

EXPLOSIVES AND MINING

Story and photos by Jack W. Peters

When operating a mine, anything that reduces wear and tear on your back and equipment is a great idea. That is why for many mining operations, large or small, blasting makes sense. In many cases, from tunneling to moving large boulders, there is no other feasible way of doing it. You can blast too, you just have to do it legally and do it right.

The fastest way to get your blasting done is to hire a professional to come in and do it for you. That is a great way to learn what explosives to use and what they can do to improve the efficiency of your operation. Explosives used correctly will be one of the best and most productive tools you can use. Use explosives incorrectly, and your friends will be standing over your grave saying things like “too soon.”

Here are a few basics of what you need to know before you start your own blasting operation:



A five ton boulder is fractured in a training class with 1.5 pounds of dynamite in three boreholes.

Keeping it Legal

Explosives used in the United States are regulated by the *Bureau of Alcohol, Tobacco, Firearms & Explosives* (ATF). After a criminal background check, an interview from an ATF Agent and a \$100, you can have a *Type 33 Permit* that will allow you to purchase, store, transport and use explosive materials. Larger operations may choose a *Type 20 License* which also allows the manufacturing of ammonium nitrate and fuel oil (ANFO).

If your mine is a commercial operation in the United States, it will also fall under the jurisdiction of *Mine Safety and Health Administration* (MSHA). Commercial mines are loosely defined as lode or placer operations that use heavy equipment to load (beyond feeding by hand), trommels, sluice boxes or rock crushers. This means additional training and safety equipment will be required including access to mine rescue teams for underground operations. Through an interagency agreement, MSHA Officers also represent the ATF in the field to ensure safety and compliance with the use of explosive materials.

Know your Caps and Powder

Explosive materials used in mining operations are reasonably straight forward. Once you are issued an ATF permit or license, you will be legal to purchase commercially manufactured explosive materials from logging-mining supply stores from brands including *Austin Powder* and *Dyno Nobel*.

The first part of an explosives sequence is the blasting cap initiator. The blasting cap detonates dynamite or other explosive materials. Based upon the application, blasting caps will be initiated by either a fuse (pyrotechnic), electric wires powered by a blasting machine (electric), or caps connected by thin plastic tubing know as shock cord (non-el).

One of the primary explosive materials used is Ammonium Nitrate and Fuel Oil (ANFO). This is ammonium nitrate prills (pellets) mixed with a low percentage of diesel or fuel oil. ANFO is commonly used because it is safe, inexpensive and its low detonation velocity is ideal for heaving rock. It is sold pre-mixed in 50 pound bags or delivered by mixing truck for larger operations. It is insensitive and safe to handle as it is classified as a 'blasting agent,' because a blasting cap will not initiate it. ANFO requires a booster (another explosive charge) to detonate. Boreholes filled with ANFO include a stick of dynamite or an RDX cast booster that includes a blasting cap to initiate the booster which then detonates the primary ANFO charge.

Although there are more modern and stable emulsion based explosives, after 140 years dynamite is still the low cost choice for many miners. Dynamite is a simple wax paper roll of sawdust or diatomaceous earth used to stabilize nitroglycerin. Sticks are sold by the weight and percentage of nitroglycerin. Sticks come in various sizes and strengths; a common size is a half-pound stick at 60% nitroglycerin. Another useful material is an RDX cast 'shape charge.' These small cone shaped charges focus energy downward to more effectively crush rock.



One half pound stick of dynamite with blasting cap



RDX 'Rock Crusher' shape charge with blasting cap



(left) A student and I run a pneumatic drill at an Oregon gold mine. (above) One-pound dynamite sticks loaded into boreholes cutting a tunnel in a Colorado gold mine.

Photos by Michael Fuller

Pneumatic Drills

For explosives to work, the material needs to be loaded in the rock. Small operations use hand-held vertical or horizontal pneumatic drills about the size of a jack hammer. These air drills are powered by a portable air compressor and can easily cut a 1.5 inch borehole horizontally or a 3 inch borehole vertically. Boreholes are packed with up to two-thirds explosive material and the rest backfilled (stemmed), with dirt and gravel to compress and focus the explosive energy into the rock.

Keeping Explosives Safe and Secure

Using explosives is an awesome responsibility. If you use them correctly, no problems, but a mistake can kill you. Security is also a big issue as there is no shortage of bad guys who would like to relieve them from you.

Explosive materials are stored in steel, wood lined secured and locked boxes called magazines. Two magazines are required, one for blasting caps and one for powder. There is a 'Table of Distances' chart from the ATF that will help you place magazines at a safe distance from occupied buildings and roadways based on the poundage of materials stored. Magazines need to be carefully inventoried and inspected at least every seven days, so no storing explosive materials over the winter or at non-occupied mining sites.

Used correctly, explosives will get you to your pay-streak quickly, just take the responsibility to use them correctly, safely and legally.

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Useful links

Bureau of Alcohol Tobacco, Firearms and Explosives (ATF)
www.atf.org

Blaster's Tool and Supply, resource for tools, equipment and storage magazines
www.blasterstool.com

Mine Safety and Health Administration (MSHA)
www.msha.org

Northwest Explosives Academy, explosives and blasting training school in Oregon
www.nwexplosives.com



Type 2 storage magazine courtesy of Tannerite Explosives