

March 2003 -The Risk of Using CO2 as an Inerting Agent

The European Industrial Gases Association, EIGA, recently published an article in their Safety Newsletter about several fatal accidents caused by explosions when CO₂ was being used to inert equipment and storage tanks that previously contained flammable materials. Their Safety Advisory Group, SAG, was informed of these accidents and in most cases the flammable materials were reported to be liquids or gases. However, SAG went on to say that dust explosions could also be triggered by using CO₂ to inert equipment and storage tanks, as well.

The SAG gave the following examples of fatal accidents that have been reported to them.

- While attempting to inert a jet fuel tank, by using a portable CO₂ fire extinguisher, an explosion occurred and killed two navy firemen.
- On board a tanker, four people were killed in an explosion while inerting a naphtha tank using CO₂ cylinders.
- In Bitburg, Germany, twenty-nine people were killed as a result of an explosion while witnessing the demonstration of a newly installed CO₂ fire-extinguishing system for a partially filled jet fuel tank.

The article reports that, "subsequent investigations have shown that, during the inerting process, static charges of several tens of kV were generated and accumulated at the end of the piping connected to the tank. Voltage of this nature is sufficient to produce sparks which act as points of ignition for the flammable mixtures."

The SAG further reports that, "when liquid CO₂ expands up to absolute pressures of less than approximately 5 bars, the result is the formation of small particles of solid CO₂ (dry ice). As the two-phase solid/gas flows through the piping, static charges are produced by the particles rubbing against other particles, between themselves, piping and equipment. Subsequently, these charges accumulate in the zones that are not earth/grounded at the end of the pipelines, most often in valves and nozzles. The size of these fields, as determined by experiments, can reach values of between 50 and 180 kV/m. Similarly, static electricity can be generated by the dry ice particles after they leave the discharge nozzle. The pressure and impurities in the CO₂, equipment materials in transfer line hoses, etc. all influence the generation of static electricity."

However, they report that, "in the case of the extinguishers, the material used in the diffusing nozzles plays an important role in the size of the electrostatic field created. In fact, the field is significantly larger if these release nozzles are made of dielectric material, as is the case for most extinguishers. The field strength can, in some circumstances, be reduced by a factor of 100 if earth/grounded metallic gas type nozzles are used instead of dielectric nozzles."

Based on this information, you want to make sure you conduct a complete risk assessment of any installation you contemplate inerting with CO₂. In addition, the SAG recommends that the following procedures be established:

- Never use portable CO₂ extinguishers for inerting any tanks/equipment containing flammable or explosive materials.
- Do not use liquid CO₂ directly for inerting containers, tanks or equipment containing flammable or explosive materials.
- If you use CO₂ gas for inerting, proper precautions must be taken regarding the formation of static electricity (such as ensuring electrical continuity).