Toltec Mesa Resources LLC

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Samantha (Sam) Rynas sent via email: samantha.rynas@emnrd.nm.gov
Reclamation Specialist
Mining Act Reclamation Program
Mining and Minerals Division - Energy, Minerals and Natural Resources Department
Wendell Chino Building
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RE: PROPOSED AMENDMENT – MINIMAL IMPACT EXPLORATION PERMIT APPLICATION FOR THE NORTH CEBOLLETA EXPLORATION PROJECT, CIBOLA COUNTY, NEW MEXICO PERMIT NO. CI019EM – PLANNED USE OF MUD PITS FOR DRILLING OPERATIONS

Dear Sam:

On behalf of Cibola Resources, LLC, we would like to propose the use of excavated mud pits in lieu of an above-ground drilling fluid management system. Cibola plans to drill vertical holes, each approximately 5 inches in diameter, average 640 feet deep, utilizing and within the proposed drill pad surface disturbance areas. These areas would also accommodate support equipment, including the drill rig, pipe truck and any ancillary support vehicles. Cibola plans to use this closed-loop drilling fluid manage system to drill the holes. Each excavated mud pit would have dimensions up to ten (10) feet wide, up to twenty (20) feet long, with a maximum depth of eight (8) feet deep and equipped with a tapered ramp on one end to enable emergency egress for personnel and livestock. At closely spaced drilling locations, the excavated mud pits could be designed to support two drill pad locations using in-line connected sumps, or mud pit sumps connected by a shallow cross-over ditch. The pit design specifics will be field fit by the drilling contractor and would allow for some freeboard. Freeboard is the difference between the fluid level in the pit and the overtopping level. It provides a safety mechanism to protect against an unexpected rise in the pit fluid level, i.e., wave action or if something large fell into and displaced fluid in the pit.

While drilling and prior to reclamation, excavated soils will be stored on the edge of the pit and used as a berm to enhance fluid containment and discourage animal access to the pit. A stock pond is already in use close to the drilling locations so wildlife and livestock use of the mud pits is anticipated to be minimal. However, temporary fencing will be used on a case by case basis if animals are found regularly entering the mud pits or as a safety measure.

<u>PURPOSE OF MUD PIT AND CLOSED LOOP SYSTEM</u>

The principal purposes of the mud pits or sumps are to:

- Store the drilling fluid (usually 3 times the anticipated volume of the borehole)
- Allow mixing of bentonite and water
- Allow settling of the solids (cuttings) from the drilling mud before it is recirculated to the borehole
- Act as permanent, below-grade containment of cuttings and dried drilling mud products, preventing such from ever being exposed to surface water run-on and run-off prior to reclamation.

MUD PIT SYSTEM DESIGN

The design of the mud pit must be adequate to allow sufficient residence time for the fluid to settle its solid load as the fluid leaves the drill hole (Australian Drilling Industry, 1997; Driscoll, 1986; Roscoe Moss Company, 1990). Generally, the larger the particles, the faster the settling rate. Fine grained particles may be recirculated. A good settling pit will force the mud to flow in a shallow stream across the full width of the pit. In this way, the flow can be slowed, and the cuttings have only a short distance to drop out of the flow path. Drilling mud pits are designed to hold and contain the drilling fluids necessary to complete the boring to the desired depth and the drill cuttings. Bentonite is used in developing the drilling fluid lines and provides a coating on the entire system, the pits, the borehole and conveyances. In essence a closed fluid-circulation system is created. Seepage losses are relatively minor, especially through fine-grained geologic units like the Mancos Shale.

ROLE AND DESIGN OF DRILLING FLUIDS WITH MUD PITS

The drilling fluid for this project will be comprised largely of a mixture of bentonite and water. In some instances, additives may be included to enhance certain properties or to address specific conditions encountered during drilling operations. The Material Safety Data Sheets (MSDS) for all proposed chemicals that might be used will be provided by the drilling contractor. The drilling fluid will be made up of three principal components, the base liquid (fresh water) and active solids (bentonite) and if necessary, polymers and inert solids (materials added to the mud to modify its properties without appreciably affecting the viscosity of the fluid).

Drilling fluids are critical to the drilling process. In the hole-making function, drilling mud cools the bit, clears cutting from the bit and bottom of the hole, transmits the energy needed to lift the drill cuttings from the hole, lubricates the rods/pipes and bit, inhibits corrosion of down-hole tools and supports the weight of the casing (buoyancy). Additionally, the drilling fluid is designed to help stabilize the drill hole by controlling downhole pressures and temperature. It provides support for unconsolidated geologic formations, protects against fluid invasion, forms a filter cake on the hole wall and restricts its thickness, controls circulation fluid losses and inhibits formation deterioration.

During drilling operations, fluid properties are usually monitored by the driller to obtain the objectives of the project. Maintaining the design properties of the drilling fluids are important to efficiently carrying cuttings in suspension from the hole, allowing the solids to drop by gravity from the drilling mud in the mud pit and preventing fluid losses as the fluid is recirculated back into the borehole. A mud filled drill hole also stabilizes the hole and prevents it from collapsing. The mud is designed to balance both the lithostatic and hydrostatic pressures anticipated during the drilling operations. The drilling fluid also provides relatively stable pressures within the borehole to inhibit pressure surges that could cause erosion or other instabilities within the hole. A thin, tough filter cake generally develops and coats the wall of the borehole during drilling and fluid circulation, which is critical to achieving hole stability. The filter cake is generally designed and managed between 0.5 and 1.0 millimeters (mm) thickness and fluid losses are kept in the range of 5 to 10 milliliters (ml). Bentonite muds tend to build excellent filter cakes on the hole walls and in the mud pit(s). The flat platelets of the bentonite clay mineral are ideal for building a tight, thin filter cake, which also greatly reduces permeability and fluid loss from the borehole. The mud that moves into more permeable zones slows down as the pressure driving it balances against the formation pressure. The slower moving mud gels tend to lock loose materials together building a wall that is held in place by the fluid pressure. The fluid pressure is maintained by keeping the hole full of fluid.

BENTONITE-BASED DRILLING FLUIDS AND FRESH WATER

Bentonite, a sodium-rich clay mineral, when mixed with water, forms a gel. Bentonite hydrates and becomes colloidal in water. Bentonite is a relatively insoluble mineral that does not dissolve in the water and therefore would have very limited effect on water quality. There may be some exchange reactions between calcium and magnesium in the water and sodium in bentonite clay minerals. This would tend to soften the water similar to the way and exchange resin works in water treatment. Polymeric compounds, usually biodegradable, tend to be used with non-dispersed bentonite to improve wall building and development of thinner filter cakes with lower water loss properties. Polymeric compounds usually add cost to a drilling fluid program, so the costs-to-benefit are usually balanced. The water used as make-up water in the drilling fluids is expected to be from a local stock well, which will have a quality similar to the groundwater at the site. It would not impart any adverse water quality impacts from the small amount of potential seepage from the mud pit through the filter cake coating the walls of the pit.

RECLAMATION OF MUD PITS

After completion of drilling at each location, usable drilling fluids will be collected by the drilling contractor in tanks and re-used at the next drilling location. Any remnant fluids and wet cuttings will be allowed to evaporate-dry via prior to replacing the excavated soils back into the mud pit. The refilled mud pit will be compacted and graded to match the final grade of the reclaimed drill pad such that it will be indistinguishable upon final reclamation. Related surface disturbance will be re-seeded in accordance with the original application.

RECOMMENDATION TO AVOID USE OF SYNTHETIC LINERS IN MUD PITS

In anticipation of potential agency requirements for a plastic liner in the pits we have the following recommendation. A liner in this application would provide no environmental value and would complicate the backfilling, restoration and reclamation of the mud pits. Firstly, the challenge with a liner in this application, is difficult to construct in a cost-effective manner that prevents tears and punctures. The mud pits or sumps are generally constructed in the field, fit to the site conditions, with limited or no engineering consideration other than their function as sumps during drilling operations. Large rocks, sticks and other debris encountered during excavation are commonly present, which pose a threat to the liner integrity, particularly when the lined sumps are filled with fluid. If the liner is punctured, obviously the benefit of having a liner is compromised. The puncture creates permeability many times greater than the bentonite-lined system that we are proposing. Secondly, liners are difficult to impossible to effectively remove while simultaneously containing cuttings within the same pit. Removal of liners at the end of the project would require excavating wet cuttings to be temporarily placed on the surface, unnecessarily exposing them to potential surface water run-on/run-off prior to reclaiming the pits. With backfilling and reclamation of the pit, the liner material in the subsurface may not be retrievable without considerable effort and likely causing greater surface disturbance. Thirdly, there have been circumstances where animals have fallen into the pits and become entangled in the liner and drowned even when the pit is equipped with an emergency ramp.

REFERENCES

Australian Drilling Industry Training Committee Ltd. 1997. Drilling – The Manual of Methods, Applications, and Management. J. Stein ed. Lewis Publishers. New York, NY.

Driscoll, F.G. 1986. Groundwater and Wells, 2nd ed. Johnson Division, St. Paul, MN.

Roscoe Moss Company. 1990. Handbook of Ground Water Development. John Wiley & Sons, NY.

Sincerely,
Toltec Mesa Resources LLC

Bob Newcomer
Principal Consultant

cc: David (DJ) Ennis, Program Manager (via email: David.Ennis@emnrd.nm.gov)
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