

# **A Regulatory Guide to Geothermal Direct Use Development**

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## **NORTH DAKOTA**

### **Introduction**

Geothermal resource temperatures range from low temperatures of 50 to 80 degrees F (10 to 27 °C), to temperatures exceeding 650 degrees F (343°C). Although power can be generated economically from resources as low as 218 degrees F (103° C), power generation projects typically favor resource temperatures above 300 degrees F (149° C). High temperature resources (>300 degrees F, 149°C) can also be used for direct-use applications. However, lower temperature resources (< 212° F, 100° C) are often better suited for these projects.

Low temperature, direct-use projects cover a variety of applications. Projects may include traditional space heating applications, as well as greenhouse heating, spas and swimming pools, aquaculture, crop drying, industrial processing and other activities requiring lower temperatures. Because these projects are primarily water use applications, they often fall under a different regulatory process than high temperature, power generation projects. Typically this process is shaped by water and wastewater laws and regulations, and administered by their respective state, and in some cases, federal water and wastewater resource agencies.

The intent of this document is to help guide developers of direct use geothermal projects through the regulatory process of drilling, using and disposing of low temperature geothermal fluids in North Dakota. This guide will provide background on the state regulatory process and identify contact information necessary for completing the various applications and permits. This guide; however, cannot substitute for direct communication with the regulatory agencies. These agencies need to be contacted early in the process so that any regulatory hurdles are identified upfront and in time. Projects that are located on federal lands are regulated according to the national Geothermal Steam Act and related federal regulations.

### **Regulatory Process for Direct Use Applications**

In North Dakota, geothermal (ground source) heating and cooling systems require a permit and are regulated under Chapters 38-19 and 43-02-07 of the North Dakota Century and Administrative Codes, respectively. Under Chapter 38-19 of the North Dakota Century Code, the State declares that it is in the “...*public interest to encourage, and promote the proper use of geothermal resources in a manner which will prevent waste and provide for the operation of geothermal resource extraction facilities in such a manner as will achieve the optimum utilization of the geothermal resource and protect the rights of all owners*”. Under this same chapter, “*geothermal energy*” is defined as

“...the internal energy of the earth, available to man as heat from rocks or liquids”. In addition, a “geothermal energy extraction facility” is defined as “...any drilled, bored, or excavated device or installation to provide for the extraction of geothermal energy”.

The North Dakota Industrial Commission acting through the office of the North Dakota Geological Survey (state geologist) has administrative authority over all geothermal resources in North Dakota, including low temperature, direct use applications. The rules and regulations governing the siting, permitting and development of a geothermal project are presented in *North Dakota Century Code Chapter 38-19-Geothermal Resource Development Regulations* and *Chapter 43-02-07- Geothermal Energy Production*. These rules can be viewed at <http://www.state.nd.us/ndgs/geothermal/geothermalh.htm>.

The authority of the state geologist in permitting geothermal projects extends to both open and closed loop systems regardless of resource temperature. While closed loop systems are handled exclusively by the state geologist, other state authorities may become involved if the project is of an open loop design. For open loop projects, a developer will need to obtain a water appropriation right and the appropriate discharge permit before the state geologist will issue a geothermal permit. The State Water Commission is in charge of water appropriations and well construction requirements. Fluid disposal and discharge permits come under the authority of the Department of Health.

In general, the State of North Dakota discourages open loop systems, since they present a greater potential for environmental problems. As a result, the permitting requirements become much more stringent. The Geological Survey has not issued a permit for an open loop system since 1996. Apart from state regulations, developers must also secure ownership or lease rights to a proposed geothermal development site. In addition, developers need to contact local and county agencies to ensure compliance with local land use laws including building permits and zoning restrictions.

In summary, the regulatory process for developing a low temperature, direct use geothermal project consists of the following steps:

- Gain access to lands either through lease or direct ownership.
- Contact local and/or county agencies to ensure compliance with local land use laws including building permits and zoning restrictions.
- For open loop systems-obtain water right. (*State Water Commission*)
- For open and closed loop systems- permit/construct production well. (*Geological Survey/State Water Commission*)
- For open loop system- determine fluid disposal option and obtain permits for either injection or surface disposal. (*Department of Health, Geological Survey*)
- For open and closed loop systems-obtain geothermal permit. (*Geological Survey*)

### **Geothermal Permit**

All geothermal projects must obtain a permit from the North Dakota Geological Survey and are regulated under Chapters 38-19 and 43-02-07, of the North Dakota Century and

Administrative Codes, respectively. A permit is not required for a private residential system. The permit review system helps to ensure that geothermal systems are properly designed and constructed, and minimizes the risk of groundwater contamination or other environmental problems. The General Rules and Regulations for Geothermal Energy Production can be viewed at <http://www.state.nd.us/ndgs/geothermal/geothermalh.htm>.

The state geologist may grant a *Geothermal Energy Extraction* permit for up to 10 years once the application is approved and project bonding is completed (if required). The state geologist may deny an application for a permit if it is found that the project would violate correlative rights or would cause damage to the environment or contaminate underground sources of drinking water.

The *Geothermal Energy Extraction Permit* application form can be downloaded at <http://www.state.nd.us/ndgs/geothermal/geothermalh.htm>. Other necessary forms including the *Geothermal Energy Extraction Bond*, the *Geothermal Energy Sundry Notices and Reports*, the *Geothermal Energy Report of Production*, and the *Geothermal Extraction Completion Report* can also be downloaded at the same website. The application permit is a single page form requiring a description of the facility and ownership information. A permit fee of one hundred dollars must be included with the application, along with a map of the site. An applicant will also need to submit and receive bonding approval prior to receiving a geothermal permit. The amount and type of bond will depend on the project, as described under *43-02-07-08 of the North Dakota Century Code*.

Once the permit is issued and work begins, the project developer must ensure that all wells are made by a certified water or well contractor. Well drillers and pump installers are certified through the Board of Water Well Contractors of the State Water Commission. All open-loop geothermal energy wells must also be in compliance with *Article 33-18-01, Water Well Construction and Water Well Pump Installation, of the North Dakota Administrative Code*. The water well code provides details and specifications with respect to well locations, grouting requirements, and related construction activities. The water well code can be downloaded at <http://www.state.nd.us/ndgs/geothermal/PDF/adntl.pdf>.

Within thirty days after completion of the geothermal facility, a *Geothermal Extraction Completion Report* must be filed with the state geologist. The form can be downloaded from the aforementioned website. Within 6 months of the filing of the completion report, a developer may be required to submit additional well data including sample cuts and core chips, sample logs, radioactivity logs and resistivity logs, elevation and location information and other pertinent data as requested by the state geologist. Additionally, a developer must submit an annual report showing temperatures, quantities, and the nature of products extracted from the facility.

Projects involving open loop systems will also need to obtain a water appropriation permit and a fluid discharge permit. The process for obtaining these permits is discussed in the following sections.

## **Water Rights**

### Background:

Laws relating to water resources can be found in *Title 61 – Waters*, of the *North Dakota Century Code*. The Water Code establishes that surface and ground water sources belong to the public and that appropriation of these waters follows the doctrines of “prior appropriation” (first in time, first in right) and “beneficial use”. Chapter 61-04 defines beneficial use and establishes the legal process for water appropriation in the state. The Water Code can be viewed at <http://www.state.nd.us/lr/cencode/t61.html>.

The North Dakota State Water Commission, through the office of the State Engineer, administers the rules and regulations governing water appropriations and use. These rules are codified under the North Dakota Administrative Code, Title 89-Water Commission. The specific regulations governing water appropriations under Section 89-03. These regulations can be viewed at <http://www.swc.state.nd.us/waterlaws.html>. Water Commission contacts can be found in Appendix A.

### Water Right Permit Process

The State Engineer administers the procedure for obtaining a conditional water permit. A conditional water permit reserves a specified volume of water for a specified use, subject to conditions that are part of the permit. The conditions protect prior appropriations and public interest.

A direct use geothermal project will need to acquire a water right permit if it is an open loop design. A water right permit is not needed if the project is for domestic or livestock purposes, or for fish, wildlife or recreational uses, provided that the amount of water appropriated from a well does not exceed twelve and one-half acre-feet (15418.52 cubic meters or 7.75 gallons/minute) per year.

Water right permits are issued by the State Engineer if the proposed use meets the following requirements:

- rights of a prior appropriator will not be unduly affected;
- the proposed means of diversion or construction are adequate;
- the proposed use of water is beneficial; and
- the proposed appropriation is in the public interest.

In determining the public interest, the State Engineer considers the following: 1) the benefit to the applicant, 2) the effect on economic activity, 3) the effect on fish, wildlife and recreation, 4) lost opportunity water costs, 5) harm to other persons resulting from the appropriation, and 6) the applicant’s ability to complete the project.

The process for obtaining a water right permit involves a series of steps. The first step is to obtain and complete the application form. The form is then submitted to the State

Engineer with the required map and application fee. Once granted, the applicant is issued a permit to appropriate water for a period of from one to three years. This permit allows the applicant to drill a well(s) and develop the full use of the water. Provided that all permit conditions are met and the water is put to full use, a perfected water permit is issued. This is the legal document that establishes a water right and should be recorded with the county register of deeds. Early consultation with the State Engineer should provide the applicant with an understanding of the time required and any outstanding issues that may complicate the process. The following steps outline the permit process:

1. Prepare and submit an application and a filing fee to the State Engineer. The filing fee ranges from \$100 to \$750 depending on the amount of water withdrawn and the type of use. Application fees are listed in *North Dakota Century Code 61-04-04.1*, which can be viewed at <http://www.swc.state.nd.us/waterlaws/rules/8903WatApp.pdf>. The application form cannot be downloaded but copies are available by contacting the State Engineer either by mail or through e-mail. Contact information is included in Appendix A, or can be viewed at the State Water Commission website located at <http://www.swc.state.nd.us/Permits/waterpermits.html>. The application form requires the applicant to provide information on the proposed use, amount, location, ownership and any other relevant information required by the State Engineer. A map of the site is also required. The priority date is established when the application is received by the State Engineer.
2. When the State Engineer receives a completed application, the applicant is instructed to send a “Notice of Application” by certified mail to all recorded title owners of real property and water permit holders within a 1-mile radius of the project site. A list of interested parties is provided by the State Engineer. The notice states that an application for water permit has been made and provides details concerning the application.
3. After notice has been provided to all interested parties, the applicant informs the State Engineer by submitting an “Affidavit of Notice”. The State Engineer then publishes a hearing notice once a week for two consecutive weeks in the official county newspaper. The notice is published at the applicant’s expense.
4. Comments on the proposed appropriations are accepted and reviewed by the State Engineer. If warranted, the State Engineer will hold a public hearing on the appropriation and will notify all interested parties at least 20 days prior to the meeting date.
5. Once all of the public testimony has been reviewed and evaluated, the State Engineer will issue a conditional permit to appropriate water if the appropriation meets the permit criteria as described under *61-04-06* of the *North Dakota Century Code*. The permit will be issued for a period of time consistent with the public interest and adequate to finish construction and establish the full use of water. The permit period varies from one to three years depending on the type of project and the amount of water.  
A water right is acquired when beneficial use of water is made in accordance with the conditions of the permit. After the water is put to beneficial use and the

facilities are determined to be compliant, a perfected water right is issued by the State Engineer.

### Well Construction

Once the permit is issued and work begins, the project developer must ensure that all wells are made by a certified water or well contractor. Well drillers and pump installers are certified through the Board of Water Well Contractors of the State Water Commission. All open-loop geothermal energy wells must also be in compliance with *Article 33-18-01, Water Well Construction and Water Well Pump Installation, of the North Dakota Administrative Code*. The water well code provides details and specifications with respect to well locations, grouting requirements, and related construction activities. The water well code can be downloaded at <http://www.state.nd.us/ndgs/geothermal/PDF/adntl.pdf>.

Before starting well construction, the developer of a geothermal project may want to review data from other wells in the area. The State Water Commission maintains a database which tracks specific information pertaining to the construction and installation of production wells in North Dakota. This information can be accessed at <http://www.swc.state.nd.us/dataresources.html>. The Geo-Heat Center, located in Klamath Falls, Oregon also maintains an extensive database covering wells and springs greater than 50 °C (122 °F) for 16 western states, including North Dakota. This database can be found at <http://geoheat.oit.edu/database.htm>.

### **Disposal of Geothermal Fluids**

The regulations governing the disposal of low temperature geothermal fluids will depend on the type of application. Non contact (closed) geothermal projects, where the geothermal fluids are kept in a closed system and do not come in contact with outside contaminants, will work through the Office of the State Geologist's geothermal permit process. Open loop projects that will reinject fluid to the ground or dispose of fluids to the surface will need additional disposal permits. In general, the state of North Dakota discourages open loop systems since they have a much greater potential to degrade the environment.

There are a couple of disposal options available to a developer of a direct use geothermal project: underground injection; or disposal to surface waters or to the ground. In some cases, the regulatory agency(s) will specify the preferred disposal method. In North Dakota, the preferred approach is to keep the geothermal system a closed loop and not have any fluid disposal. However, this may not be an option with some projects, so it will be up to the project developer to determine the best disposal method based on regulatory requirements and the cost of compliance. For most cases, reinjection will be the preferred method of disposal.

The North Dakota Department of Health's Division of Water Quality administers water quality rules and regulations for the state. Administrative rules (*NDAC 33-16 and NDAC 61-28*) covering both surface and groundwater quality and pollution control for the state can be found at <http://www.health.state.nd.us/wq/rules.htm>. Project developers should contact the Division of Water Quality as the first step in completing a wastewater discharge plan. Contact information is included in Appendix A.

### Underground Injection Control

From a resource perspective, the preferred method of disposing of geothermal fluids is to return them to the ground by way of injection wells. Injection wells are wells that are used as an entry point for fluids, including geothermal fluid, which is put underground for temporary or permanent disposal or storage.

The federal Underground Injection Control (UIC) Program was established in 1982 when the U.S. Congress passed the Safe Drinking Water Act. This program regulates, to one degree or the other, every "injection" of "fluid" into the subsurface. An "injection" is the emplacement of "fluids" regardless of whether the injection requires the application of pressure or not, and a fluid is defined as any liquid, gas or semisolid which can be made to flow. The intent of the program is to preserve and protect underground water from becoming polluted.

The UIC program is authorized by the Part C of the Safe Drinking Water Act (SDWA), PL 93-523 and Amendments. The UIC program also implements portions of the Resource Conservation and Recovery Act (RCRA), PL 94-580 and Amendments, with respect to the underground disposal of hazardous wastes. Regulations are published in Title 40 of the Code of Federal Regulations, primarily in Parts 144-146.

Injection wells for direct use geothermal applications are classified under the UIC program as Class V wells. The specific EPA well codes are:

- 5A6 wells are direct heat reinjection wells that reinject geothermal fluids used to provide heat for large buildings or developments - deep wells;
- 5A7 wells are heat pump/air conditioning return flow wells that reinject groundwater used to heat or cool a building in a heat pump system - shallow wells; and,
- 5A8 wells are groundwater aquaculture return flow wells that reinject groundwater or geothermal fluids used to support aquaculture.

The Department of Health's Division of Water Quality administers the Underground Injection Control Program for North Dakota. An overview of the program can be found at <http://www.health.state.nd.us/wq/gw/uic.htm>. The administrative rules (*NDAC 33-25-01*) covering the UIC program can be viewed at <http://www.state.nd.us/lr/information/acdata/pdf/33-25-01.pdf>.

In general, Class 5 injection wells, including open loop geothermal wells are “rule authorized” which basically means that an injection well may be operated without a permit as long as two primary conditions are met. First, the injection well must be inventoried, i.e., a form must be submitted to the UIC program. This form provides the UIC program with information about the injection well, including the address of the owner/operator, physical location of the injection well, type of fluid disposed, and number of injection wells used. Second, the injection well must be constructed, installed, operated, maintained, and/or closed in a manner that protects ground water quality. If these two primary criteria can be met by the owner/operator of an injection well, a UIC permit will probably not be required for that injection activity.

In some cases, obtaining regulatory approval for a UIC well may not be as simple as completing an inventory form. If the project is complex and there is concern over the injectate, the Division of Water Quality may require a UIC permit. Either way, the first step to obtaining UIC approval is to complete the Class V inventory form. UIC inventory forms are not currently posted on the Division of Water Quality’s website and will need to be obtained by contacting the department directly. Contact information is included in Appendix A.

To assist the department in determining whether a project can be rule authorized, or needs to obtain an individual permit, a developer should consider including some additional project descriptions. This information could include:

- Description and operation of the injection well, including depth, construction information, injection rate and pressure.
- Description of well construction features ensuring that overlying aquifers will be isolated from injected and extracted geothermal brine.
- Analysis or description of the geothermal fluids being extracted/injected.
- Describe any impact to extracted water before re-injection.
- Review of current users of geothermal source and potential impacts on other vested water rights.

Based on the inventory information and any additional information, a determination is made on UIC approval. If the department decides that an individual permit is needed, the developer will be required to apply for a permit. A UIC permit application requires substantially more information on project characteristics and hydrogeology than the inventory form. Typically, the UIC inventory is accepted within 30 days. UIC permitting will take a longer period of time depending on informational needs. Permit application forms will need to be obtained from the Division of Water Quality. Contact information is provided in Appendix A.

#### National Pollution Discharge Elimination System (NPDES)

Discharge of low temperature fluids to surface waters would require a National Pollution Discharge Elimination System (NPDES) permit. The NPDES wastewater discharge permit program is established under Section 402 of the Clean Water Act (CWA). The

NPDES permit process regulates discharges of pollutants to surface waters. The purpose of NPDES permitting is to ensure that surface waters remain clean and healthy..

NPDES permitting is administered by the North Dakota Department of Health, Division of Water Quality under *NDAC 33-16-01*. These rules follow the provisions of *402b of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq)* and can be viewed at <http://www.state.nd.us/lr/information/acdata/pdf/33-16-01.pdf>. NPDES permits are issued under either a general permit, which includes a large group of similar operators, or for individual projects, which address large or unique discharges by a single operator. The potential to be included under a general permit is typically advantageous, since both the level of paperwork and the fees are much less burdensome than for an individual permit. A general permit covers a set of like facilities, such as a coal facility or a fish farm. Here, a set of conditions are already developed which meet the general operating conditions of these similar facilities. If eligible, the developer would need to submit a Notice of Intent form or equivalent, which provides additional information needed by the resources agency administering the NPDES program. The advantage of the general form is that the resource agency can issue the permit as soon as all information needs are satisfied. For individual permits, there is an additional 30 day public notice process, as well as the potential for intervention on the terms and conditions of the permit.

The Division of Water Quality has not issued an NPDES permit for an open loop system in over 10 years. The Division does not have a general permit for these type of applications, although if a substantial need arises, they are open to developing a general permit. Until then, a developer will need to apply for an individual permit. The most likely permit forms covering a direct use application are EPA NPDES forms 1 and 2D or 2E. Form 1 collects general information from the applicant and must be filled out in addition to a supplemental form. Form 2D covers process wastewater discharge. Because many direct use geothermal applications involve non-contact heat exchange, a developer may consider using Form 2E. This form was designed by the US Environmental Protection Agency to cover projects which do not discharge process wastewater. The state also has a state permit application, or short form, that they can issue, depending on the project type.

Early contact with the Division is necessary to determine how to proceed with an individual project and to determine the length of time necessary to complete the process, which can extend over a period of months. Currently, the Division does not post NPDES forms on their website. Instead, applicants will need to contact the Division directly to obtain these forms and instructions on how to proceed. Contact information is provided in Appendix A. The Division does provide a link to the U.S. EPA website at <http://www.health.state.nd.us/wq/WasteWater/WasteWaterProgram.htm>. The EPA website is an excellent source of information on the NPDES program. EPA has also developed a software program which uses an interview based process to guide the applicant through the permit process. The program can be downloaded through their website.

In general, an NPDES applicant will need to provide mapping information, flow data, an estimate of the type and quantities of pollutants discharged and a brief description of any planned treatment. This information will be used to determine the conditions of the permit including appropriate control or treatment strategies, monitoring and reporting requirements. Since most direct use applications involve non-contact geothermal heat exchange, the water quality of the source water should be unaffected. For these type of projects, permit conditions should be relatively strait-forward. Even so, a developer may still be required to cool the geothermal water, or provide other pre-treatment, before discharging into a surface water source.

### **Aquaculture**

Any individual raising fish or other aquatic species in North Dakota is no longer required to have a private fish hatchery permit. The statutory reference is contained in NDCC 20.1-06-12, the regulatory reference is contained in Administrative Code 30-03-02. The North Dakota Game and Fish Department oversees fishery activities in the state and should be contacted for additional information. Contact information is presented in Appendix A.

## **Appendix A**

### **North Dakota Contacts**

#### **Geothermal**

North Dakota Geological Survey  
600 East Boulevard Avenue  
Bismarck, ND 58505-0840  
Lorraine Manz  
Phone: (701)328-8000  
e-mail: [lmanz@state.nd.us](mailto:lmanz@state.nd.us)  
website: <http://www.state.nd.us/ndgs/>

#### **Water Resources Program Contacts**

North Dakota State Water Commission  
State Engineer  
900 East Boulevard  
Bismarck, North Dakota 58505  
Phone: (701) 328-2754  
Website: <http://www.swc.state.nd.us/Permits/waterpermits.html>

#### **Water Quality Program Contacts**

##### Underground Injection Control Program

Scott Radig  
Environmental Engineer  
Manager, Ground Water Protection Programs  
ND Dept. of Health, Division of Water Quality  
Phone: (701) 328-5233  
E-mail: [sradig@state.nd.us](mailto:sradig@state.nd.us)  
Website: <http://www.health.state.nd.us/wq/>

National Pollution Discharge Elimination System (NPDES)

Gary Bracht  
NDPDES Program  
Division of Water Quality  
1200 Missouri Ave.  
Bismarck ND 58506-5520  
Phone: 701.328.5227  
E-mail: [gbracht@state.nd.us](mailto:gbracht@state.nd.us)  
Website: <http://www.health.state.nd.us/wq/>

**Aquaculture**

North Dakota Game and Fish Department  
Fisheries Division  
100 North Bismark Expressway  
Bismark, ND 58501-5095  
Phone: 701/328-6300  
Website: <http://www.state.nd.us/gnf/>.

## **Appendix B**

### **Geothermal References and Contacts**

#### **References**

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Rafferty, Kevin, 2001, An Information Survival Kit for the Prospective Geothermal Heat Pump Owner: Geo-Heat Center, Oregon Institute of Technology, Grant No. DE-FG07-90ID 13040, pp. 1-23.

Rafferty, Kevin, 2001, Small Geothermal Systems: A Guide For The Do-It Yourselfer: Geo-Heat Center, Oregon Institute of Technology, Contract No. FG01-99-EE35098, pp. 1-30.

Lund, John W., **date**, Balneological Use of Thermal Waters: Geo-Heat Center, Oregon Institute of Technology, pp. 1-10.

Boyd, Tanya, Rafferty, Kevin, **date**, Aquaculture Information Package: Geo-Heat Center, Oregon Institute of Technology, Contract No. DE-FG07-90ID 13040, pp. 1-60.

Rafferty, Kevin, Boyd, Tonya, **date**, Geothermal Greenhouse Information Package: Geo-Heat Center, Oregon Institute of Technology, Contract No. DE-FG07-90ID 13040, pp.1-80.

## **Contacts**

Geothermal Resources in Hawaii

Website: [http://www.hawaii.gov/dbedt/ert/geo\\_hi.html#anchor367806](http://www.hawaii.gov/dbedt/ert/geo_hi.html#anchor367806).

Geo-Heat Center

Website: [www.oit.edu/-geoheat](http://www.oit.edu/-geoheat)

Geothermal Education Office

Website: [www.geothermal.marin.org](http://www.geothermal.marin.org)

Geothermal Resources Council

Website: [www.geothermal.org](http://www.geothermal.org)

Geothermal Heat Pump Consortium

Website: [www.geoexchange.org](http://www.geoexchange.org)

International Ground-Source Heat Pump Association

Website: [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu)

U.S. Department of Energy

Website: [www.eren.doe.gov/geothermal](http://www.eren.doe.gov/geothermal)

Washington State University Energy Program

Website: <http://www.energy.wsu.edu/projects/renewables/geothermal.cfm>