County of San Diego

Department of Environmental Health & Quality

Land and Water Quality Division

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SEALING MATERIALS FOR WATER WELLS, MONITORING WELLS, CATHODIC PROTECTION WELLS, GEOTHERMAL HEAT EXCHANGE WELLS, AND OTHER PERMITTED WELLS NOVEMBER 13, 2016

PURPOSE

To clarify the appropriate use of bentonite products in the construction of the various types of wells that are permitted and installed in San Diego County. The current State Well Standards have not been updated since 1984 (Bulletin 74-81, Chapter 2, Section 9, D 5.) with respect to the use of bentonite products. In general, bentonite sealing materials currently fall into three categories:

1. High solids bentonite grout
2. Non-slurry bentonite
3. Bentonite slurries

The State of California has issued a notice of exclusion on the use of bentonite slurries (the 3rd type listed above) as a sealing material for annular seals for the construction and the destruction of wells.

BACKGROUND

The State of California's Department of Water Resources has issued a statewide advisory[1] that identifies studies that have shown that bentonite, a sealing material included in the California Well Standards[2], may not perform adequately in unsaturated zones.

In a multi-year study of grout performance, the Nebraska Grout Task Force evaluated several sealing materials including sand-cement[3], high solids bentonite grout[4], non-slurry bentonite[5], and bentonite slurries[6], by using downhole cameras and dye testing in installed wells.

Task Force findings indicate that bentonite slurries do not perform adequately as a sealing material in the unsaturated zone. Bentonite slurries can shrink and crack when they dry out and do not adequately hydrate and swell once water is reintroduced to the seal.

Although, in general, the cement based grouts listed in the well standards (Bulletin 74-81, Chapter 2, Section 9, D 1 through D4.), high solids bentonite grout and non-slurry bentonite performed adequately in the unsaturated zone, the Task Force found that the

local subsurface environment's, soil particle size and composition, and soil moisture content have the largest impact on the stability of grout over time.

In San Diego County, for wells installed in fracture bedrock environments, bentonite seals generally are not appropriate due to the bentonite being washed out over time. In these situations cement based seals are more appropriate.

POLICY

The following policy for using and mixing well sealing materials shall be adhered to for all well constructions and well destructions.

1. **Bentonite slurries are not approved for use as a well sealing material.** Bentonite slurries are mixtures of bentonite suspended in water consisting of various bentonite slurry mixtures ranging from less than 20 percent to greater than 20 percent active solids by dry weight.
2. High solids bentonite grout is approved for use – This grout has solids content from sixty-four to seventy-two percent (64% - 72%) by dry weight of solids (sand and sodium bentonite) to the total weight of mixed grout (solids and water) and a sand to bentonite ratio of 4:1 to 8:1 by dry weight. Use of these products must follow manufacture specifications.
3. Non-slurry bentonite is approved for use – This sealing material is pure bentonite chips or pellets placed in lifts with adequate water hydration to meet the definition of a sealing material by filling the voids in the annular space. Use of these products must follow manufacture specifications.
4. All other sealing materials shall be allowed in accordance to the California Well Standards.

[1] Statewide Advisory: Sealing Materials for Water Wells, Monitoring Wells, Cathodic Protection Wells, and Geothermal Heat Exchange Wells: http://www.water.ca.gov/groundwater/docs/FINALGroutAdvisory_30Sep15.pdf

[2] Water Well Standards: State of California, Bulletin 74-81, California Department of Water Resources, December 1981; and, California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81), Draft, California Department of Water Resources, June 1991.

[3] Sand-cement, in accordance with the California Well Standards:
"Sand Cement. Sand-cement shall be mixed at a ratio of not more than 188 pounds of sand to one 94-pound sack of Portland cement (2 parts sand to 1 part cement, by weight) and about 7 gallons of clean water, where Type I or Type II Portland cement is used. This is equivalent to a '10.3' sack mix."

[4] High solids bentonite grout has:
1) Solids content from sixty-four to seventy-two percent (64% - 72%) by dry weight of solids (sand and sodium bentonite) to the total weight of mixed grout (solids and water); and
2) Sand-to-bentonite ratio of 4:1 to 8:1 by dry weight.

[5] Non-slurry bentonite is bentonite chips or pellets placed without water.

[6] Bentonite slurries are mixtures of bentonite suspended in water. The Nebraska Grout Task Force studied various bentonite slurry mixtures ranging from less than 20 percent to greater than 20 percent active solids by dry weight.