The Primer

Newsletter of the Golden West Chapter, International Society of Explosives Engineers
430 32nd Street, Suite 100, Newport Beach, CA 92663

Volume 30 | **Fall 2019** | Issue 3

In this issue . . .

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

www.iseegoldenwest.org

Articles may be submitted to:

Mike Burneson - editor
P O Box 2540
Napa, CA 94558

or

mburneson@syar.com

President's Message...

Hey Members, Guests & Supporters

In 2019, the Wesley L. Bender Scholarship was awarded to: Cody Mallmann

With only one scholarship award available, we had the unbelievably difficult job of choosing this year's winner of the Wesley L. Bender Scholarship Award. We would like to congratulate Cody Mallmann on winning the award. Cody, a recent graduate of Del Oro High School in Loomis CA, plans on attending Sierra College this Fall working towards a four-year degree in Environmental Sciences.

Continued on next page.

President's Message Continued…

.. Cody enjoys hunting, fishing and is an accomplished competitive trap shooter. Cody's Mom, Paula Mallmann, works as an administrator for Neil's Controlled Blasting in Newcastle,CA. His Dad, Mark Mallmann, is a Superintendent for Wescon Construction in Roseville, CA. Congratulations Cody!

As I write this message from the president, I can't help but feel for all of you working out in this miserable heat. We are coming up on the Fall season, however, we all know from experience this heat can last well into September. I'd like to take this opportunity to remind you of what's required by Cal Osha regarding Heat Illness prevention that I pulled off the Cal Osha website.

California employers are required to take these four steps to prevent heat illness:

Training-Train all employees and supervisors about heat illness prevention.

Water-Provide enough fresh water so that each employee can drink at least 1 quart per hour, or four 8-ounce glasses, of water per hour, and *encourage them to do so.*

Shade-Provide access to shade and encourage employees to take a cool-down rest in the shade for at least 5 minutes. *They should not wait until they feel sick to cool down.*

Planning-Develop and implement written procedures for complying with the Cal/OSHA **Heat Illness Prevention Standard**.

Just a few suggestions. Training should include the company's Injury & Illness prevention plan. Employees including Supervisors, should be trained to recognize and identify the signs and symptoms of Heat illness. As any type of training goes, Document, Document, Document! Don't forget those important tail gate meetings on high heat days. Make sure a copy of the Heat Illness Prevention plan is at the site the employee will be working. Make sure employees have access to bottled water or igloos of cool, clean water with cups on the jobsite. Make sure shade is provided to employees. Due to uneven rocky terrain on most blasting job sites; the use of shade tents may not be practicable. Providing shade in the form of a running vehicle with air conditioning are easy ways to keep you and employees cool, safe and in compliance with applicable regulations at all jobsites. Just make sure it's written in your plan and you document the training to all employees exposed. For complete information on Heat Illness Prevention go to https://www.dir.ca.gov/DOSH/heatIllnessQA.html **-Heat Illness Prevention Enforcement Q&A** Updated: July 2018.

Once again, Thank You for your support of the Golden West Chapter. Enjoy the newsletter, and as always, BE SAFE OUT THERE!

Your President,
Mike Chiurato

Editors Notes:

Congratulations ! Cody Mallmann on being selected to receive the 2019 Wesley L. Bender Scholarship.
Congratulations also must go out to America Aguilar-Andrade and Charity Goldsmith Ding on maintaining a GPA of 3.0 or better.
These scholarships provide $1000 per semester to the recipients and will continue for 8 semesters (four years), providing the recipient remains a student in good standing and maintains a GPA of 3.0 or better.
On behalf of the Membership and Donors who have made this award possible, we would like to wish you the best in your educational endeavors. We look forward to hearing of your success and to follow your academic achievements as you embark on this exciting new journey.
I am very saddened to report the passing of our Chapter President's Mother and Father recently. Angelo Peter Chiurato born 1934 and passed on June 29,2019. Melinda Lou Chiurato born 1935 and passed on July 27, 2019. Mike and Donna Chiurato took Mike's Mom and Dad out on the bay to spread the ashes of his parents as this was their last request.
I hope all of our readers take the time to read Wes Bender's article in this issue of the Primer. It is a real treat to read this interesting project about the Roosevelt Dam Modifications.
I will pump the business dinner in the winter issue of the Primer. Remember to save the date Saturday February 22, 2020. It may be the last crab feed at Mount Pleasant if we don't have a good attendance.

" If It's Not Safe Don't Do It"

Theodore Roosevelt Dam Modifications,

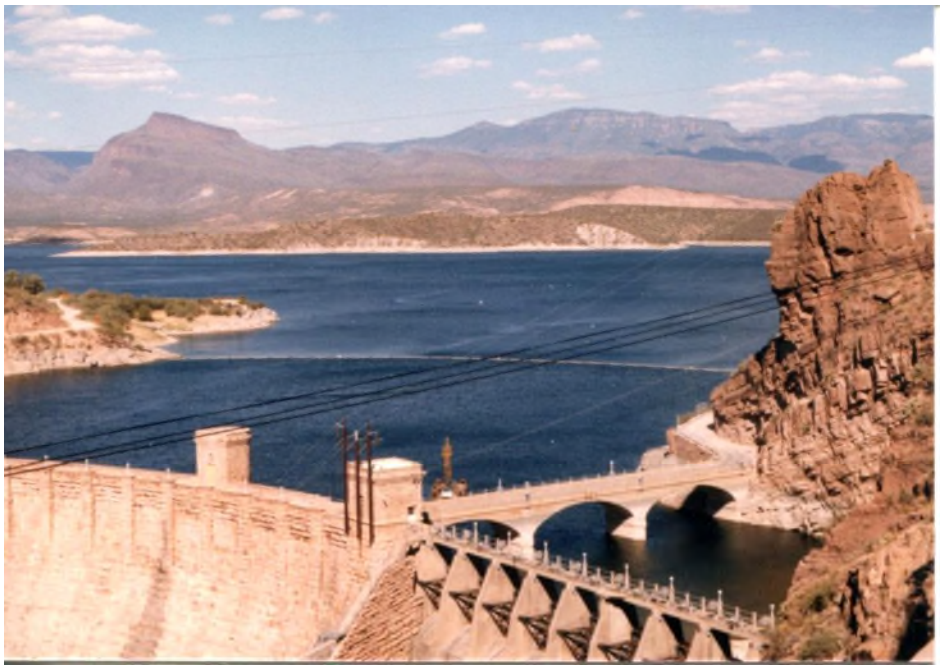
Access and Drainage Adits Contract

by Wes Bender

Several events took place in the 1960s and 1970s that played a part in the Bureau of Reclamation's (hereafter called the Bureau's) decision to modify Theodore Roosevelt dam in east central Arizona. The Phoenix area was growing rapidly and more water was needed both for the expanding population and for agriculture. The 1968 Colorado River Basin Act provided for the proposed Orme Dam to be built at the confluence of the Salt and Verde Rivers. This would have provided the additional water, but was opposed by environmental interests who appealed to President Carter to cancel it, which he eventually did in 1973. Several alternate plans were considered to provide the much-needed water. The Bureau eventually settled on a plan that included raising Roosevelt Dam by 77 feet and constructing a larger New Waddell Dam on the Agua Fria River, northwest of Phoenix.

Failure of the Teton Dam in Idaho in 1976 caused the Bureau to investigate the safety of most of the dams in the west. Among these was Roosevelt Dam, which had been constructed in the early 1900s. One of the suspected causes of the Teton Dam failure was water percolating through the foundation rock under the dam. At Roosevelt, water had been seeping out of the canyon walls below the dam. Because the water was at a temperature of approximately 100 degrees (F), it was felt that it was artesian rather than from the lake, but it wasn't conclusively known if lake water was indeed permeating the dam's foundation. Failure of Roosevelt Dam would be catastrophic. It impounds water from over 5000 square miles of watershed. If a 200 year storm struck the area and Roosevelt Dam were to be breached, the water would also take out the four dams located below Roosevelt Dam on the Salt River; Horse Mesa, Mormon Flat, Stewart Mountain and Granite Reef Dams. Much of Phoenix and its surrounding communities would also be inundated.

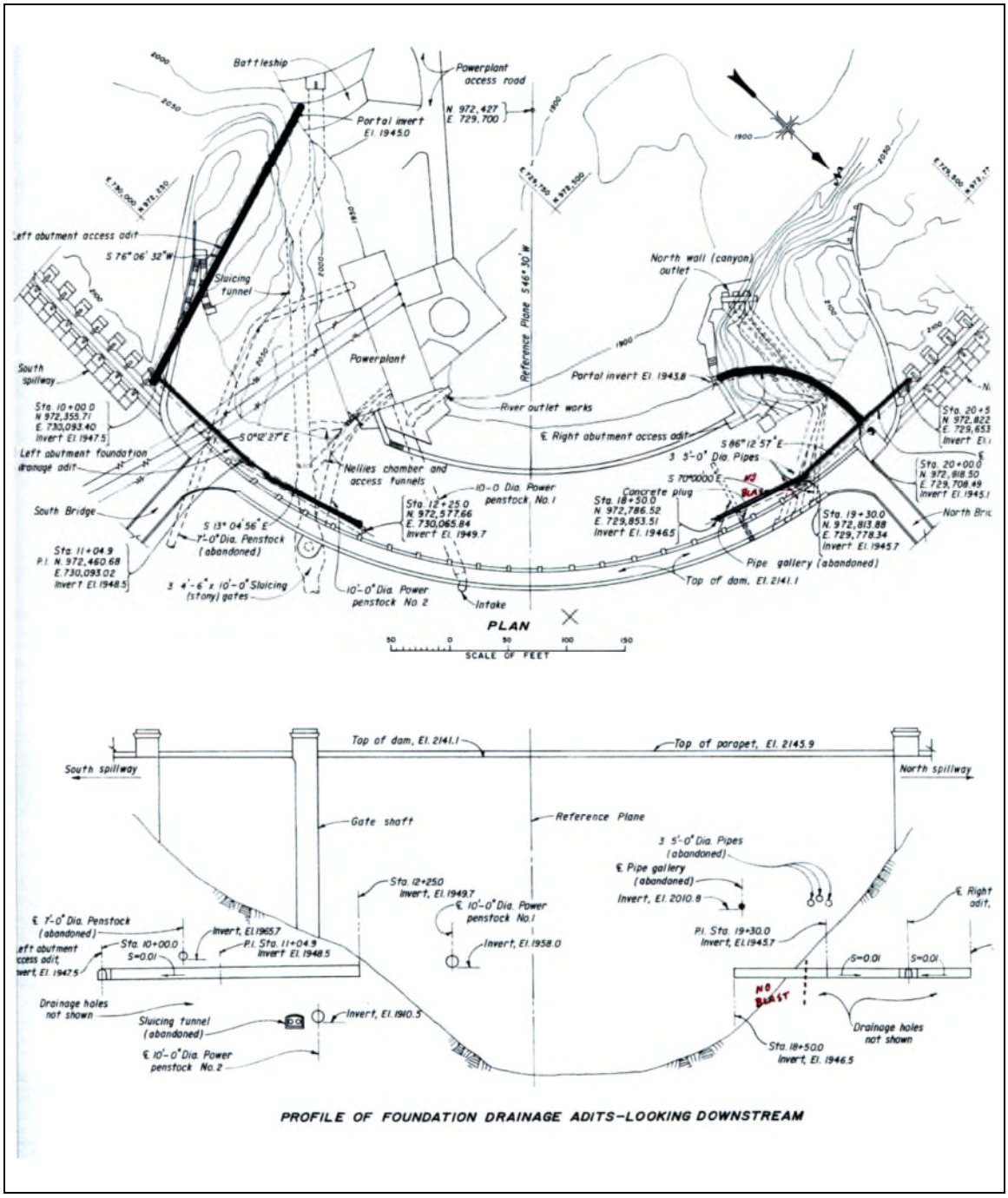
Four contracts were envisioned to be let if the dam was to be raised. One was to build a bridge upstream from the dam to reroute traffic on AZ highway 188, which was then being carried on top of the existing dam. The second was a contract to drive access adits (tunnels) and drainage adits into each of the abutments, and into the dam foundation. This would allow for the measurement of the amount of water that was percolating through the foundation and also to measure and possibly relieve any resulting pressures. The third contract was to develop a new lake tap, penstock tunnel and river outlet works. The fourth contract would be the contract that would actually raise the dam 77 feet and provide for two new spillways.



Theodore Roosevelt Dam prior to any modifications.

The dam is a masonry dam constructed during the period of 1903 through 1911. Most of the stonework was accomplished by very talented Italian stone masons. The terms “left” and “right” abutments are as viewed from the lake side of the dam. And, yes, AZ Highway 188 was dirt back when I took the pictures…..

The Drainage Adit contract entailed driving two access tunnels under the dam, one into each abutment. Drainage tunnels would then be driven off each of the access tunnels. 150 drain holes would then be drilled into the foundation from the drainage tunnels, some in excess of 200 feet in length. (The number of drain holes was eventually reduced to 141.) The drawing below shows the general layout of the project. Access and drainage tunnels are emphasized as dark lines.



In early 1987, I was contacted by Frontier Kemper Constructors, a contractor from Evansville, Indiana. They were preparing to bid on the Drainage Adit contract and were looking for a blasting consultant to assist in their bid. I think one of my contacts in the explosives industry had given them my name. I sent them a copy of my resume. They decided that I would fit their needs and sent me a list of questions concerning various aspects of the specifications. I gave them my opinions on those and also provided some suggestions regarding the blasting that would be required. They didn't request that I visit the site and look at specific items prior to the bid, but the plans and specifications were reasonably complete. My office was still in Nevada City, or I would have taken a day trip over to the dam to check it out.

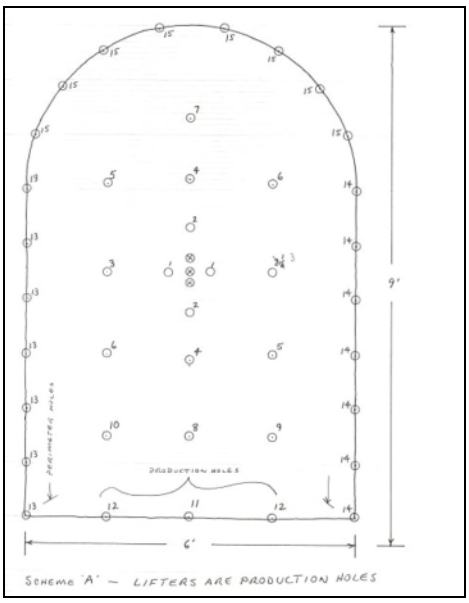
On this particular contract, the Bureau of Reclamation had put a considerable number of restrictions into the specifications regarding the tunnel blast designs. No blast holes could be larger than 1-7/8" diameter. No holes could be deeper than four feet. Adjacent rows of holes had to be separated by at least one delay interval from the preceding row, except that the row of perimeter holes had to be separated by two delay intervals from the adjacent row.

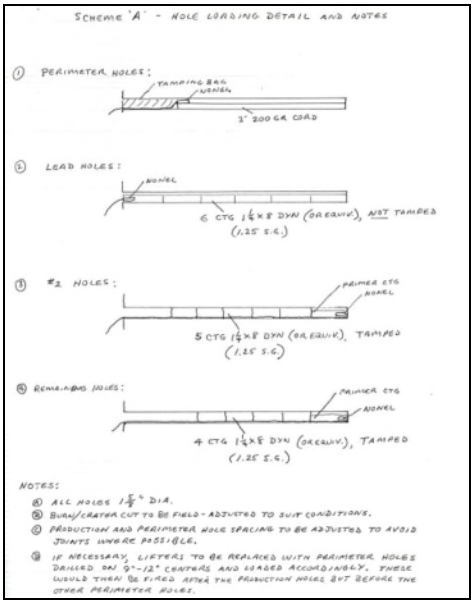
Maximum charge weight was initially limited to 2 lbs per delay. (Later, after sufficient vibration data had been obtained, this was eventually increased to 3 lbs per delay.) Perimeter holes could contain no more than 200 grains of explosive per foot, generally indicating that the perimeter holes would be smooth-blasted using detonating cord only. All of these restrictions pretty much dictated how the blasts had to be designed.

Blast vibration, measured at the nearest point of the existing powerhouse structure, could not exceed 2.00 inches/second of peak particle velocity on any blast. Although this limit is usually applied at non-engineered residential structures and would seem quite conservative for massive structures, it was established to protect sensitive mercury switches inside the powerhouse. 2.00 in/sec was never reached, however, because of the weight limit of 2 lbs per delay (later 3 lbs per delay) and the distance to the powerhouse from the blasts. The test blasts at the left abutment portal were at a distance of 135 feet and the nearest point that the left abutment access tunnel would approach the powerhouse was 90 feet. All blasting for the right abutment access and drainage tunnels would be across the canyon from the powerhouse at a distance of at least 200 feet. The actual ground path for the vibration from that source was considerably longer.

Airblast, measured at any non-government structure, could not exceed 133 decibels. The portal for the right abutment access tunnel faced directly toward the powerhouse from across the canyon and it was quite likely that the 133 dB limit would be exceeded from most the blasts at that location. I recommended using a limit of 150 dB instead, which would be the below the threshold for glass breakage in poorly-mounted windows.

The following are the rough drawings for the access tunnel blast design that I developed for bidding purposes. These were to be used for driving the two access tunnels after the test blasts were completed and would result in vibration levels below the limit specified. Designs were to be revised as needed by the contractor to adjust for changes in the rock as the tunnels progressed.



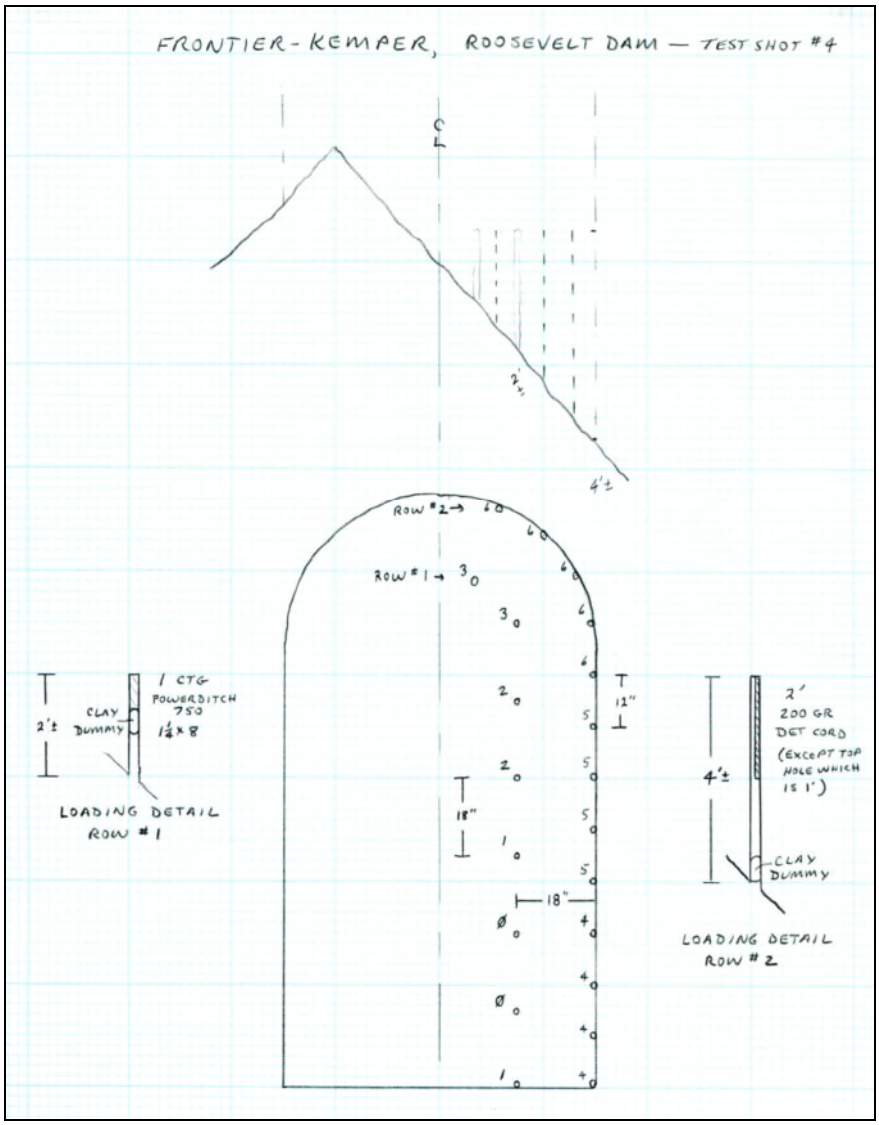


The Bureau of Reclamation did their own vibration and airblast monitoring and there was no requirement for the contractor to monitor, but I recorded several of the blasts with my own equipment so that I would have good vibration regression data for later use if we needed to modify the tunnel blast designs. (I have always done this when I have had the chance. One never knows when additional data will prove useful. Being in the seismograph business anyway, I usually had ready access to equipment.)

Frontier Kemper turned out to be the successful bidder and after they had mobilized their equipment on site, I met with them at the dam. This was early October of 1987. The specifications called for test blasts to be accomplished at each of the portals to begin the blasting program. Although the test blasts at the right abutment portal proceeded normally, the tests at the left abutment turned out to be a bit of a problem. Where we were supposed to load and shoot the first several test blasts, the rock was in very poor shape. It was badly weathered shale and would hardly stand up to being gouged with a #2 round point shovel. It proved very difficult to keep the holes open after they were drilled. It was possible to drill some holes and remove some of the poor quality rock, but there was no way that we could drill, load and shoot the perimeter holes and get a reasonable portal started until we encountered competent rock. Much to the dismay of the inspectors, the portal was hand excavated past the location where the first test blasts were to have taken place.

Three rock types were encountered in the driving of the access tunnels and the drainage tunnels; D5 shale, D6 sandstone and M1 dolomite. Badly weathered shale was what was giving us fits in the left abutment portal. If you can load explosives into it, you can probably blast most any type of rock. In the cautious blasting of rock however (whether pre-splitting or smooth blasting), there are three factors; (a) explosive type, (b) the method to be used and (c) the quality of the rock. Experienced blasters know that the latter has the most effect on the end result. No amount of blasting expertise was going to “cure” the problem of smooth blasting the loose shale that we were encountering.

While they lightly blasted and hand excavated the poor quality shale, I revised the test blast designs (tossing out the first few as they dug deeper) and, when rock quality improved to the point where we could keep the drill holes open, the necessary test blasts were conducted successfully. The following figure depicts my design for test shot #4, which was actually the first actual test blast after most of the loose rock was removed. This test blast was intended to partially square off the face. The actual access tunnel would angle off to the left and the sandstone there would finally allow additional test blasts and full perimeter blasts to be accomplished.



Approximately 60 feet of the right abutment drainage tunnel was to be driven into the dam itself. The specifications precluded any blasting within the dam. Prior to the tunnels reaching that point, I developed a scheme to conduct cautious blasting into the dam and we tried to get the Bureau to allow it. It was certainly possible and safe to do so. The Bureau's consultant, Lew Oriard, concurred with me (I believe he had actually recommended the procedure earlier in the project design stages also), as did several key Bureau people, but the Salt River Authority (who operated the powerhouse) were adamant in their opposition to it and the contractor had to excavate that short portion mechanically.

After the initial test blasts were completed and it was obvious that vibration would not be a problem, there was no further need for my assistance at the project and I retired to Nevada City.

Post project notes:

As it turned out, I was correct in my prediction that 133 dB would not be high enough of a limit at the dam from blasts at the right access adit. Out of 74 blasts in the right abutment access tunnel, only 13 were at or below 133 dB, as measured at the powerhouse. As expected, the loudest were the early blasts, but the limit was also exceeded by blasts deep within the drainage tunnels. This was predictable with the portal directly facing the powerhouse. The highest airblast listed was in excess of 0.0369 psi (142 dB). The actual maximum was unknown because the seismograph operators failed to increase the range on the airblast channel and it maxed out at 142 dB. To their credit however, the Bureau inspectors never complained about the high airblast readings.

Vibration was never a problem at the initial limit of 2.0 lbs per delay, nor at the later limit of 3.0 lbs/delay. Measured at the nearest part of the powerhouse, the highest PPV for the opening blasts at the left portal was 0.129 in/sec. The highest overall PPV recorded at the powerhouse was 0.311 in/sec and that was seen when the left access tunnel was being driven approximately 90 feet from the closest part of the powerhouse. (It should be pointed out that higher readings <u>were</u> recorded for several blasts in the left drainage tunnel, but the recordings were made on the ground directly above the tunnel rather than at the powerhouse. The fact that all of these readings were 0.49 in/sec however, indicates that the seismograph had reached the limit of the range set on the instrument. The actual PPV was in excess of 0.49 in/sec, but because no waveforms were preserved, we can't estimate by how much.)

Since the completion of this project, readings taken within the dam foundation indicate that the drainage tunnels and the associated drains have significantly reduced the water pressures within the dam foundation. These pressures and the flow from the various drains are constantly monitored by personnel from the Salt River Project, the operators of the dam and powerhouse.

In a future issue, we will take a look at the Lake Tap Contract. It involved putting in a new lake tap for the powerhouse, excavating for a new outlet works, driving a river outlet works tunnel, a new penstock tunnel and excavating a gate shaft. This all involved considerably more blasting. The new lake tap was excavated under 130 feet of water. Vibration limits on various structures ranged from 2 in/sec to 10 in/sec. All in all, it was an interesting and challenging project.

Current board members and officers are:
President Mike Chiurato
Treasurer Gerald "Jerry" Fulghum
Secretary Joe Stack
Board member Todd Quigley
Board member/ Newsletter
Editor Mike Burneson
Website Master Wes Bender

Chapter Activities 2019
Crab Feed Business Dinner
Saturday February 22, 2020

Fire in the Hole…

Two friends are walking their dogs — a Dalmatian and a Chihuahua — when they smell something delicious coming from a nearby restaurant.
The guy with the Dalmatian says, “Let’s get something to eat.”
But the guy with the Chihuahua says, “We can’t go in there, we have dogs with us.”
So the first guy says, “Just follow my lead.” He puts on a pair of sunglasses and walks into the restaurant.
“Sorry,” says the owner, “no pets allowed.”
“But this is my seeing-eye dog,” the guy with the Dalmatian says.
“A Dalmatian?”
“Yes, they’re using them now.”
The owner says, “Very well, then, come on in.”
The guy with the Chihuahua repeats the process and gets the same response from the owner: “Sorry, pal, no pets allowed.”
“But this is my seeing-eye dog,” says the second guy.
“A Chihuahua?” asks the incredulous owner.
“A Chihuahua?!,” says the man in the dark glasses.
“They gave me a Chihuahua?!”