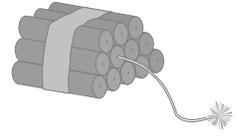


The Primer



Newsletter of the Golden West Chapter, International Society of Explosives Engineers
23633 Brewster Drive, Columbia, CA 95310

Volume 21

Fall 2010

Issue 3

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The Primer is published
four times per year
on the web site of the
Golden West Chapter
of the ISEE:

www.iseegoldenwest.org

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Editor's Notes.....

Several things to cover in this issue and, unfortunately, the first isn't good. The explosives industry lost two of their retired friends in September. Ed Criley's and Dale Johnson's obituaries are on page two. I really valued my working with Dale when I was at Alpha and he was Hercules' Western District Manager. I'll always have fond memories of him. Ed Criley's passing also brings back memories of being on field trips with him and detonating fairly large charges in the middle of the night. Due to space constraints, I'll have to save a couple of stories about Ed and relate them in the next issue.

Mark your calendars now to attend the Chapter's annual dinner meeting on Saturday evening, January 15th. It will be held at Marie Callender's in Stockton. More details will be available in the flyer in the next issue of The Primer, due out December 15th. The website calendar will also contain details as they are confirmed.

A big thank you to Sandy Figuers for providing the article and photos of the pipeline explosion and fire in San Bruno. I think you will find it quite interesting. For those of you with internet access, Sandy provides some links to videos and more photos.

If any of you readers have an article you would like published, or if you have an idea for an article, please contact the editor. We can always use more.

Until next issue,
Wes Bender

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Edward (Ed) Criley -

Ed Criley, 82, passed away on Thursday Sept. 23rd, from complications following surgery last year. Ed was retired from the U. S. Geological Survey, where he worked in the Earthquake and Volcano research programs in Menlo Park. He was a former member of the Golden West Chapter and was a contributor to The Primer.

Ed was a graduate of Kent State University. He retired from the USGS in 1995, but continued to do volunteer field work on research projects until 2002.

He is survived by his wife of 57 years Donna, three sons, Duff, Kyle and Coyn, five grandchildren and two great-grandchildren.

Dale C. Johnson -

Dale Johnson, 86, passed away peacefully on September 12th. Dale had a degree in Mechanical Engineering from UC Berkeley. He was employed by the Hercules Powder Company, first as a salesman, then working his way up to Western District Manager. While District Manager he organized the first regional meeting of Hercules Distributors, a group that went on to help form the basis of HEDA, the Hercules Explosives Distributors Association.

Dale retired from Hercules in 1986 and enjoyed golf, hobbies and working around his cabin in Twain Harte.

He is survived by his wife of 57 years, Pat, children Ann Marie Frasco and Bryan Dale Johnson and five grandchildren.

San Bruno Gas Pipeline Explosion and Fire -

By Sandy Figuers

Just after 6 pm on September 9, 2010, a ~30 inch diameter natural gas pipeline (about 380 psi) exploded. The pipeline exploded, throwing out a 15 to 20 foot section of the pipe and showering the area with fly rock. A few seconds later, a large natural gas vapor cloud ignited creating a massive fireball. Natural gas continued to spew out of the pipe creating a monstrous blow torch that burned for about 2 hours until the gas line was shut off. Adjacent houses caught on fire and the fire spread. The fire burned for at least a day and destroyed about 34 houses and damaged many others. Several people were killed and others were burned.

A surveillance camera at a near-by gas station caught the initial fireball on film. You can see it on YouTube at: <http://www.youtube.com/watch?v=J254kYXHMOs>

This is a short video from a surveillance camera at a gas station at the top of the hill south of the explosion site (which was at the bottom of the hill). In the first part of the video, you see part of a fireball . You cannot see the site of the explosion, nor do you have any concept of the scale of the explosion. The camera was more than 1000 feet away and several hundred feet above the explosion site. The initial fireball was in the range of 300 to 500 feet high. It looks like the flames were shooting straight up the street. This is may be an illusion. A small west-to-east wind was blowing at the time. The second part of the video was taken from the second story of someone's house.

<http://www.youtube.com/watch?v=uUbBc8acz54> is another view of the same video, but it is longer. You can see cars, cops, and people running into and out of the area.

To help provide a scale to the video, this photo was taken from near the top of the hill south of the blast site. The blast site is at the bottom of the hill behind the distant white truck. You can see the entrance to this street in the video. It is the street that extends to the upper left corner of the screen. The video camera is about 200 feet behind (south) of this location. The flames were 100 to 200 feet above the top of the near-by houses.



(continued on the next page)

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San Bruno Pipeline Explosion and Fire (continued)...

Also see the following videos:

<http://www.youtube.com/watch?v=f8NfeVIOULU&NR=1> This is a video taken from a helicopter that was hovering west of the explosion. About half way through, the camera pans to the right (south) and you can see the street in the above photograph and the gas station where the video was taken.

http://www.youtube.com/watch?v=hHc_3XDh8zE&NR=1 This is a montage of still photos.

<http://www.youtube.com/watch?v=97zfX-B1Cng&NR=1&feature=fvwp> This is a montage of short videos, but about 2/3 of the way through, it has good views of the pipe that exploded.

All of these videos have links to many other videos of the fire.

The aftermath was eerily similar to the Oakland fire in 1989 (and 1928). All that was left in the burn area was a forest of chimneys. There was a sharp boundary between total destruction and seemingly undamaged homes. The fire spread into an adjacent heavily forested area, but quick action by the firefighters prevented a major catastrophe.

The explosion blew flyrock over a wide area. Smaller flyrock (a few inches in size) was blown 400 to 500 feet. Some of the larger pieces (4 and 5 foot sized pieces of asphalt) were blown a few hundred feet where they crashed through roofs and interior floors. The flyrock distribution appears directional, but this may be an artifact of information loss from the subsequent fire. There appears to be little data about what the initial explosion did to adjacent buildings.

Many dramatic photographs of the fire and aftermath were published. The following are some details that are not as well known.

This truck was about 200 feet from the site of the explosion. Note the melting of the front of the vehicle and tire, and likely flyrock damage to the windshield and hood. Also note the lack of visible paint damage.



(continued on the next page)

San Bruno Pipeline Explosion and Fire (continued)...

This truck was about 400 feet from the explosion but the house just to the right burned down. Note the melting of the plastic along the side of the vehicle and around the windows, but no visible damage to the paint. The front bumper partially melted. The glass pattern on the ground suggests that the rear window blew outwards.



A chimney forest. Crews are in the process of demolishing burned buildings.



The site of the pipeline explosion is behind the chain link fence in the background. This house was destroyed, but the astro turf front lawn was not visibly damaged. Note the asphalt flyrock in the yard.



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San Bruno Pipeline Explosion and Fire (continued)...

This house did not burn, but was at the edge of the burn area. It is not known if the windows were blown out by overpressure or flyrock. It is about 200 feet from the explosion site. It is not known if the house sustained structural damage.



The asphalt on the sidewalk was blown south about 200 feet. Note other pieces of asphalt in the background.



(continued on the next page)

San Bruno Pipeline Explosion and Fire (continued)...

It is difficult to see in this photo, but the roof is covered with remains of smaller flyrock and flymud (the small whitish areas). This house is about 400 feet north of the explosion.



This is a recent photo of the explosion site. Here is one end of the pipeline.

The crater has not significantly been enlarged. The fire-gutted houses have been razed and the lots cleared. The local DA declared this area a crime scene and only authorized personnel can enter the area. Guards are sitting in the black car in the foreground and in the white car in the background.



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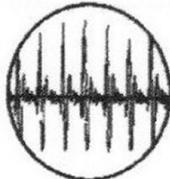


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Shakin' It Up

with Wes Bender

How much is too much? On a recent birthday, I got a tee shirt with a fly fishing scene on the back and the slogan, "**Too Much of a Good Thing is Still a Good Thing.**" I know that holds true for fly fishing, actually for all forms of fishing for that matter, and probably applies to quite a few other things in life, but it doesn't really apply to powder factors or the amount of explosive that you load. A short case history might better explain my point.

Back in 1984 I got a call from the contractor's project manager on a large hydroelectric project in the central Sierras. He wanted me to come investigate a situation that had developed. The owner's inspectors were concerned about the quality of the tunnel ribs (walls). They were complaining that they were experiencing "druminess" when they tapped some areas in the ribs with their rock hammers. In their opinion, the contractor's blasters were over-shooting the rock. They were concerned that chunks might fall out later when the tunnel was transporting water. They were threatening to shut things down if the contractor didn't correct the situation.

I made a visit to the project site and met with the contractor's engineers. They provided me with the tunnel blast designs that they had developed. I then went underground and witnessed the drilling and loading of a couple of rounds. I also checked into the "druminess" issue that was the source of the complaint.

The tunnel round design was a bit heavy. It called for 84 1-3/4" holes (not counting the four unloaded 3" burn relief holes) for an 18 ft horseshoe tunnel. When loaded with 1-1/2" water gel cartridges in the production holes and a combination of 1-1/2" water gel cartridges and 3/4" pre-split cartridges in the perimeter holes, the design powder factor was close to 6.5 lbs. per cubic yard.

(continued on the next page)

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Shakin' It Up (continued).....

(Now before any of you surface blasters get too excited about the high powder factor, tunnel rounds will naturally carry a higher powder factor than surface blasts because you are having to fracture and shift rock from a face that is perpendicular to the axis of the holes. It takes more powder to do this than when the holes are breaking to a free face parallel to the hole axis.)

The area of the face was approximately 290 square feet. Smaller tunnels with a corresponding smaller free face area will take higher powder factors and vice versa. From past experience in Sierra granite, I would have expected that the rock in a tunnel of this size could probably have been adequately blasted at a powder factor not exceeding 4 to 4-1/2 lbs. per cubic yard. Compounding the problem was that the drillers were adding a few extra holes to each round, further increasing the powder factor. There could be several reasons for this. A couple of the tunnel hands had recently been involved in a project using water gels where they had a considerable amount of trouble with misfired holes. This had been attributed to the shock wave from detonating holes desensitizing cartridges in adjacent holes. Of course, increasing the number of holes probably exacerbated the problem rather than correcting it. Another possibility is that it is typical for many tunnel hands to worry more about failing to properly pull a round than blasting it too hard. (I have met some who's philosophy was, **If a Little's Good, More Must be Better and Too Much is Just Right.**) While you may sympathize with their concerns, one also has to pay attention to the quality of the rock structure that is left behind.

After comparing all the information that I had gathered and reviewing the magazine records to verify that my calculated actual powder factors matched their consumption numbers, I met with project management people to discuss my findings and to provide some recommendations. My first recommendation was to have better field supervision of what was being accomplished at the face. The second was to reduce the powder factor in steps. This could be accomplished by reducing the hole count slightly. I further recommended that, in an attempt to reduce the "druminess", they reduce the column density in the outer production holes (those nearest the perimeter holes). The perimeter holes had been loaded with one primer cartridge and one cartridge of 1-1/2" water gel, followed by 3 cartridges of pre-split powder, and finished with two more cartridges of water gel. I recommended that they reduce this to one primer cartridge, followed by pre-split powder to the collar, and stemming the collar if necessary. I also stated that I felt the tunnel rounds in this particular rock (a quartz diorite) could eventually be successfully shot with a total powder factor of 4-1/2 to 5 lbs. per cubic yard.

I further expressed the opinion that the "druminess" that had been experienced may not have been the result of over-shooting the rounds. When rock that has been under compression for eons has a void suddenly opened within it, the rock tends to expand somewhat toward the void. This is referred to as elastic rebound and can be quite violent in some situations. Several articles have been written about "rockbursts" from this effect in Canada and other locations.

(contined on the next page)

Shakin' It Up (continued).....

After I presented my findings, comments and recommendations, they asked if I minded staying over one more night. They were having a meeting the next morning with the owner's management people and they wanted me to present my findings to them also. I indicated I was quite willing to do so, as long as they understood that I would be presenting exactly the same information and findings even though some of it was a bit critical of some of their methods. They had no problem with this and indicated that I would probably be given a time slot early in the meeting.

And then things took a very interesting turn.....

I had not counted on staying the extra day and had a little time to kill, so I called up a contractor from Redding who was doing some work in the local area and asked if he and his wife could join me for dinner. They were free for the evening and said they would be pleased to do so.

Nearby was a restaurant that served good food at reasonable prices. It was frequented by all the contractors, peddlers, consultants, etc. when they were in town. I met Bill and his wife there and we sat down in the dining room and ordered an adult beverage. Shortly after we were served our salads, a group of gentlemen came in and were seated fairly close to us. I recognized several of them as being management people employed by the owner of the hydroelectric project. With them was a fairly distinguished gentleman who seemed to be the center of attention.

As the evening wore on, this gentleman expounded on tunnel blasting, tunnel round design and similar things that led me to believe he might be some sort of consultant to the group. As he continued with his dissertation, much of what he was saying had a familiar ring to it. Eventually I came to the realization that I had read the same book. I assumed (and confirmed the next day at the meeting) that this gentleman was a professor at a well-known west coast university and had been brought in to, in his words, "set this contractor straight". I really didn't think it was right for me to hear all of what he had to say, but then it was really hard not to, considering the circumstances. He was quite firm in his belief that "there wasn't a tunnel that couldn't be blasted with 4 lbs. or less per cubic yard." He was very much enjoying being the center of attention and, when we left, he was still holding forth. Some of his comments led me to believe that, although he had the theories down pat, he didn't have much field experience, at least in the blasting of tunnels in Sierra granite.

When I got back to the motel, rather than going straight to bed, I spent a little time going over my notes, rearranging them into a more logical sequence and doing a little "massaging" to better refute some of the statements to which I had been exposed earlier in the evening.

At the meeting the next morning, as the contractor was given the floor first, I was introduced to the personnel in attendance. All of the owner's people who had been at the restaurant the night before were there, in addition to their consultant, but none of them appeared to recognize me.

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Shakin' It Up (continued).....

I went into the matter of powder factor and what I proposed be done about it. I carefully laid out examples of previously blasting tunnels in similar rock. I paid particular attention to gradually bringing the powder factor down to 5 lbs. per cubic yard, and then lower if conditions allowed. I further addressed the theory of elastic rebound and its possible contribution to the perception of excessive druminess. Along the way, I tried to refute, and in a few instances where we were in agreement, to reinforce the points that I expected their consultant to make in his presentation. It was apparent by the look on his face that his moment of fame had occurred the night before and would probably not be repeated at this meeting today, at least without being totally redundant. He didn't have much to contribute when it was his turn and, in a way, I felt a little sorry for him. I'm not sure he ever figured out what had taken place.

The moral: Too much of a good thing isn't necessarily still a good thing when it comes to loading explosives. (Or for that matter, I guess, expounding on something when you don't know who might be listening or what they might tend to do with it.....)

How Come????

In the next issue, we're going to try our limerick contest again. Send your best ones to the editor and he'll print them (if they're not too risqué). To get you primed, here are a couple:

There was a young woman named Astor,
Whose clothes fit her tight as a plaster.
When she happened to sneeze,
She felt a cold breeze,
And knew she had met with disaster.

There was an old lady from Knoxville
Who bought her brassieres by the boxful,
Which she stuffed with corn kernels
And old Wall Street Journals
And thus kept the front of her frocks full.

* * * * *

Who says we don't have mass transit in Arizona??

