

PREPARING A GROUNDWATER PROTECTION PLAN FOR INSTALLATION OF CLOSED LOOP GEOTHERMAL BOREHOLES

Kentucky Division of Water
Watershed Management Branch
Groundwater Protection Program
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(502) 564-3410

[Groundwater Protection Webpage](#)

The Groundwater Protection Plan Regulation, 401 KAR 5:037, requires anyone who conducts an activity having the potential to pollute groundwater to develop a Groundwater Protection Plan (GPP). A Groundwater Protection Plan identifies the activities being conducted at a site that have the potential to pollute groundwater and states the practices that will be used to prevent groundwater pollution. Section 2 of the regulation identifies the activities that require a GPP. Installation of closed loop geothermal systems is one of the activities identified under Section 2.

(1)(h) "Transmission in pipelines of raw materials, intermediate substances or products, finished products, or other pollutants;"

(1)(m) "Installation, construction, operation, or abandonment of wells, boreholes, or core holes;"

Your GPP must include all activities being conducted at your sites that are subject to 401 KAR 5:037. Read Section 2 carefully to determine if there are other regulated activities being conducted other than the ones listed above. If so, include them in the GPP. The regulation may be downloaded from the GPP Program Webpage link above.

A GPP is required for every job site prior to initiating the drilling of the boreholes and installation of the loops. However, developing a site-specific GPP for each job site may not be practical time-wise. Therefore, one GPP may be used for all job sites; only the Inspection Checklist will change. For additional explanation, see Section F, page 5.

USING THE GUIDANCE

Follow the Guidance Format

Follow the format provided in this guidance to develop your GPP. Using this format will assure that most, if not all, of the information necessary for an adequate review is included. It also organizes the information so that anyone from the general public can follow your plan without needing additional explanation.

Use all Headings and Subheadings as stated in the Guidance

Do not make up your own headings or subheadings. Use the headings and subheadings in the order provided in the guidance. Do not leave out headings.

Provide all Information requested in the Guidance, where applicable

Be sure that you have provided the information requested. The review process is delayed when necessary information has been left out.

Contact the GPP Program if you need assistance or have any questions

Call (502) 564-3410 and ask for the GPP Program Coordinator.

WHEN YOU HAVE COMPLETED THE GPP...

Review the GPP

Review the draft to be sure that the GPP addresses all the activities occurring at your sites that are covered by 401 KAR 5:037 and that you have provided all of the information, where applicable, for each section.

Implement the GPP

To be in compliance with 401 KAR 5:037, the GPP must be implemented immediately following development, even if it is in review by the Groundwater Section. If your GPP is in review, continue to implement the practices in the submitted GPP. If changes are required, then the new practices should be implemented.

Submit the GPP

At this time submittal of a GPP for installation of closed loop geothermal boreholes for review by the Groundwater Section is optional unless:

1. it is required as part of an Agreed Order;
2. it is stated by a DEP inspector as a requirement in a Notice of Violation;
3. it is requested by letter by the Groundwater Section.

To submit your GPP for review and approval, email the GPP Program Coordinator a copy or mail a hardcopy to the address below. Your initial GPP submittal and any further drafts will not be returned. Be sure to keep a copy of each draft so that required changes can be made. When your GPP meets regulatory requirements, you will receive a letter to that effect. It is not necessary to include a copy of 401 KAR 5:037 or this guidance document with the GPP when submitting it to the Groundwater Section for review.

Kentucky Division of Water
Watershed Management Branch
GPP Program Coordinator
300 Sower Blvd. 3rd FL
Frankfort, KY 40601

FORMAT FOR THE GPP

SECTION A. GENERAL INFORMATION

1. Name and Address of Company

--P.O. Box, if preferred for receipt of mail.

--Telephone Number

--County

2. Name of Driller

--Address if different from Company

--Telephone Number if different from Company

3. Person Developing GPP

--Name

--Address (business address, not home address unless business operates out of the home)

--Telephone Number (business phone, not home phone unless business operates out of the home)

--e-mail address (optional)

4. Person Responsible for Implementing GPP

--Name

--Address (business address, not home address unless business operates out of the home)

--Telephone Number (business phone, not home phone unless business operates out of the home)

5. Brief Description of Facility Operation

State that you drill and install closed loop geothermal boreholes.

SECTION B. ACTIVITIES THAT HAVE THE POTENTIAL TO POLLUTE GROUNDWATER

List all the activities that are conducted at each installation site that require a GPP. One (1) and two (2) below must be listed.

1. Drill boreholes and/or trenches of varying depths for the installation of geothermal vertical or horizontal loops.

2. Fill loops with water or antifreeze/refrigerant and install in boreholes and/or trenches.

3. List any additional regulated activities.

SECTION C. PRACTICES SELECTED TO PROTECT GROUNDWATER FROM POLLUTION

Kentucky Administrative Regulation 401 KAR 5:037 was promulgated in response to the requirement of KRS 224 that the cabinet adopt administrative regulations to protect and prevent pollution of the waters

of the Commonwealth. Failure to implement Best Management Practices to prevent pollution will not only violate 401 KAR 5:037, but also KRS 224.70-110 which states that "No person shall, directly or indirectly, throw, drain, run or otherwise discharge into any of the waters of the Commonwealth, or cause, permit or suffer to be thrown, drained, run or otherwise discharged into such waters any pollutant, or any substance that shall cause or contribute to the pollution of the waters of the Commonwealth....."

Statutory penalties for polluting the waters of the Commonwealth due to failure to develop and implement a GPP can be as high as \$25,000 per day for each day during which the violations continue (KRS 224.99-010(1)).

The following protective practices (BMPs) should be used, where applicable, in your GPP. The listing is not complete. So include any protective practices not listed below that you are currently using or will be using to protect groundwater.

Practices to Protect Groundwater from Pollution

1. Notify property owner that it is his/her responsibility to know the locations of all potential sources of pollution in the area where the boreholes will be drilled. This includes:

- location of all underground and aboveground utilities
- septic tank and lateral field
- sewer and water lines
- buried heating oil tank
- water wells and monitoring wells

2. Geology of the site will be evaluated to determine if there is a possibility that groundwater will be encountered in the drill holes, or if more than one hydraulically separated water-bearing zone (aquifer) will be encountered.

3. When using mud rotary drilling, the mud for drilling domestic water wells will be used. This mud does not contain additives that may pollute groundwater.

4. Any fuel spills, leaks, or drips will be cleaned up immediately and disposed of according to Kentucky state regulations.

5. Drilling fluids, cuttings and spoils will be disposed of according to Kentucky state regulations.

6. Loop and grout will be installed in each vertical borehole within 24 hours of drilling completion. If more than 24 hours will elapse before a borehole can be completed, the borehole will be equipped with a water-tight cap.

7. If groundwater is encountered, the following protective practices will be used:

- only environmentally safe greases and oils will be used for all borings.
- pads, bras, or plastic sheeting will be used under the drill rig.
- air compressors will use in-line filters to remove oils.

If one aquifer is encountered, each affected borehole will be pressure grouted from the bottom up with neat cement or high solids bentonite.

If more than one aquifer is encountered, temporary casing or pressure grouting and/or drill fluids will be used to temporarily isolate the aquifers during drilling. Each affected borehole will be pressure grouted from the bottom up with neat cement or high solids bentonite.

8. Boreholes that do not encounter groundwater will be grouted to within 3 feet of the ground surface with 17% to 20% solids bentonite, which will provide a tight seal, preventing surface water from entering the borehole.

9. After the loops are installed, all connections between boreholes will be checked and the system pressure tested to assure there will be no leakage of heat transfer fluid at onset of system operation.

10. Water used in the loops will be from a potable source, and antifreeze, if used, will pose no risk to groundwater should a leak develop in the system.

11. Any vertical loop piping that is to be permanently abandoned will be completely filled so that vertical movement of water within the loop piping is effectively and permanently prevented. Any unsealed portion of the borehole surrounding the vertical loop piping will be sealed so that groundwater is permanently confined to the specific zone in which it originally occurred.

SECTION D. IMPLEMENTATION SCHEDULE

- The GPP must be implemented immediately upon development.
- Having a GPP on file in an office somewhere does not keep you in compliance with 401 KAR 5:037. The Groundwater Section recommends that your GPP be retained in the drilling rig or company vehicle that will be present at the job site.

SECTION E. EMPLOYEE TRAINING

- Training must educate the employees about the importance of groundwater protection and include all aspects of the GPP.
- State the frequency of training sessions--initial and refresher. Be specific, such as initially on hire and annually. "When needed" or "frequently" are unacceptable.

SECTION F. INSPECTION SCHEDULE

Inspections are conducted to insure that the practices selected to prevent groundwater pollution are being used and are effective. Since developing a site-specific GPP for each job site may not be practical time-wise, it is permissible to develop one GPP that will apply to all your job sites. Sections A through H must be completed initially and retained as the GPP. Only the Inspection Checklist will change from job site to job site. The Inspection Checklist will provide required technical information and also document that you are implementing the GPP at each job site.

Please be aware that although Sections A through H in the GPP need not be written down each time, they must be considered in effect at every job site. The information recorded on the Inspection Checklist for each job site will reflect your compliance with 401 KAR 5:037.

Since the Inspection Checklists will serve as your records of compliance, the Inspection Checklist for each job site must be retained for six years (401 KAR 5:037 Section 4(1)(c)) following job completion.

SECTION G. CERTIFICATION STATEMENT

- The person who can make the managerial and/or financial decisions that are required to implement your plan should be the one signing the Certification Statement.
- Use the following Certification Statement verbatim.

I (typed name) certify that this Groundwater Protection Plan complies with the requirements of 401 KAR 5:037. I have read the terms of the plan and will implement its provisions.

Signature (hand signed) _____ Date _____

SECTION H. REVIEW LOCATION FOR GROUNDWATER PROTECTION PLAN

Section 4(7) of 401 KAR 5:037 provides for public inspection of GPPs. Should you choose to designate the Kentucky Division of Water, or any site other than your office for public review, a copy of the up-to-date GPP must be available. A recertified or revised copy of the GPP must be sent to the Groundwater Section, Watershed Management Branch, Kentucky Division of Water, 300 Sower Blvd., 3 FL, Frankfort, Kentucky 40601, or other site every three years, or whenever revision is required by a change in activities being conducted.

Note: A GPP can be recertified provided all protective practices remain effective and no changes have occurred in activities, practices, or responsible persons. Regardless of the site chosen for public review, you are requested to notify the Coordinator of the GPP Program that you have recertified your GPP. If any changes have occurred, the revised GPP, with signed updated Certification Statement to the Program Coordinator at the previously stated address.

INSPECTION CHECKLIST

This checklist must be retained in your records for six (6) years following completion of the installation.

A. Property Owner (if owned by a business or government agency, state name of entity).

Name _____

Address of Site _____

Latitude & Longitude of Site: _____ decimal degrees N latitude

_____ decimal degrees W longitude

B. Borehole Construction

Date Borehole Construction Initiated: _____ Date Completed: _____

Number of Borings: _____ Approximate Depth of each boring (feet): _____

Is the borehole cased? Yes No. If yes, provide casing information such as type, (steel, PVC, plastic, etc.), diameter, and depth.

Provide site map showing locations of all boreholes.

C. Type of Tubing Used in Closed Loop System

___copper, ___PVC, ___HD polyethylene Other_____

D. Type of Heat Transfer Fluid Used in Closed Loop System

___propylene glycol ___ethanol ___methanol ___potable water _____Other (Specify)

D. Grout

Type of Grout Used:

_____ Neat Cement _____ Bentonite _____ Other (Specify)

Method of Grout Installation: ___ Tremie ___ Positive Displacement ___ Gravity

Complete the following questions at completion of the installation and before leaving the job site.

- Were all boreholes grouted and tubing installed within 24 hours?

___Yes ___No

If no, was a water-tight cap installed over each borehole?

___Yes ___No

- Were all boreholes that encountered groundwater grouted from the bottom to the top?

___Yes ___No

If no, explain what was done:_____

- Were all boreholes that did not encounter groundwater grouted from the bottom to within three (3) feet of the ground surface?

___Yes ___No If no, explain what was done_____

- Were all piping and connections checked for tightness prior to pressure testing the system?

___Yes ___No

- If there were spills, leaks, or drips, were they cleaned up immediately and disposed of according to Kentucky state regulations?

___Yes ___No

- Were cuttings/spoils contained to prevent washing into nearby ditch/water body?

___Yes ___No If no, explain what was done_____

_____ (Date)
Signature of person in charge of drilling boreholes

_____ (Date)
Signature of person in charge of installing loops and heat transfer fluid at the job site