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## **Subject: Filling and Sealing of Exploratory Drillholes**

With the initial rapid expansion of industrial mining operations in the state, an increased amount of exploration drilling to identify sand deposits is occurring. It is important that drilling operators are aware of State Law which requires that all drillholes which exceed 10 feet in depth must be properly filled and sealed according to the standards in chapter [NR 812, Wisconsin Administrative Code](#), and reported to the department. Open drillholes may pose a threat to the safety and quality of groundwater by providing a direct path for contaminants and pollutants to enter underground aquifers that supply drinking water wells.

### Department Authority

The authority for requiring the filling and sealing of exploratory drillholes is found in s. NR 812.02(2), Wis. Adm. Code, which states “For the purposes of filling and sealing, the provisions of this chapter apply to all drillholes and wells including, but not limited to, elevator shaft drillholes, unsuccessful or noncomplying heat exchange drillholes, mining exploration drillholes not regulated by ch. NR 132 and wells and drillholes not regulated by s. NR 141.25.”

### Definition of Drillhole

NR 812.07(33), Wis. Adm. Code, defines drillhole as “an excavation, opening or driven point well deeper than it is wide that extends more than 10 feet below the ground surface.”

### Methods for Filling and Sealing

The Department encourages that drillholes be filled and sealed as soon as the drillhole is completed, in order to avoid the potential for soils collapse and bridging to occur in the drillhole. Bridging or clogs in the drillhole can prevent complete filling and sealing of the full length of the hole. Section NR 812.26(7), Wis. Adm. Code, describes the required methods for permanent filling and sealing of drillholes and wells:

(a) *Methods*. Once obstructions have been removed from a well or a drillhole, it shall be permanently filled and sealed by filling, from the bottom up, with the materials specified in this paragraph and Table C with the use of a conductor (tremie) pipe, except where the use of a conductor pipe is specifically exempted, by using one of the following methods:

1. ‘Wells and drillholes completed in unconsolidated formations’.
  - a. Drilled wells and drillholes or driven-point wells larger than 3 inches in diameter in unconsolidated formations shall be filled and sealed with neat cement grout, concrete (sand-cement) grout, concrete or with department-approved bentonite chips as provided and specified in subd. 3. for wells 4 inches or larger in diameter.
  - b. Wells and drillholes less than or equal to 3 inches in diameter completed in unconsolidated formations shall be filled and sealed with neat cement grout which may be poured or pumped down the drive pipe or drillhole. The use of a conductor pipe is not required.
2. ‘Filling and sealing bedrock wells and drillholes’. Wells and drillholes completed in bedrock formations shall be completely filled and sealed from the bottom up with neat cement grout, concrete (sand-cement) grout, concrete or approved bentonite chips as provided in subd. 3. As an alternative for uncontaminated bedrock wells and

drillholes deeper than 250 feet, chlorinated, sand-free pea gravel may be used to fill the well or drillhole from the bottom up to 20 feet below the bottom of the casing pipe, or up to the 250-foot depth, whichever is deeper. This alternative may be used provided that for wells having drillholes extending through the Maquoketa Shale formation, a neat cement grout, concrete or bentonite chip plug at least 40 feet thick is placed and centered at the contact surface between the Maquoketa Shale and adjacent geologic formations, both above and below. Additionally, a neat cement grout, concrete or bentonite chip plug at least 40 feet thick shall be placed and centered at the top of the uppermost Cambrian Sandstone formation and at the top of the Eau Claire Formation of the Cambrian Sandstone whenever these layers are present in the open bedrock drillhole. When pea gravel is used for this alternative, it may be poured without the use of a conductor pipe provided the well is sounded at 50-foot intervals to ensure that bridging of the gravel in the well does not occur.

3. 'Use of bentonite chips to fill and seal wells and drillholes'. Approved bentonite chips may be used to fill and seal both unconsolidated formation and bedrock wells and drillholes with the following restrictions:
  - a. For wells and drillholes 4-inch diameter and larger the total depth may not be deeper than 500 feet and the number of feet of standing water in the well or drillhole may not be more than 350 feet. As an alternative for uncontaminated wells and drillholes deeper than 250 feet, chlorinated, sand-free pea gravel may be used to fill and seal the well or drillhole from the bottom up to 20 feet below the bottom of the casing pipe, or up to the 250-foot depth, whichever is deeper. This alternative may be used provided that for wells or drillholes extending through the Maquoketa Shale formation, a bentonite chip plug at least 40 feet thick is placed and centered at the contact surfaces between the adjacent geologic formations, both above and below. Additionally, a neat cement grout, concrete or bentonite chip plug at least 40 feet thick shall be placed and centered at the top of the uppermost Cambrian Sandstone formation and at the top of the Eau Claire Formation of the Cambrian Sandstone whenever these layers are present in the open bedrock drillhole. When pea gravel is used for this alternative, it may be poured without the use of a conductor pipe provided the well is sounded at 50-foot intervals to ensure that bridging of the gravel in the well does not occur.
  - b. Not allowed for wells and drillholes less than 4-inch diameter, and
  - c. Not allowed for any well or drillhole filled with drilling mud or bentonite slurry.
  - d. Fine particles and dust, typically present in the bags of chips, shall be prevented from entering the well by pouring the chips across a coarse-mesh screen such that they tumble under their own weight across the screen before falling into the well.
  - e. The chips shall be poured at a rate such that a 50-pound bag is emptied in a time period not less than 3 minutes. Once the chips rise above the water table, the rate of pour may be increased.
  - f. The depth of chips shall be monitored during the filling process, at a minimum of once every calculated 10 bags, to ensure the chips are not bridging in the well or drillhole. Any bridge of the chips shall be removed.
  - g. Water from a clean, bacteriologically safe and uncontaminated source shall be poured into the well in order to hydrate the chips. Water shall be introduced until the water level rises to the top of the well casing and the well will not accept any additional water at the time the individual who performs the filling and sealing operation leaves the site.

Materials for Filling and Sealing

Section NR 812.26(7)(b), Wis. Adm. Code, describes the allowed materials that can be used for filling and sealing:

(b) *Materials.*

1. Neat cement grout or concrete (sand-cement) grout as described in s. NR 812.20 (1), or approved bentonite chips shall be used to fill and seal wells and drillholes where the use of such materials are required in this section. The grout mixture shall be measured with a mud balance and shall have a slurry weight of at least 15.2 pounds per gallon unless powdered bentonite is added. Approved powdered bentonite may be added to the neat cement grout mixture, using a ratio of up to 5 pounds of bentonite per 94-pound bag of cement. When added, the resulting mixture shall meet the specifications of Table VI. Bentonite used for this purpose shall be 90-barrel per ton yield meeting the specifications of API 13A, Sec. 9. High yield drilling mud bentonite, also known as beneficiated bentonite, may not be used for this purpose. Any other ingredients or additives, to increase fluidity, control shrinkage or time of set may only be used with approval.
2. Concrete shall consist of a mixture of cement, water, sand, and gravel in the proportion of one bag Portland cement (94 pounds) (ASTM C 150, Type I or API-10A, Class A), an equal measure of sand and an equal measure of gravel, by weight or by volume, and not more than 6 gallons of water. As an alternative, a commercially prepared mix may be used providing the mix has at least 6 bags of cement per cubic yard. The gravel size may not exceed 1/3 of the inside diameter of the conductor (tremie) pipe used for filling and sealing the well or drillhole.

Reporting

Section NR 812.26(8), Wis. Adm. Code requires a well and drillhole filling and sealing to be reported no later than 30 days after the well or drillhole is filled and sealed. The filling and sealing must be reported by the person performing the work on department form 3300-005. The report must be a complete, true and accurate detailed description of the location of the drillhole(s) that was filled and sealed, materials and method of filling and sealing, and construction and geologic features.

Complete a copy of report [Form 3300-005](#) for each drillhole. Submit reports to DNR Bureau of Drinking Water and Groundwater, P.O. Box 7921, Madison, WI 53707-7921.

For more information

See DNR's web page on [Well Filling and Sealing](#).