



# When a spark suddenly flash over

Accident in synthesis plant – electrostatic discharge identified as cause of ignition

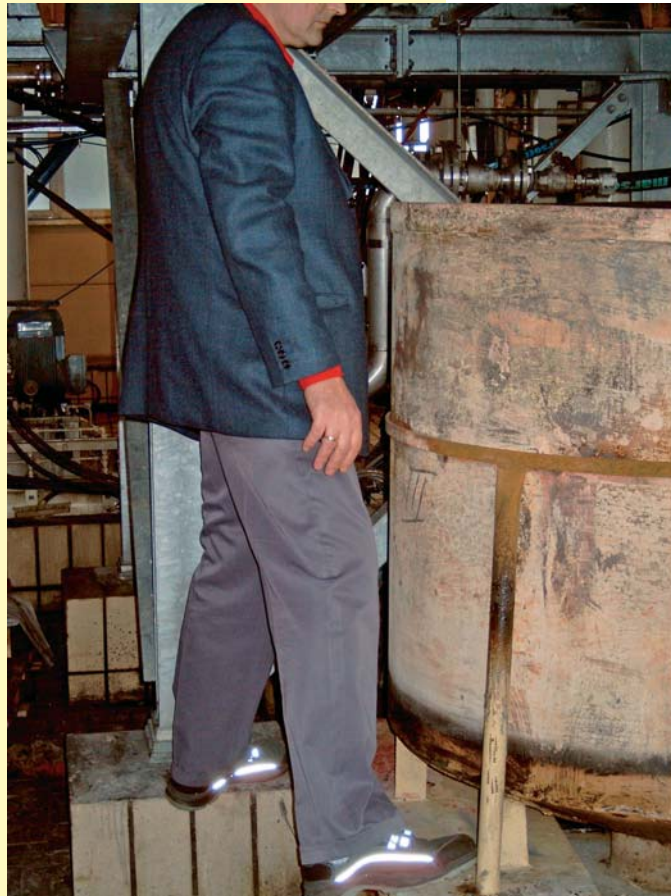


Figure 1: Re-constructed: this is how the employee was standing when the accident occurred

It was a completely normal working day for the late shift in the synthesis plant: For some days the active components for a pesticide had been formulated and processed here. An hour before shift change, a toluene-air mixture ignited. Luckily there was no explosion, but there was a fire during which an employee suffered burns. As a consequence the synthesis plant was out of action for several weeks. What happened?

During production the raw materials for the active component reacted in various process stages. As part of this process, a suspension of a solid in toluene is produced initially. The excess toluene is separated with the aid of a centrifuge and is returned to the reaction containers in the previous process stages via pumps. The residual



Figure 2: Old transport container



Figure 3: New transport container

moist product, still containing some toluene, but which is now free-flowing, is removed using a screw conveyor. During this process around 150 kilograms of product are pumped through a hose around one metre long with a diameter of 150 millimetres. This hose ends over an open wheeled container. It takes several minutes to empty the centrifuge and the process is monitored by an employee.

As the bulk material fills the wheeled container, a heap of bulk material forms under the end of the hose. To better utilise the capacity of the wheeled container, the employee attempted to distribute the heap of bulk material using his hands. For this purpose he climbed onto the steelwork for the bottling plant, held onto a steel member with the left hand, bent over the wheeled container and smoothed the heap with the other hand.

He then reached to the hose and moved it in a circle to prevent a new heap of bulk material forming. During this process a flash flame occurred. The employee suffered burns to the face and arms.

The modern synthesis plant was placed in operation in autumn 2002. During planning the explosion protection of the electrical equipment was correctly taken into account. All devices such as switches, drives and lights were suitable for operation in hazardous areas Zones 1 and 2 for explosion group IIA and temperature class T1.

All fixed installed components of the assembly and pipes were connected together conductively and earthed. Only the transport containers and the hose were not included in the equipotential bonding. The centrifuge was also inertized using nitrogen. All essential production process parameters come together in the measuring station.

On the day of the accident there were no irregularities in the technological or chemical parameters.

In the area of the filling hose according to the classification Zone 1 a toluene-air mixture capable of ignition occurs occasionally. This was the case at the time of the accident. The source of ignition was the discharging of the electrostatically charged hose for the bulk material.

The transport of the solids in pipes or hoses always involves the separation of surfaces. Here electrical charges occur that remain on the surfaces of insulated objects or substances for some time. As a measure against electrostatic charging, normally conductive plant components are used and earthed. Although the hose used here was dissipative, it was not continuously earthed during assembly. Due to the lack of contact to earth, it was not possible to dissipate the charge that occurred, and the surface became electrostatically charged. As the employee's right hand approached the hose, a spark discharge occurred. As he was holding onto a steel girder with the left hand, he acted as an earth.

The removal of the heap of bulk material had probably favoured the formation of a mixture capable of ignition in the area of the hose, because the vapours in the wheeled container were stirred up in the process. The energy in the spark discharge from the charged hose was more than enough to ignite the toluene-air mixture present.

The company now uses closed wheeled containers to prevent the escape of toluene vapours during emptying. The dissipative emptying hose and wheeled containers are included in the inertization. The connection between the centrifuge outlet, hose and wheeled container, and earth potential is monitored.

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