

## Unusual Uses for Explosives

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How many times have you encountered unique ways of using explosives? Some of them relate quite easily to conventional blasting tasks but others seem to be a bit more creative. Maybe you have encountered instances where someone has a strange request for your blasting skills. Here are a few examples of creative blasting.

Back in the '70s, we used to sell binary explosives at Alpha Hardware in Nevada City. They were easy (and quite legal) to store under lock and key in the warehouse. Our main customers were the occasional weekend miners, small utility contractors and some of the local loggers. One of the logging companies was going through an inordinate amount of 1 and 5 lb binary pouches. I knew the area where they were logging. They weren't building roads and there wasn't much rock in that location even if they were. On questioning their foreman, I found out that they were hanging the pouches from tree limbs and detonating them to kill the large number of meat bees and wasps that were harassing them. He claimed that it would knock their wings off at a hundred feet. I didn't check that out, but on hindsight, I missed a good chance to conduct some serious investigation and write a paper for the ISEE on the radius of bee kill per pound of explosive.

Another missed chance for a good technical paper occurred when a Lake Tahoe contractor contacted me and needed to know the radius for abalone kill per pound of explosive underwater. (He had heard that I had blasted a couple of submerged boulders at Donner Lake and that I had noted the lack of injury to the crawdads on the rocks we blasted.) He had a contract to put in a sewer outfall in the ocean that required blasting. The California Department of Fish and Game required that he send divers down and move all the abalone to a safe distance, conduct the blasting, and then send the divers down to move the abalone back. He felt that this was going to be pretty costly. Abalone injured or killed would cost him \$7 each in fines. I told him I had no idea how far he had to move them, but I did have a suggested scheme: (1) Don't move any abalone, (2) do the blasting, (3) pay the state for any dead abalone, (4) take them home and eat them, (4) write a book on the radius of abalone kill per pound of explosive and (5) sell the book to recapture the costs. He didn't see the logic (or the humor) in my suggestion and I never did get a chance to report the scientific particulars to the ISEE.

Of course, if California Fish and Game wants to kill fish with explosives, that's an entirely different matter. Most of you are aware of the situation with the Northern Pike at Davis Lake, near Portola. Quite a few years ago I was informally asked (no contract, no money, no credit, no blame) about the possibility of eradicating the Northern Pike with explosives.

Using Cole's formula for pressures from underwater detonations, pressure rise and fall times and what limited information I could obtain at that time on mortality rates of fish, I determined that the best way to do it was to lower the lake level (to diminish the volume of water involved), lay out a detonating cord grid, put 1 pound boosters on down lines and shoot the whole lot at once. Because you can't eradicate the fish if ANY survive, I naturally designed a little on the strong side. (Detonating cord manufacturers would have loved me...) Of course, I didn't give F&G the particulars on spacing, etc. (no contract, remember?), but I did give them ballpark numbers on cost. They eventually figured it would be better to poison the Pike and this was attempted after a lot of environmental/political/legal wrangling.

This first poisoning was tried in 1997. Unfortunately, they either didn't get them all or someone replanted Pike because they started showing up again in 1999. F&G then decided that they would use explosives after all. They would use detonating cord, but without the boosters. (This was long enough after their initial inquiry to me that I doubt any of my comments were available to the persons then in charge.) A test shot killed a good number of the Pike and they decided that they could keep their numbers in check if they blasted them once in a while with detonating cord. For the record, on the test shot, F&G strung two 400 foot long 50 grain detonating cord lines spaced about 40 feet apart. They had caged Pike at 23 feet, 28.75 feet and 34.5 feet from the nearest cord. All the Pike at 23 feet were killed. One of two at 28.75 feet was killed and none were killed at 34.5 feet. Bear in mind these were Northern Pike and the size of a fish and whether it has a swim bladder plays a major part in the expected mortality rate. Recently (2007) an extensive program to poison the Pike in Davis Lake and its tributaries was undertaken, so they may no longer be blasting them. Please note that I'm not advocating that any of you fisherman out there use the information in this article in your endeavors. I'd rather not see an excise tax put on explosive devices just because they are considered fishing tackle.

While on the subject of detonating cord, many of you are aware that trees can be cut down with it. It doesn't make a very clean cut, though. Lots of toothpicks. Although you and I might not be able to obtain the stuff, forest fire fighters have a weapon at their disposal called Fire Line Explosives. It is a large diameter (think fire hose size) detonating cord. When I was familiar with it in the late '70s, they used flame-quenching salts around the main powder core, similar to seismic cord. The object was to clear a firebreak, not to start another fire. One of the drawbacks to using FLE is that you must be absolutely certain that no one is in the vicinity when you shoot it. I don't know if it is still being used, but if it is, it would only be by well-trained crews and only in very isolated locations.

Quite a few years ago, after reading a paper on shearing off bridge piers written by the late Don Mathews, I became interested in using detonating cord as the main explosives charge. It has some advantages. It is easy to control exact quantities.

If you load the shot too lightly, you can usually re-load (after the holes cool) and shoot it again. The diameter allows it to be fed into small orifices if necessary. Of course the big drawback is the noise. I was able to use cord as the main charge on several projects.

I was once asked by Danny Lewis of Grass Valley to assist in a contract to chamfer the outer top edge of the concrete breakwater at Diablo Canyon nuclear power plant. This was while the power plant was still under construction. The owner wanted to remove a slice of concrete measuring 2.3 feet horizontally and 4 feet vertically from the entire ocean side of the breakwater. This was being done to prevent rogue waves from physically moving the whole breakwater. (It was felt that it would be better to have water slop over the top than to have the force of the wave move the entire block.)

I did some rough calculations using various loadings of 50 and 200 grain per foot detonating cord as the main explosive charge to nearly instantly pressurize a parallel line of holes to remove the concrete. We gave the owner the option of shearing large chunks of the concrete off cleanly, letting them slide into the water where they could be retrieved later or, optionally, making the concrete just go away. The owner felt the latter would prove cheaper, but was concerned we might damage the remaining concrete.

They also asked where the blasted concrete went when we made it "go away". (We refrained from using the term "vaporize" because, while it sounded plausible, it wasn't technically correct and the term tends to worry some people.) We assured them that the massive concrete that remained would not be damaged and that the blasted concrete would be reduced to small pieces that would be propelled out into the ocean. My initial calculations estimated that 8 strands of 50 grain cord placed in holes drilled on 16 inch centers would accomplish the job satisfactorily. (We would have used less, if we just wanted to shear and drop it.) A previous contractor had intended to blast the concrete with conventional explosives in holes on 24 inch centers. I don't know what his designs were nor why he wasn't allowed to proceed, but we inherited a fairly long stretch that he had already line-drilled on 24 inch centers (not very accurately I might add). I didn't wish to increase the charge to account for the increased spacing, so we drilled interim holes, bringing the spacing down to 12-13 inches. (If the owner had wanted the concrete sheared and left, the 24 inch spacing would have been fine, but I did not want to risk damaging the remaining concrete with the heavier charge weights that would have been required to heave the concrete using that spacing. We were also striving for a fairly smooth clean cut.)

We didn't plug the top or bottom of the holes, leaving them open. With the cord detonating at approximately 23,000 feet per second, the pressure rise is sufficiently fast that the concrete shears between holes before an appreciable amount of the gas can exit the open ends. Of course the noise was fierce, but we were fairly isolated from any residential areas.

Usually 75 to 100 holes were shot at a time. While most blasts were shot at night so as not to conflict with other work in progress on the breakwater, several were shot during daylight hours. The results were rather spectacular. I suppose you could have called it flyrock (maybe flycrete?), but this was not flyrock. It was behaving exactly as we intended.

Danny and I did, however, suffer from some security glitches. Because the Diablo Canyon Nuclear Power Plant was a controversial issue with environmentalists and with several groups bent on stopping or delaying the project, the owner had an on-site SWAT team that would respond to any disturbances or unusual situations. With protesters at the gates and threats of sabotage being commonplace, they were a bit on edge and would react quickly to perceived threats. They even had concerns that the protesters might launch an invasion from the ocean side of the plant. When we brought the detonating cord and caps onto the plant site, Danny was careful to coordinate the delivery ahead of time with plant security. At the appointed time, we showed up at the main gate with the explosives loaded in a legal, placarded pickup truck. The guard checked our passes and then asked, "What's under the tarp?" Danny explained that we were bringing in explosives for the chamfering job and that he had notified security beforehand. The guard told us to wait and made a short phone call. He came back, pulled his gun and told us not to move. If I remember correctly, Danny said, "Don't worry, Hoss. Moving is the last thing we'll be doing, but be careful where you point that gun or we'll all go away." The SWAT team arrived shortly, had us spread-eagled on the hood of the truck and, after several discussions over the radio, decided that we were legitimate and not intent on sabotage. We were allowed to proceed.

We stored the detonators and cord near the breakwater and laid out the test blast. At the time, a crane was working on the breakwater on both day and swing shifts, so we scheduled the first test blast to occur on the graveyard shift at 2:00 a.m. the next morning. That would give us two hours to load and hook up the shot after everyone had gone. Again, Danny notified security to expect a rather loud explosion at that time of morning. Shortly after midnight we went about loading 13 holes and tied everything in. At 1:45 he again called security to remind them that the shot was on schedule for 2:00. At exactly 2:00 a.m., we set off the test blast. At exactly 2:03 a.m., the SWAT team had us spread-eagled on the ground at gunpoint. After a few minutes of radio conversation and some discussion as to whether the call to the local sheriff should be cancelled, we were finally turned loose and allowed to investigate the results of our test blast.

The results were quite good. While the floodlights didn't allow us to see the concrete in actual motion during the shot, the chamfer was found to be exactly as we had planned and you could see half of each hole with relatively smooth concrete surface between the holes. We did learn that the ends of the shot line needed empty pilot holes to provide a clean break at that point.

With the successful completion of the test blast, we decided no changes needed to be made to the design and Danny carried out the remainder of the chamfering without any problems (nor with any more unexpected visits from the SWAT team). He gave me several photos he took during daylight blasts and the sight of concrete chunks launching into the ocean was quite spectacular. There was some talk of reducing the charge weights, but they were happy with the results and didn't make any changes as far as I know. Come to think of it, we forgot to bill Fish & Game for providing additional fishing reef material out in the Pacific.....

What have you done with explosives lately that might seem out of the ordinary? Harvested any potatoes with it? A Hercules distributor in Iowa once tried it. (Scared the daylight out of his wife too, but that's another story.) Clear ice off of radar domes in remote mountainous country? I know a lady in Salt Lake City that can do that. Loosen up any stuck machinery? How about freeing up a large stuck hydraulic piston inside a cylinder with detonating cord? It was done on a cylinder that had been exposed to salt air. Only required a small hole to be drilled into the cylinder, and then welded up after the job was done. Explosives have been used to clear ice and snow off of roadways on numerous occasions. They did it during the construction of I-80 over Donner Summit. Explosives have also been used to clear ice and snow off of the road from Bishop up to the Cardinal Mine, but that was in the '30s. I believe the same process was used at Pine Creek when that tungsten mine was still operating.

There's got to be a lot of other instances where explosives were used in unconventional situations. If you know of any, let's hear about them. We'll even protect your identity, if you have any concerns about getting in trouble over it.

Before any of you readers go out and start experimenting though, bear in mind that most of the above situations occurred before explosives laws and security measures were as tight as they are today. While not necessarily illegal, some of the uses described would surely be frowned upon if tried today.

**BE SAFE!**