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SINGLE ROUND BLASTING OF 10-FOOT DIAMETER X 65-FOOT DEPTH EMPLACEMENT COLLAR HOLES AT THE NEVADA TEST SITE

Since 1961 REECo has drilled and mined emplacement holes for testing nuclear devices underground. REECo has drilled over a thousand holes with diameters between 36 and 120 inches. In earlier days, holes were drilled to a specific diameter by multiple pass techniques. Now holes are drilled in a single pass with a flat bottom bit and with an efficient system for cleaning the cuttings. As a result of REECo's drilling technology, the average maximum offset from surface to total depth is only one-foot per 1000 feet of hole drilled. For holes over 2000 feet deep the average offset is 0.5 feet per 1000 feet.

These drill rigs are used on the collar casings covered in this paper. These rigs are standard oilfield rigs, modified to accept large bits and to provide the high torque needed with large bits and drill pipe. The price of a Class I Rig is in the range of 2.5 to 3.0 million dollars. The three large compressors (1600 cubic feet per minute (cfm) each) used to run the circulation system are about $425,000 each.

Drilling is expensive. Prior to the present method of drill and blast, devised by Atlas, when a collar casing hole was put in to accept a Class I Rig it could cost as high as $105,000 depending upon how long the Class I Rig was in use. Now, by drilling the collar hole to depth (60-65 feet), loading to Atlas design, then blasting and mucking out with the Auger Rig and setting the casing, the cost is approximately five to seven thousand dollars. This is a significant savings to the Department of Energy due to the number of emplacement holes we drill.

Prior to the present method of using 65-foot surface holes being drilled and blasted at the Nevada Test Site for collar casing installations, an oversize drill pattern was the primary method used.

This oversize pattern was drilled with an Air Trac. The holes were normally 2 1/2-inch diameter x 10 feet in depth. A standard V-cut was used and the pattern was normally a 12-foot circular pattern.

The holes were drilled and loaded using conventional explosives and electric detonators.

After blasting, the broken rock was mucked out using a back hoe. A thin walled 122-inch diameter x 10-foot long casing was placed in the hole. Then the inside of the 122-inch diameter casing was filled with concrete to about one-foot in depth. This was to seal the bottom of the casing. After the concrete set inside the casing, the outside of the casing was encased completely with concrete.

A Class I Drill Rig (EMSCO 3000) API Static Hook Load 2,000,000# - Working Hook Load (80%) of Static Hook Load 1,600,000# - REECo Safe Load Rating 1,300,000# - Limiting Component is HOMCO Swivel - Wire Line 1 3/4-inch to 12-part line would then be moved in to the area and positioned over the center of the 122-inch diameter casing. A 120-inch drill string and bit would then be installed and the hole drilled to a 65-foot depth. Penetration rates were slow due to the restricted distance between the

subbase and the collar top as added weight could not be installed when starting from the surface.

The 120-inch bit would then be removed and a 98-inch surface casing would be run into the bottom of the 65-foot hole and this casing would then be fully concreted in. The Class I Rig would then tool up and the drill hole would then be drilled to total depth with a 96-inch drill string and bit one.

This method of collar casing installation prevailed only in areas where there was solid rock to surface. In areas where there was at least 10 feet of dirt, alluvium or cap rock blasting was not required. In these areas a drive-in Auger Rig was used to drill the surface hole. The Auger Rig can auger holes from 26- to 172-inch diameter to a depth of 118 feet. Poor fragmentation in the collar holes prior to Atlas Powder becoming involved resulted in slow hole cleanout and excessive rig maintenance which resulted in increased costs.

The collar hole operation using a Class I Rig plus the drilling, blasting, mucking, moving in, setting up, running casing and cementing was costly and time consuming.

The application of drilling the final size configuration hole to a 65-foot depth and mucking with the Auger Rig was then investigated. This was a joint effort by REECo Drilling, Mining and Occupational Safety personnel.

Numerous drilling patterns, loading and time schemes and methods were tried. Some were successful. Most were expensive. All concerned looked for a better and less costly method for this collar casing installation. Poor fragmentation in the collar holes prior to Atlas Powder (thru W. A. Murphy, Inc.) becoming involved resulted in slow hole cleanout and excessive rig maintenance with associated excessive costs.

One of the more successful shots was a 120-inch diameter x 60-foot deep hole that was drilled using 3 1/2-inch holes and then casing them to a 2-inch diameter using PVC pipe. A 30-inch burn hole was drilled to total depth. Twenty-seven 3 1/2-inch holes were drilled and then loaded with 1 1/2-inch powder boosted with Detaprimes and wired using all "0" delay caps. This shot smooth walled and the blast holes were visible all the way from top to bottom. Fragmentation was excellent and the Auger Rig mucked out quickly. The 28-inch bit used for the burn hole was a high cost item in this test and other methods continued to be investigated.

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