



Drilling and Grouting Products For Monitoring Wells



Bentonite chips.

Ground water monitoring wells and environmental remediation wells require care in the design and installation phases to ensure that products are not used that will adversely affect water quality and test readings. This is especially true of the drilling fluid and grouting products used to construct these wells.

There are many drilling fluids and grouts on the market today that are used to complete oil wells, water wells, mineral exploration holes and horizontal boring holes. Some of these products do not work as well in monitoring wells because they can distort sample test readings. Some of these products require much more well development to remove product left in the well from drilling. The products that can be used safely in monitoring wells are fewer in number than those products that can be used for other types of drilling mentioned above. Over the past three decades, a number of products have been developed that work very well for monitoring well applications. These include:

- Natural untreated bentonite drilling mud
- Natural polymers for drilling
- Dry bentonite sealants for grouting
- High solids bentonite grouts

Natural bentonite drilling mud simply is an unaltered bentonite that can be mixed with water, and yields approximately 90 barrels of drilling mud slurry per ton of product. No polymers or additives have been added; these products are pure bentonite clay. There are several versions on the market today, and they work

well in applications that specify no polymers in the drilling fluid. These products meet American Petroleum Institute (API) specifications.

Natural polymers now are widely used in environmental applications that specify no bentonite clay in the drilling fluid. These polymers are biodegradable, environmentally friendly, and can be broken down at the completion of the project with protein enzymes, which also are environmentally friendly. These natural polymers are beneficial because they are easy to mix, provide viscosity, help with filtrate control, provide gel strength, and stabilize

the borehole. They can be used in freshwater or saltwater conditions.

Natural bentonites and natural polymers provide a choice so that various applications and specifications can be covered. There certainly are other products that can be used as well, but these would require much more well development time than the natural bentonites and natural polymers in order not to interfere with test data.

There also are a number of grouts and sealants available for monitoring wells and other types of environmental wells.

The list includes:



Bentonite tablets.

- Bentonite chips
- Bentonite tablets
- Coated bentonite tablets
- High-solids bentonite grouts (usually 30% solids)
- Cement grout

A typical design for monitoring wells includes a 2-foot to 3-foot bentonite seal above the gravel pack. This seal normally consists of bentonite tablets, coated bentonite tablets, or bentonite chips. Above this seal, a slurry grout often is added to the well, and this grout column usually is either high-solids bentonite slurry grout or cement grout.

The choice of sealant material for the 2 feet to 3 feet of seal mentioned above basically is up to the design engineer, contractor or client. All three products work very well, although there are advantages and disadvantages of each

The hydration will prevent the grout slurry from migrating into the bentonite seal and possibly into the gravel pack. If the grout slurry is to be cement, it is absolutely essential that the bentonite seal be completely hydrated before the cement slurry is introduced to the well. If the bentonite seal is not hydrated, the cement slurry will destroy the swelling characteristic of the bentonite, and then can travel through the seal and into the gravel pack.

Cement grout does have some disadvantages for monitoring well construction:

- Elevated pH and some ingredients in cement can alter sample data.
- Heat of hydration from cement can damage PVC pipe.
- Cement tends not to bond to casing, and can shrink and crack throughout the grout column.

High-solids bentonite grouts tend to be easier to work with and to clean up than cement grouts. Bentonite grouts bond to casing, and do not affect water chemistries as cement grouts do. Bentonite grouts have a lower pH than cement and no heat of hydration. Bentonite grouts tend to be flexible, an advantage in freeze/thaw conditions and for reconstructing wells.

Granular bentonite.

product. Depth of the well and static water level could influence the decision, as coated tablets allow more time for placement. The coating, which is environmentally safe, gives an additional 30 minutes before it dissolves and the bentonite begins to hydrate. Uncoated tablets are made up of high-swelling sodium bentonite, and provide a very effective, pure seal for monitoring wells. Bentonite chips provide a great seal as well, even though they are not as pure as tablets, fall more slowly through water, and do not hydrate as fast as uncoated tablets.

Whichever sealant is chosen, it always is recommended that the tablets or chips be given ample time to hydrate before a grout slurry is placed over it.

Both cement grouts and high-solids bentonite grouts are mixed in a grouter or mixer, and introduced into the annulus of the well through a tremie pipe placed in the well above the bentonite seal and gravel pack so that the entire volume of the annulus can be filled with slurry. These grouts should be weighed with a mud balance to determine that the specifications are being met.

If you have questions or comments on the above information, please contact me through *National Driller*, or contact your local bentonite manufacturer or bentonite supplier. **ND**

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