Blasting Near Water Wells

Author: Wes Bender

(This article first appeared in *The Primer* in the spring of 2006)

"My well dried up after you set off that blast down the street!" Some of you have encountered that statement before. Some of you will hear it in the future, especially in drought years. Is it possible for a blast to cause a well to dry up? Maybe, in certain instances, but probably not. There are three instances where blasting could possibly adversely affect a well's performance. Two of these are quite closely related and all three would require the blasting to be done in very close proximity to the well, in most cases within a couple of tens of feet. Let's analyze those instances.

The first would involve damaging the well by physically offsetting the well casing, cracking the casing or pinching the well closed or nearly closed. To do this, the well would have to be within the crater zone (or inelastic zone) of the detonating charge. The size of this zone would vary with the diameter of the borehole and size of explosive charge, but should not extend beyond the distance where you would expect to find some back-break cracks from the blast.

Back in 1991, Roy Rose, Bruce Bowles and I presented a paper at the ISEE International Conference addressing blasting near water wells at the Sleeper Mine near Winnemucca, Nevada. I had been asked to investigate other un-related blast vibration concerns at the mine and, in the process, discovered that they were blasting very close to dewatering wells inside the pit, sometimes to the extent that the well was located <u>within the blast</u>. The wells, amazingly enough, survived. Having had to previously address several issues of homeowners claiming well damage, I recognized the value of what these guys were doing and asked them if we could co-author a paper on it. For those situations where a well was located within the blast, Roy had developed blasting schemes that would fracture the rock surrounding it without destroying the well. Blast holes were 6-3/4 inches in diameter drilled 23 feet deep. They would routinely detonate 45 lbs of AN/FO in holes at a distance of 14 feet and 128 lbs of AN/FO in holes at a distance of 21 feet from a well. Granted, they occasionally caused some damage to the top 20 feet or so of the well casing due to rock block movement, but after carefully digging out the shot, cutting off the damaged section of casing and reinstalling the pump, pumping resumed. Their experience had been that, while it was physically possible to offset the well casing at the same elevation of the blast charges, it could only occur at short distances and by using large charge weights. They were confident enough that, if the well was located outside the blast perimeter by a distance of at least 35 feet, <u>they wouldn't even bother to pull the pump</u>. In these cases, neither the casing nor the pump were damaged by the blast.

Since your blasting in urban situations will normally involve smaller holes and charge weights, you would not be expected to cause damage at even shorter distances, although your blasting will probably alarm the homeowner. The key is to make sure the crater zone does not come so close as to damage the well.

To look at this from a vibration perspective, one could consider a well to be a buried pipe. It is a constrained object and is not free to vibrate except in concert with the surrounding rock and soil that is supporting it. There have been numerous instances where blasting has been conducted in very close proximity to buried pipelines without causing damage. Again, the pipeline would have to be included within the crater, or inelastic zone, before the possibility of damage could take place. I am not aware of any instance where vibration from blasting has been the cause of damage to a buried pipe or, for that matter, has been proven to have caused damage to a well.

Other possible instances of damaging a well by blasting would have to involve intercepting the source of the aquifer or diverting it away from the well. Old-timers used to shoot water wells in order to fracture the rock, allowing better water flow into the well. If there was a sufficient supply of water surrounding the well, this could be successful. There were instances, however, where excessive fracturing of the rock allowed the water to take a different path and the well could go dry. Modern methods such as “hydrofracturing” have pretty much replaced shooting wells with explosives. As in the previous instance, in order to fracture the rock surrounding the well, your blast would have to be in very close proximity to it. It could even be argued that a nearby blast might increase the flow in a well, but don't expect to make that argument fly without some sort of proof, especially during drought years. In the Sleeper Mine studies, it was found that water flow in wells often increased after blasting. It was thought that the possibility of scale being knocked off the screens by vibration was allowing for better flow, but we never confirmed that.

A situation similar to the above could occur if nearby blasting and excavation intercepted the source of the water and, because it took the path of least resistance, the water was diverted from the well. An instance of this occurred several years ago near Sonora. A major highway cut below some houses caused one homeowner's well to dry up. It was determined that the aquifer had been intercepted and diverted. This was fairly obvious because the water was now flowing out of the side of the highway cut. It would not be fair to call this "blasting damage" although blasting would have been the first step in the process of excavation. It certainly could not have been attributed to vibration from blasting.

A study done in 1980 for the Bureau of Mines, Survey of Blasting Effects on Ground Water Supplies in Appalachia, addressed water wells extensively.

It is interesting to note that, in the study, which was conducted around large open pit coal mines, as large scale blasting and excavation approached the location of a well, the flow in the well would occasionally increase. It was felt that the increase was caused by the reduced compression on the rock and soil near the well as material was removed at some distance. Of course, as excavation continued toward the well, a point would be reached where the water would take a path of lesser resistance and the well would become dry.

Other interesting points came out of this study. One point was that vibration measured at depth in the wells was considerably less than that measured on the surface. This concurs with geophysical studies that have shown that body waves diminish more quickly than do surface waves. Another point was that unless excavation took place that diverted the water from a well, the only adverse effect from the blasting was temporary turbidity in the water. Other than the temporary turbidity, no damage to water wells was found to have been caused by blast vibration.

If you encounter a blasting situation where there is a water well in the vicinity, even though you probably would not damage it, you need to take some extra precautions. It would be prudent to get a hydrologist involved and to obtain some background data on the well's performance before proceeding with your blasting. Even the most honest of homeowners is going to have some concerns about the safety of his well.

If you are faced with claims of damage to someone's well, unless you blasted right on top of it, it is extremely unlikely that you caused anything other than minor temporary turbidity to occur. Unfortunately though, because of the liability issues involved, the burden of proof will usually fall upon you as the blaster. The best defense is to have your blasting consultant, along with a competent hydrologist, assist you in disproving the claim. Of course, your insurance carrier needs to be kept informed of all claims. However, they should not be in a hurry to settle, just because it might be cheaper than to fight the claim. To do so establishes a very bad precedent and can invite additional problems.