

Indoor Pyrotechnic Electrostatic Discharge Hazard

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An investigation of an unfortunate accident involving indoor pyrotechnics was completed a little while ago. This article was written in the hope that by suggesting a trivially simple step, similar accidents might be avoided in the future.

The accident occurred during the demonstration of indoor pyrotechnic effects in the course of obtaining a permit for their use. The particular effect being demonstrated was a concussion mortar. The mortars in question had not been fired for days; earlier on the day of the accident the concussion mortars had been put in place in a carpeted area; there were electric matches installed in the mortars; and firing control wiring had been attached to the electric matches, but that wiring was not connected to the firing controller. The pyrotechnic operator had previously mixed the concussion powder but had not yet loaded any of the mortars. With the one-ounce (28 g) supply of concussion powder in hand, the operator approached the first mortar. He opened the bottle of powder and poured out a cap-full of powder. As best as can be determined, as the powder was poured into the mortar, an explosion occurred involving the essentially full bottle of powder that he was holding in his other hand. The force of the explosion was sufficient to cause the traumatic amputation of some of his fingers.

One likely scenario for the cause and sequence of the accident is as follows. As the result of walking on the carpeting, the pyrotechnic operator had built-up a significant charge of static electricity on his body. As he began pouring the concussion powder, an electrostatic discharge occurred from the operator to the mortar. This might have been a result of a dielectric breakdown through the flowing powder or as the result of the pyrotechnic operator touching the metal mortar. As a result of the electrostatic discharge, the powder being poured into the mortar was ignited. (The discharge might have directly ignited the powder being poured; or the

discharge might have ignited the electric match, which in turn ignited the powder.) Apparently an incendive spark produced by the burning concussion powder then entered the open bottle of powder in the pyrotechnic operator's other hand, causing the ignition and explosion of the bottle of powder, and in turn causing the severe damage to his hand.

Assuming the cause and course of the accident were as described, this accident could easily have been avoided by using a well established safety precaution. The pyrotechnic operator could simply have touched the metal concussion mortar for an instant before opening the bottle of powder. In this way the charge on the operator and that on the mortar would have been equalized by an electrostatic discharge safely occurring at that time. (Having such electrostatic discharges occur safely is the principle behind having grounded touch plates or other means of discharging personnel entering magazines and process buildings.) In the case of this accident, had the operator caused the discharge to occur by first touching the mortar, at worst the electric match installed in that mortar might have fired, or if another mortar had already been loaded with concussion powder, its electric match and powder might have fired. However, even if this had happened, assuming no one was in the proximity of the other concussion mortar, it is unlikely there would have been an injury.

Note that: as is often the case in investigating accidents, not all of the facts are clearly established or completely free of dispute; not all concussion powders and electric matches are equally sensitive to accidental ignition from electrostatic discharges; not all indoor venues are equally likely to produce electrostatic charges on people and / or equipment; and not all concussion powders produce equally powerful explosive effects. Nonetheless, while it is always appropriate to consider the hazards of each

situation, it is prudent to take basic precautions as a matter of habit.

(An earlier draft of this article was reviewed by L. Weinman and G. Laib.)
