Increasing Explosive Safety at Snowmass

By John Brennan

Avalanche hazard mitigation at ski areas throughout the world relies on the use of explosives. Even so, as a user group, our annual consumption of explosive products is very small compared to the mining industry. In recent years, explosive manufacturers’ liability concerns have forced many in the United States snow safety industry to purchase initiating products from foreign suppliers. In addition, as recently as last fall’s meeting between the National Ski Areas Association’s (NSAA) Explosive Committee and the International Society of Explosive Engineers (ISEE), disagreements regarding the use of explosives continue to plague our industry. Naturally, a proactive approach to safety serves our best interests. The following are my recommendations for increased safety with explosive systems as used at the Snowmass Ski Area.

**Examples of Static Generation**

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**Electrostatic Discharge**

Electrostatic discharge (ESD), more loosely known as static electricity, has been a concern to explosive users since the 18th century. Back then, black powder users strove to prevent ESD from causing pre-ignition at sea level forts. More recently, owing to at least one ESD accident, Canada mandated the use of static neutralizing shoes and/or static dissipative footwear to ground the ESD. The fuse powder used at the time of the accident in Canada was conductive. They have since changed the type of powder to a non-conductive core. Although not mandated in the U.S., in part because United States fuse manufacturers never used a conductive core, it is interesting to note that all the pre-assembled cap/fuse assemblies being imported by Petro-Explo have these stiples installed. The core of these fuses is described as “insulative.” This may be a truer description of a core of fuse powder since it is made up of carbonaceous material and carbon.

**Examples of Static Generation**

Typical Voltage Levels

- **Generation 10-25K:** 65-99% RH Walking across carpet at 35,000 volts.
- **Generation 25K:** 65-99% RH Walking across vinyl tile at 12,000 volts.
- **Generation 30K:** 65-99% RH Poly bag picked up from bench at 20,000 volts.
- **Generation 35K:** Chair with urthane foam at 18,000 volts.

As compared to other items in the table showing static generation, blowing snow can generate readings in excess of 20,000 volts. Rotor wash during heli-bombing has its own inherent static concerns. As a reference, the ESD shock on the human body needs to be around 3,000 volts before it can be felt. Bottom line voltage values and sources necessary to cause pre-detonation are elusive as many factors can contribute to pre-ignition: relative humidity, the conductivity of the powder train, the fuse’s outer coating, and the sensitivity of the detonator’s initiating mixture. Many detonators use lead styphnate as part of the initiation mixture, and this compound is known to be extremely sensitive to ESD.

To keep static from entering the fuse train, traversing through a conductive black powder train and reaching the potentially ESD-sensitive detonator, Ron Thomas of Ensign-Bickford recommended simply tapping over the exposed end of a cap/fuse assembly. For operations that build a sizeable number of cap/fuse units, this tapping process is laborious and slow. A simple solution is to use a Poly Vinyl Chloride (PVC) nipple over the end of the cut fuse. The PVC nipple not only effectively eliminates the fuse’s internal path-way for static, but it also keeps the moisture-absorbing black powder fuse train dry.

As Russ Johnson commented in the 2001 Fall issue of The Avalanche Review, stringent explosives use protocols “revealed a dramatic drop in the mitigating and no-light cud statistics.” Keeping the fuse train dry as dry as possible and crimping off a 4-inch section of fuse prior to placing the pull wire ensures that the fuse is protected by these favorable statistics. To add additional protection, a section of a PVC nipple that has a .187 inch inner diameter by .5 inch inner length. These units sell for less than two cents each when purchased in quantity.

The electronics industry has a long history of financial woes due to ESD. One of their simpler and less expensive deterrents to ESD damage is to package susceptible components into static shielding packages. For the avalanche community, this can be as simple as placing cap/fuse or primed boosters into these sacs. Conveniences, these bags can also accomplish the segregation of the primers from other equipment inside a route pack. State regulation in Colorado.

**Thermite Connectors**

It should be noted that Petro-Explo imports pre-assembled cap and fuse units that may have a Thermite igniter cord connector crimped to one end. This unit is painted red to differentiate it from the detonator. These ignitors are so heat sensitive that simply holding a lit butane cigarette lighter under them for a few seconds can cause an ignition. For comparison, a freshly cut piece of safety fuse in the best condition needs to have the flame held against it for almost 10 seconds before initiating. Common sense certainly dictates removing any type of pre-installed igniter before arming your shots. Likewise, NSAA Explosive Explosives Guidelines and certain State Regulations mandate it. After the Thermite igniter has been removed, the PVC nipple can be installed.

**Double Capping**

For those operations that are double capping without the benefit of using cast boosters manufactured with two cap wells, there is a temporary solution. One cap/fuse assembly may be inserted into the cast booster capwell and the fuse taped to the outside of the capwell. The other cap/fuse unit is installed in the “through tunnel” and the fuse taped to the outside. This procedure has been mentioned as a reliable method of detonating certain cast Penitole charges. Extreme care must be exercised when using this temporary procedure as there is potential for having the shock-sensitive detonator extend out the end of the primer. A small cork can be purchased and placed into the unarmed charge effectively sealing the tunnel. Once properly placed, taping over the exposed end of the ‘through-hole’ or cork will prevent the possible entrance of foreign material during transport to the blast site. Before using this described method, it is wise to contact the manufacturer of the explosive to ensure that their boosters will detonate in this manner. The best solution to arming with two detonators is the use of a cast booster that is designed to accommodate the two detonators.

I am very interested in ongoing research or opinions regarding these topics. Reach me at johnbrennan@aspensnowmass.com.

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[Image]

> #8 Detonator

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