Safe *explosive* operations

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Caution: The following description of an unplanned surface detonation by a wireline perforating gun is graphic in nature and based on a composite of real events during the past years and could happen again, unless...

The wireline crew was on its second run and second misfire of the perforating guns and everyone was getting anxious, after all, time is money. The engineer was very aware that if he and his crew didn't get it right on the third try they would probably get "run off the job," damaging his reputation and his company's reputation for timely service.

The second misfired perforator was lowered to the ground and placed next to the newly armed third perforator. The engineer began his electrical firing circuit checks. The customer's well site supervisor took his job to heart and was carefully looking over the shoulders of the helpers who were getting the third run ready. The workover crew was also standing close by in order to help control the heavy perforating gun when it was lifted up and over the wellbore and lowered for a third run. After all, the rig needed to be released by the end of the day to proceed to the next job.

In order to confirm the perforating firing circuit was complete, the engineer yelled over the din of his electrical generators to his helper. The helper was told to short the end of the line where the wireline would be attached electrically and physically to the perforating gun. The helper, a veteran of over six months in the perforating business, knew the engineer would shoot current down the line, simulating the process that would detonate the gun — hopefully with success. He also knew that the "firing head" would spark when the engineer sent the current. The helper would then motion to the engineer that there was a spark and the engineer would then put the firing circuit in safely and indicate that the helper could now put the firing head on the perforator. This sequence would ready the perforator for lowering into the hole.

The engineer waved at his helper to "short the line" and then he increased the current to simulate the firing process. The engineer sees a strange reaction to his current/voltage meter. Something isn't quite right! The engineer waves at the helper — he wants do this again — just to make sure everything is in order. He yells again at the helper, but the helper is too far away, over by the rig, and doesn't hear what the engineer is saying. So the engineer waves again at the helper and the helper waves back. The engineer resets his firing circuit and tries it again, watching his meters very carefully this time.

The helper, watching the engineer wave at him and seeing the sparks, knows that now is the time to get the perforator connected up. The helper waves back at the engineer and begins making the connections. After all, he wants to do a good job for the boss and the customer.

An explosive perforating gun, once initiated, cannot be recalled or stopped. There are perforators that can pack 12 shaped charges per foot and will send concentrated chemical energy outward at speeds of over 25,000 feet per second with enough force to blast precise holes through steel, concrete and rock to depths of over a meter.

In the first thousandth of a second, the helper was engulfed in a fireball so fast, the human eye cannot see it. The shape charges penetrated his lower body as he stood over the device, making the connection just as the engineer tested the firing circuit for the second time while concentrating only on his meters. In the second thousandth of a second, the helper was thrown clear just as the energy caused the second, fully armed (and presumed misfired) perforator to initiate from the concussion sending the workover crew and "company man" flying in all directions, breaking bones and shattering eardrums. In the third thousandth of a second, the engineer, safely in his truck, became aware that something was wrong.

Accidents are very rarely a result of a single action or condition. Perhaps you have already deduced some of the steps that could have been followed to prevent this incident from ever happening. And unlike the position that no one point causes the incident, one "break in the chain" or in other words, one safe action, perhaps your action or words, could keep the incident from happening.

There are literally thousands of successful perforating operations performed daily. In truth, following the procedures has provided for an excellent safety record involving oilfield explosive devices. However, even one failure can be catastrophic, even deadly. So, what can you do as an observer or participant of such operations to keep it safe?

(1) Have a "tailgate meeting" and discuss exactly what is going to happen with these devices and what is the proper arming and firing procedures. How, what, when, where, etc., Got it? Number ONE!

(2) Check for stray electrical energies around the rig. Detonators are very sensitive to electrical energy, heat and shock. These checks have found some very unusual sources of electrical energy. By the way, dry blowing air and even static charges from lightning five miles away can detonate some of these devices.

(3) Clear the area of all unnecessary personnel and reduce the hazard exposure. It only takes one man (the engineer) to arm a perforator.

(4) Secure all electrical power after checking the firing circuits, away from any explosive device and close enough to the instrument room to talk to the helpers, no sign language, please!

(5) Arm the gun electrically before ballistically. This means make up the electric detonator (in a safety blast tube) to the now-electrically locked-out firing circuit. Then attach the detonator to the main charge. This way, if a mistake was made, the detonator goes off in the tube and doesn't set off the larger explosive train.

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(6) Keeping the firing circuit locked out, energize the instruments below 200 feet minimum and the reverse for returning to the surface, even if you had every reason to believe that there was a successful, planned detonation.

(7) Assume a misfire. There have been times when a perforator only partially detonates, giving good indications of a successful operation, only to finish the job upon return to lower pressure or increased oxygen levels of the surface.

(8) Watch for trapped pressure. Some devices can hold tremendous pressure only to release it with devastating results upon unsuspecting help.

(9) If there is a misfire, get the detonator cut away from the main charge as quickly and safely as possible (no crowds, please). Get the detonator in a safety tube and then, cut and shunt (twist the electrical wires together) the detonator away and safely store back in a magazine. This is the reverse of arming or ballistic before electrical.

(10) Account for all explosive materials and scrap and lock it up in approved magazines for transportation off-site. No dumping in the mud pit.

Ten steps. Not a lot to remember but a minimum requirement for safe explosive operations. Write them down, commit them to memory or use a checklist, but use them to keep yourself and your fellow worker safe during explosives operations on the well site. If you are not sure or clear about something in this or any operation, ask the question or stop the operation. You may be the person who saves a life today — and it may be yours.

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