriately sized for each application. The technique of suppression is less well known; Suppression is designed to detect the earliest stages of an explosion and prevent its full development by injecting a quenching agent into the developing fireball to end the combustion process.



IPD System applied to Dust Collector

The BS&B ' IPD Explosion Suppression System ' uses a highly accurate sensor to detect the pressure wave that runs ahead of the flame front in the early stages of an explosion. (The sensor is designed to prevent false activations arising from vibration or other non explosion pressure wave events.) An electrical signal generated by the operation of the sensor activates the opening of 'cannons' mounted directly on the protected equipment causing the injection of the food grade sodium bicarbonate flame quenching agent into the equipment. The agent is efficiently dispersed by an integral nozzle and extinguishes the flame before it has time to build into a deflagration that would develop levels of pressure dangerous to the process equipment. The IPD system typically limits the pressure developed within enclosures to less than 0.2 Bar. By comparison, an unprotected explosion will typically reach more than 8 bar in less than 1/4 of a second (value is different for each combustible dust).

Propagation of explosions between connected enclosures can cause catastrophic secondary dust explosions. **NFPA (National Fire Protection Association, USA)** has highlighted this risk in the most recent change to Standard **NFPA 654**, published in Oct 2005.

NFPA 654 is the standard for prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids. (2006 edition)

Below is an extract from this standard:

7.1.4 Isolation of Equipment.

7.1.4.1 Where an explosion hazard exists, isolation devices **shall** be provided to prevent deflagration propagation between pieces of equipment connected by ductwork.

Note: The use of the word **"Shall"** indicates a mandatory requirement. This and other related NFPA standards, such as NFPA 68, 69, 61, 664 & 30B, related to Explosion Protection were also discussed.

The talk concluded with a case study of an explosion that occurred in a grain handling facility in Europre.

This interesting talk generated much animated discussion between Mr Ong and members of the audience. These discussions continued into the dinner that followed.

By Ngiam Tong Yuen

BS&B's Toh Thiam Boon attentively listening to a member of the audience

Felipe Ong in full action

Felipe receiving his well deserved momento from VP Ong See Hee

Attentive audience not missing a single point