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KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

PROCEDURE FOR GEOTHERMAL CLOSED LOOP HEAT PUMP SYSTEMS USING VERTICAL BOREHOLES

Procedure #: WWP-8
(7/17/2009)

Narrative:

Geothermal closed loop heat pump systems using vertical boreholes are recognized as an efficient and environmentally friendly heating and cooling technology if installed and operated properly. Geothermal systems use the relatively constant temperature of the ground below the earth's surface as a source of heating and cooling. Closed loop systems use a heat transfer solution circulated in a ground loop of pipe to transfer heat from or to the ground. The vertical borehole shall be installed by a KDHE licensed water well contractor.

Procedure:

Borehole:

Borehole alignment is important. The borehole should be properly aligned to allow for proper installation of the closed loop piping to the entire borehole depth, the borehole does not intersect another nearby borehole and so the borehole can be properly grouted.

The borehole size must be sufficient to allow for placement of a grout tremie pipe and grouting of the borehole from bottom to the ground surface.

Grouting:

Grouting is very important to ensure proper operation of the system, for protection of the soil and groundwater and prevention of wasting of groundwater resources. Grouting should take place as soon as possible to prevent cave-in potential or other deterioration of the borehole conditions that would adversely impact proper grouting.

As required by KDHE regulation K.A.R. 28-30-6 (d)(3), the entire borehole shall be filled with an approved grout material from bottom to surface using a grout tremie pipe or similar method approved by KDHE. The grouting should be done as a continuous operation.

The grout mixture used must meet the requirements of KDHE regulation K.A.R. 28-30-2 (k). Approved grout mixtures include:

- Bentonite
- Cement
- Neat Cement
- Bentonite Slurry with high sand content

Heat Transfer Fluid:

The fluid used should have a low toxicity and should not produce an unacceptable risk to the public health and safety and to the environment. Any water used in the heat transfer fluid mixture must be from a potable source. The fluid must be approved by KDHE. Acceptable heat transfer fluids include the following:

- Water
- Potassium acetate
- Dipotassium phosphate
- Sodium chloride water
- Calcium chloride water
- Ethanol and water
- Methanol and water
- Propylene glycol and water

Other fluids may be used if a written request and supportive information are provided to KDHE for review and consideration of approval prior to use.

Decommissioning:

The loop piping should be filled with grout and the heat transfer fluid removed and properly disposed.