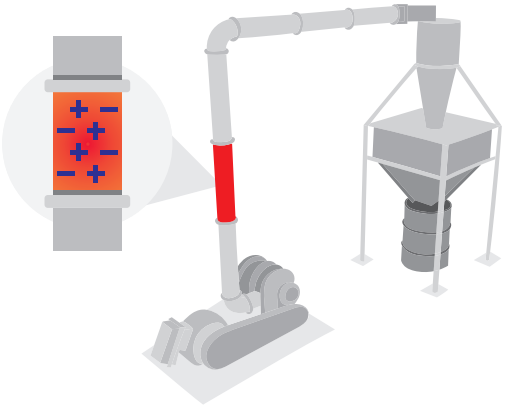
Fundamentals of Static Electricity in Hazardous Area Industries

To people in everyday life static electricity is simply an annoyance. In industries where hazardous materials are handled, static electricity is a very real and unseen hazard that can act as a catalyst for fires or explosions in flammable and combustible atmospheres. It is often misunderstood and is a volatile source of ignition encountered in modern industry. Static electricity is, by definition, an insidious and therefore difficult to detect, phenomenon. Despite this commonly held perception the generation of electrostatic charge can be predictable and potentially controllable.

01

Static electricity is trapped electric charge on the surface of a material which can accumulate to hazardous levels over a short period of time. When an imbalance of static charge is present on an object, the object is said to be electrified. Contact electrification occurs when, for example, powder particles collide or rub against a conveyor during mixing and when the insulating soles of footwear make contact with flooring. Rubbing two materials against each other increases the contact between their surfaces, which is what is known as the triboelectric effect.

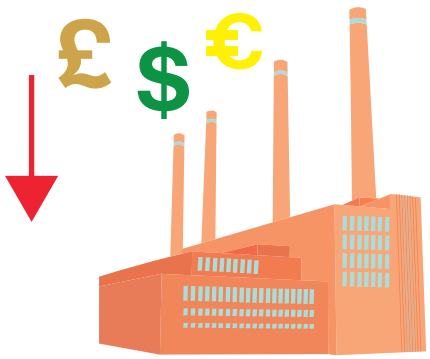


02

Hazardous Area Classification and Control of Ignition Sources by the HSE list 19 potential sources of ignition, with electrostatic discharge sparks listed amongst them.

03

Static electricity is generated in industry by virtually all operations and processes involving movement – for example, product transfer, mixing and size reduction. Fires and explosions can occur as a result of uncontrolled static discharge from plant, people and processes, and sadly, these commonly result in civilian injuries and fatalities, as well as significant financial losses in direct property damage and plant downtime.



It is necessary to transfer only about one electron for each 500,000 atoms to produce a condition that can lead to a static electric discharge

– NFPA 77, Recommended Practice on Static Electricity Section: 5.2.1

“All large conductive objects, such as fixed plant and equipment systems, should be earthed. Where the earthing is by means of metallic conductors the resistance to earth should be less than 10 Ω. This resistance indicates a reliable earth connection with a metallic conductor.”

- IEC 60079-32-1
Section: 10.1.2

05

The sensitivity of a flammable atmosphere to electrostatic ignition depends on the concentration and minimum ignition energy (MIE) of the flammable material. The minimum ignition energy (MIE) is one of the most important considerations when assessing the explosion risks and protection techniques when handling flammable and combustible materials. It identifies the measure of the minimum amount of spark energy necessary to ignite the material when it is in its combustible range.

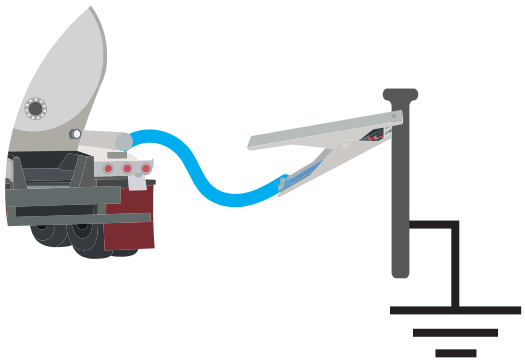
Powders	MIE (mJ)
Corn Flour	*20*
Aspirin	*25 to 30*
Sugar	*30*
Magnesium	*40 to 80*
Aluminium	*50*
Wheat Flour	*50*
Zinc	*200*

04

Generation of charge itself is not a threat, however the unrestricted accumulation of static that is allowed to freely build up in flammable or combustible atmospheres is. Charge accumulates on industrial process equipment as a result of their isolation from earth. A build-up of electrostatic charge will eventually develop enough energy to discharge a spark onto an object held at a different potential in an attempt to equalise the charge. Objects at earth potential could be operators working in the vicinity of a vacuum truck or filling pipe situated in the hatch on a road tanker.

06

The most important action an operator can take to control static electricity is to ensure any conductive objects are connected to a verified earth. This will avoid the most common problem which is the accumulation of charge on a conductor and the release of virtually all the stored energy as a single spark.



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