

# Virginia Administrative Code

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# Virginia Administrative Code

Title 4. Conservation and Natural Resources

Agency 25. Department of Mines, Minerals and Energy

Chapter 170. Geothermal Energy Regulations

## 4VAC25-170-10. Definitions.

The following words and terms when used in this chapter shall have the following meanings unless the context clearly indicates otherwise:

"Bottom hole temperature" means the highest temperature measured in the well or bore hole. It is normally attained directly adjacent to the producing zone, and commonly at or near the bottom of the borehole.

"Casing" means all pipe set in wells.

"Conservation" means the preservation of geothermal resources from loss, waste, or harm.

"Correlative rights" means the mutual right of each overlying owner in a geothermal area to produce without waste a just and equitable share of the geothermal resources. Just and equitable shares shall be apportioned according to a ratio of the overlying acreage in a tract to the total acreage included in the geothermal area.

"Department" means the Virginia Department of Mines, Minerals and Energy.

"Designated agent" means that person appointed by the owner or operator of any geothermal resource well to represent him.

"Director" means the Director of the Department of Mines, Minerals and Energy or his authorized agent.

"Division director" means the Director of the Division of Gas and Oil, also known as the Gas and Oil Inspector as defined in the Virginia Gas and Oil Act of 1990, Chapter 22.1 (§ [45.1-361.1](#) et seq.) of Title 45.1 of the Code of Virginia or his authorized agent.

"Drilling log" means the written record progressively describing all strata, water, minerals, geothermal resources, pressures, rate of fill-up, fresh and salt water-bearing horizons and depths, caving strata, casing records and such other information as is usually recorded in the normal procedure of drilling. The term shall also include the downhole geophysical survey records or logs if any are made.

"Exploratory well" means an existing well or a well drilled solely for temperature observation purposes preliminary to filing an application for a production or injection well permit.

"Geothermal area" means the general land area that is underlaid or reasonably appears to be underlaid by geothermal resources in a single reservoir, pool, or other source or interrelated sources, as such area or areas may be from time to time designated by the department.

"Geothermal energy" means the usable energy produced or that can be produced from geothermal resources.

"Geothermal reservoir" means the rock, strata, or fractures within the earth from which natural or injected geothermal fluids are obtained.

"Geothermal resource" means the natural heat of the earth at temperatures 70°F or above with volumetric rates of 100 gallons per minute or greater and the energy, in whatever form, present in, associated with, or created by, or that may be extracted from, that natural heat. This definition does not include ground heat or groundwater resources at lower temperatures and rates that may be used in association with heat pump installations.

"Geothermal waste" means any loss or escape of geothermal energy, including, but not limited to:

1. Underground loss resulting from the inefficient, excessive, or improper use or dissipation of geothermal energy; or the locating, spacing, construction, equipping, operating, or producing of any well in a manner that results, or tends to result, in reducing the quantity of geothermal energy to be recovered from any geothermal area in Virginia; provided, however, that unavoidable dissipation of geothermal energy resulting from oil and gas exploration and production shall not be construed to be geothermal waste.
2. The inefficient above-ground transportation and storage of geothermal energy; and the locating, spacing, equipping, operating, or producing of any well or injection well in a manner causing or tending to cause, unnecessary or excessive surface loss or destruction of geothermal energy.
3. The escape into the open air of steam or hot water in excess of what is reasonably necessary in the efficient development or production of a well.

"Geothermal well" means any well drilled for the discovery or production of geothermal resources, any well reasonably presumed to contain geothermal resources, or any special well, converted producing well, or reactivated or converted abandoned well employed for reinjecting geothermal resources.

"Injection well" means a well drilled or converted for the specific use of injecting waste geothermal fluids back into a geothermal production zone for disposal, reservoir pressure maintenance, or augmentation of reservoir fluids.

"Monitoring well" means a well used to measure the effects of geothermal production on the quantity and quality of a potable groundwater aquifer.

"Operator" means any person drilling, maintaining, operating, producing, or in control of any well, and shall include the owner when any well is operated or has been operated or is about to be operated by or under the direction of the owner.

"Owner" means the overlying property owner or lessee who has the right to drill into, produce, and appropriate from any geothermal area.

"Permit" means a document issued by the department pursuant to this chapter for the construction and operation of any geothermal exploration, production, or injection well.

"Person" means any individual natural person, general or limited partnership, joint venture,

association, cooperative organization, corporation whether domestic or foreign, agency or subdivision of this or any other state or the federal government, any municipal or quasi-municipal entity whether or not it is incorporated, receiver, trustee, guardian, executor, administrator, fiduciary, or representative of any kind.

"Production casing" means the main casing string which protects the sidewalls of the well against collapse and conducts geothermal fluid to the surface.

"Production record" means written accounts of a geothermal well's volumetric rate, pressure and temperature, and geothermal fluid quality.

"Sequential utilization" means application of the geothermal resource to a use with the highest heat need and the subsequent channeling of the resource to other uses with lower temperature requirements before injection or disposal of the geothermal fluid.

"Unitized drilling operation" means the management of separately owned tracts overlying a geothermal area as a single drilling unit.

"Water protection string" means a string of casing designed to protect groundwater-bearing strata.

#### **Statutory Authority**

§ [45.1-179.7](#) of the Code of Virginia.

#### **Historical Notes**

Derived from VR480-04-13 § 1, eff. May 1, 1984; amended, [Volume 29, Issue 02](#) , eff. October 24, 2012; [Volume 33, Issue 21](#) , eff. July 27, 2017.

### **4VAC25-170-20. Resource Conservation.**

A. In order to foster geothermal utilization, prevent waste, protect correlative rights, safeguard the natural environment, and promote geothermal resource conservation and management, the department may designate geothermal areas, require well spacing and unitization, and allow sequential utilization on a case-by-case basis.

B. Wells shall be classified as to the geothermal area from which they produce, and geothermal areas shall be determined, designated, and named by the department in accordance with the definition provided in [4VAC25-170-10](#) . In designating geothermal areas, factors to be considered shall include but not be limited to common usage and geographic names; the surface topography and property lines of the land underlain by geothermal energy; the plan of well spacing being employed or proposed for the area; the depth at which resources have been found; and the nature and character of the producing formation or formations. In the event any person is dissatisfied with any such classification or determination, an application may be made to the department for reclassification or redetermination.

C. Information provided the division director in the notice of intent to proceed shall be used by the department to determine spacing between production wells and between production and injection wells. The department may also conduct independent investigations as deemed necessary to determine appropriate well spacing and utilization.

When two or more separately owned tracts of land lie within a geothermal area, the department may require unitized operations under supervision of the division director. Unitized drilling operations shall be operated according to the principle of correlative rights.

D. Persons desirous of engaging in sequential utilization shall file a formal request with the department that shall contain the following items:

1. A statement of the uses to be made of the geothermal resource.
2. Evidence that sequential utilization will not cause heat drawdown in the geothermal aquifer, cause land subsidence, hinder observation of the geothermal resource, or contaminate potable water supplies.
3. Requests for sequential utilization shall be reviewed and acted upon by the department within 45 days of receipt.

Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-13 § 2, eff. May 1, 1984; amended, [Volume 29, Issue 02](#) , eff. October 24, 2012.

#### 4VAC25-170-30. Bonds, Permits and Fees.

A. 1. Before any person shall engage in drilling for geothermal resources or construction of a geothermal well in Virginia, such person shall give bond with surety acceptable to the division director and payable to the Commonwealth. At the election of the permit applicant, a cash bond may be given. The amount of bond required shall be sufficient to cover the costs of properly plugging the well and restoring the site, but in no case shall the amount of bond be less than \$10,000 for each exploratory and injection well, and \$25,000 for each production well. Blanket bonds of \$100,000 may be granted at the discretion of the division director.

2. The return of such bonds shall be conditioned on the following requirements:

- a. Compliance with all statutes, rules, and regulations relating to geothermal regulations and the permit.
- b. Plugging and abandoning the well as approved by the division director in accordance with [4VAC25-170-80](#) .

3. A land stabilization bond of \$1,000 per acre of land disturbed shall be required. Such bond will be released once drilling is completed and the land is reclaimed in accordance with [4VAC25-170-40](#) .

4. Liability under any bond may not be terminated without written approval of the division director.

B. Each exploration, production, and injection well permit application shall be accompanied by payment of a \$600 application fee.

1. Applications will not be reviewed until the operator or designated agent submits proof of compliance with all pertinent local ordinances.

Before commencement of exploratory drilling operations on any tract of land, the operator or designated agent shall file an exploration permit application with the department. An accurate map of the proposed wells on an appropriate scale showing adjoining property lines and the proposed locations using the Virginia Coordinate System of 1983 (Chapter 17 (§ [55-287](#) et seq.) of Title 55 of the Code of Virginia), and the depths and surface elevations shall be filed with the application. The application also shall include an inventory of local water resources in the area of proposed development.

2. Before commencement of production or injection well drilling, an application to produce and inject geothermal fluids shall be filed in the form of a notice of intent to proceed in accordance with the provisions of [4VAC25-170-40](#) .

3. New permit applications must be submitted if, either prior to or during drilling, the operator desires to change the location of a proposed well. If the new location is within the boundaries established by the permit or within an unitized drilling operation, the application may be made orally and the division director may orally authorize the commencement or continuance of drilling operations. Within 10 days after obtaining oral authorization, the operator shall file a new application to drill at the new location. A permit may be issued and the old permit canceled without payment of additional fee. If the new location is located outside the unitized drilling unit covered by the first permit, no drilling shall be commenced or continued until the new permit is issued.

4. All applications, requests, maps, reports, records, notices, filings, submissions, and other data (including report forms) required by or submitted to the department shall be in electronic form or a format prescribed by the director.

5. The department will act on all permit applications within 30 days of receipt of an application or as soon thereafter as practical.

#### Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

#### Historical Notes

Derived from VR480-04-13 § 3, eff. May 1, 1984; amended, [Volume 29, Issue 02](#) , eff. October 24, 2012; [Volume 33, Issue 21](#) , eff. July 27, 2017.

### 4VAC25-170-40. Notification of Intent to Proceed.

The notification of intent to proceed with geothermal production or injection as required by [4VAC25-170-30](#) must be accompanied by (i) an operations plan, (ii) a geothermal fluid analysis, and (iii) a proposal for injection of spent fluids.

1. The operations plan shall become part of the terms and conditions of any permit that is issued, and the provisions of this plan shall be carried out where applicable in the drilling, production, and abandonment phase of the operation. The department may require any

changes in the operations plan necessary to promote geothermal and water resource conservation and management, prevent waste, protect potable groundwater drinking supplies, or protect the environment, including a requirement for injection or unitization. The operations plan shall include the following information:

- a. An accurate plat or map, on a scale not smaller than 400 feet to the inch, showing the proposed location using the Virginia Coordinate System of 1983 (Chapter 17 (§ [55-287](#) et seq.) of Title 55 of the Code of Virginia), and surface elevation of the production and injection wells as determined by survey, the courses and distances of such locations from two permanent points or landmarks on said tract, the well numbers, the name of the owner, the boundaries and acreage of the tract on which the wells are to be drilled, the location of water wells, surface bodies of water, actual or proposed access roads, other production and injection wells on adjoining tracts, the names of the owners of all adjoining tracts and of any other tract within 500 feet of the proposed location, and any building, highway, railroad, stream, oil or gas well, mine openings or workings, or quarry within 500 feet of the proposed location. The location must be surveyed and the plat certified by a professional engineer or registered surveyor and bear his certificate number.
- b. A summary geologic report of the area, including depth to proposed reservoir; type of reservoir; anticipated thickness of reservoir; anticipated temperature of the geothermal resource; anticipated porosity, permeability and pressure; geologic structures; and description of overlying formations and aquifers.
- c. The method of meeting the guidelines of the Erosion and Sediment Control Regulations as adopted by the State Water Control Board pursuant to § [62.1-44.15:52](#) of the Code of Virginia.
- d. The method of disposing of all drilling muds and fluids, and all cement and other drilling materials from the well site; the proposed method of preventing such muds, fluids, drillings, or materials from seeping into springs, water wells, and surface waters during drilling operations.
- e. The method of construction and maintenance of access roads, materials to be used, method to maintain the natural drainage area, and method of directing surface water runoff from disturbed areas around undisturbed areas.
- f. The method of removing any rubbish or debris during the drilling, production, and abandonment phases of the project. All waste shall be handled in a manner that prevents fire hazards or the pollution of surface streams and groundwater.
- g. The primary and alternative method of spent geothermal fluid disposal. All disposal methods shall be in accordance with state and federal laws for the protection of land and water resources.
- h. The methods of monitoring fluid quality, fluid temperature, and volumetric rate of production and injection wells.

- i. The method of monitoring potable drinking water aquifers close to production and injection zones.
- j. The method of monitoring for land subsidence.
- k. The method of plugging and abandoning wells and a plan for reclaiming production and injection well sites.
- l. The method of cleaning scale and corrosion in geothermal casing.
- m. A description of measures that will be used to minimize any adverse environmental impact of the proposed activities on the area's natural resources, aquatic life, or wildlife.

2. Geothermal fluid analysis.

- a. A geothermal fluid analysis shall be submitted with the operations plan, and annually thereafter.
- b. Acceptable chemical parameters and sampling methods are set forth in [4VAC25-170-70 B](#).

3. Proposal for injection of geothermal fluids.

a. Geothermal fluid shall be injected into the same geothermal area from which it was withdrawn in the Atlantic Coastal Plain. Plans for injection wells in this area shall include information on:

- (1) Existing reservoir conditions.
- (2) Method of injection.
- (3) Source of injection fluid.
- (4) Estimate of expected daily volume in gallons per minute per day.
- (5) Geologic zones or formations affected.
- (6) Chemical analyses of fluid to be injected.
- (7) Treatment of spent geothermal fluids prior to injection.

b. Exemptions to the injection rule for geothermal fluid shall be approved by the department. Such requests shall be accompanied by a detailed statement of the proposed alternative method of geothermal fluid disposal; the effects of not injecting on such reservoir characteristics as pressure, temperature, and subsidence; and a copy of the operator's or designated agent's no-discharge permit.

Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

Historical Notes



#### 4VAC25-170-50. Well Construction and Maintenance.

A. Every person drilling for geothermal resources in Virginia, or operating, owning, controlling or in possession of any well as defined herein, shall post and keep posted in a conspicuous place on or near the well a sign showing the name of the person, firm, company, corporation, or association drilling, owning, or controlling the well, the company or operator's well number, and the well identification number thereof. Well identification numbers will be assigned to all approved permits according to the USGS groundwater site inventory system. The lettering on such sign shall be kept in a legible condition at all times.

B. The division director shall receive notice prior to the commencement of well work concerning the identification number of the well and the date and time that well work is scheduled to begin.

C. 1. Drilling-fluid materials sufficient to ensure well control shall be maintained in the field area and be readily accessible for use during drilling operations.

2. All drilling muds shall be used in a fashion designed to protect freshwater-bearing sands, horizons, and aquifers from contamination during well construction.

3. Drilling muds shall be removed from the drilling site after the well is completed and disposed of in the method approved in the operations plan.

4. Operations shall be conducted with due care to minimizing the loss of reservoir permeability.

D. All wells must be drilled with due diligence to maintain a reasonably vertical well bore. Deviation surveys must be recorded in the drilling log for every 1000 feet drilled.

E. 1. A well may deviate intentionally from the vertical with written permission by the division director. Such permission shall not be granted without notice to adjoining landowners, except for side-tracking mechanical difficulties.

2. When a well has been intentionally deviated from the vertical, a directional survey of the well bore must be filed with the department within 30 days after completion of the well.

3. The department shall have the right to make, or to require the operator to make, a directional survey of any well at the request of an adjoining operator or landowner prior to the completion of the well and at the expense of said adjoining operator or landowner. In addition, if the department has reason to believe that the well has deviated beyond the boundaries of the property on which the well is located, the department also shall have the right to make, or to require the operator to make, a directional survey of the well at the expense of the operator.

F. 1. Valves approved by the division director shall be installed and maintained on every completed well so that pressure measurements may be obtained at any time.

2. Blow-out preventers during drilling shall be required when the formation pressure on the wellhead connection is or could be greater than 1000 psi.

G. 1. Geothermal production wells shall be designed to ensure the efficient production and elimination of waste or escape of the resource.

2. All freshwater-bearing sands, horizons, and aquifers shall be fully protected from contamination during the production of geothermal fluids.

3. a. The water protection string shall extend from a point 12 inches above the surface to a point at least 50 feet below the deepest known groundwater aquifer or horizon.

b. The operator, owner, or designated agent shall use new casing. Only casing that meets American Petroleum Institute specifications, as found in API 5AC, Restricted Yield Strength Casing and Tubing, March, 1982, API 5A, Casing Tubing, and Drill Pipe, March, 1982, and API 5AX, High-Strength Casing, Tubing, and Drill Pipe, March, 1982, (and all subsequent revisions thereto), shall be used in geothermal production wells.

c. Cement introduced into a well for the purpose of cementing the casing or for the purpose of creating a permanent bridge during plugging operations shall be placed in the well by means of a method approved by the division director. In addition:

(1) Each surface string shall be cemented upward from the bottom of the casing to the surface.

(2) Cement shall be allowed to stand for 24 hours or until compressive strength equals 500 psi before drilling.

d. The department may modify casing and cementing requirements when special conditions demand it.

4. a. The owner, operator, or designated agent shall use new casing. Only production casing that meets American Petroleum Institute specifications, as found in API 5AC, Restricted Yield Strength Casing and Tubing, March, 1982, API 5A, Casing Tubing, and Drill Pipe, March, 1982, and API 5AX, High-Strength Casing, Tubing, and Drill Pipe, March, 1982, (and all subsequent revisions thereto), shall be used in geothermal production wells.

b. Each well shall be cemented with a quantity of cement sufficient to fill the annular space from the production zone to the surface. The production casing shall be cemented to exclude, isolate, or segregate overlapping and to prevent the movement of fluids into freshwater zones.

c. Cement shall be allowed to stand for 24 hours or until compressive strength equals 500 psi before drilling.

d. Cement introduced into a well for the purpose of cementing the casing or for the purpose of creating a permanent bridge during plugging operations shall be placed in the well by means of a method approved by the division director.

e. The department may modify casing requirements when special conditions demand it.

f. The division director may require additional well tests if production or monitoring records indicate a leak in the production casing. When tests confirm the presence of a production casing leak, the division director may require whatever actions are necessary to protect other strings and freshwater horizons.

H. 1. The owner, operator, or designated agent shall use new casing. Only casing that meets American Petroleum Institute specifications, as found in API 5AC, Restricted Yield Strength Casing and Tubing, March, 1982, API 5A, Casing Tubing, and Drill Pipe, March, 1982, and API 5AX, High-Strength Casing, Tubing, and Drill Pipe, March, 1982, (and all subsequent revisions thereto), shall be used in geothermal injection wells.

2. The casing program shall be designed so that no contamination will be caused to freshwater strata. Injection shall be done through production casing adequately sealed and cemented to allow for monitoring of the annulus between the injection string and the last intermediate string or water protection string, as the case may be. Injection pressure shall be monitored and regulated to minimize the possibility of fracturing the confining strata.

3. Production casing shall be cemented through the entire freshwater zone.

4. The rate of injection of geothermal fluid shall not exceed the production rate.

5. Adequate and proper wellhead equipment shall be installed and maintained in good working order on every injection well not abandoned and plugged, so that pressure measurements may be obtained at any time.

I. 1. The division director shall have access to geothermal well sites during reasonable hours.

2. The state geologist or his designated representative shall have access to any drilling site for the purpose of examining whole cores or cuttings as may be appropriate.

J. At least 10 days prior to any chemical cleaning of production casing, the operator shall notify the division director of the type and amount of chemical to be used and obtain approval for its use.

K. The well operator, or his designated agent, shall file a completion report within 90 days after well work is completed. The completion report shall be accompanied by copies of any drilling logs required under [4VAC25-170-40](#).

Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-13 § 5, eff. May 1, 1984; amended, [Volume 29, Issue 02](#), eff. October 24, 2012; [Volume 33, Issue 21](#), eff. July 27, 2017.

## 4VAC25-170-60. Records, Logs and General Requirements.

A. 1. During the drilling and production phases of every well, the owner, operator, or designated agent responsible for the conduct of drilling operations shall keep at the well an

accurate record of the well's operations as outlined in subsection C of this section. These records shall be accessible to the division director at all reasonable hours.

2. The refusal of the well operator or designated agent to furnish upon request such logs or records or to give information regarding the well to the department shall constitute sufficient cause to require the cessation or shutting down of all drilling or other operations at the well site until the request is honored.

3. Copies of all productions records required by this chapter shall be submitted to the division director.

4. Samples representative of all strata penetrated in each well shall be collected and furnished to the Commonwealth. Such samples shall be in the form of rock cuttings collected so as to represent the strata encountered in successive intervals no greater than 10 feet. If coring is done, however, the samples to be furnished shall consist, at a minimum, of one-quarter segments of core obtained. All samples shall be handled as follows:

a. Rock cuttings shall be dried and properly packaged in a manner that will protect the individual samples, each of which shall be identified by the well name, identification number, and interval penetrated.

b. Samples of core shall be boxed according to standard practice and identified as to well name and identification number and interval penetrated.

c. All samples shall be shipped or mailed, charges prepaid, to:

Department of Mines, Minerals and Energy  
Division of Mineral Resources  
Fontaine Research Park  
900 Natural Resources Drive  
P.O. Box 3667  
Charlottesville, VA 22903

B. Each well operator, owner, or designated agent, within 90 days after the completion of any well, shall submit to the division director a copy of the drilling log. Drilling logs shall list activities in chronological order and include the following information:

1. The well's location and identification number.
2. A record of casings set in wells.
3. Formations encountered.
4. Deviation tests for every one thousand feet drilled.
5. Cementing procedures.
6. A copy of the downhole geophysical logs.

C. The owner, operator, or designated agent of any production or injection well shall keep or cause to be kept a careful and accurate production record. The following information shall be reported to the division director on a monthly basis for the first six months and quarterly

thereafter, or as required by permit, unless otherwise stated:

1. Pressure measurements as monitored by valves on production and injection wells.
2. The volumetric rate of production or injection measured in terms of the average flow of geothermal fluids in gallons per minute per day of operation.
3. Temperature measurements of the geothermal fluid being produced or injected, including the maximum temperature measured in the bore-hole and its corresponding depth, and the temperature of the fluid as measured at the discharge point at the beginning and conclusion of a timed production test.
4. Hydraulic head as measured by the piezometric method.

Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-13 § 6, eff. May 1, 1984; amended, [Volume 29, Issue 02](#) , eff. October 24, 2012; [Volume 33, Issue 21](#) , eff. July 27, 2017.

#### 4VAC25-170-70. Groundwater Monitoring.

- A. 1. Groundwater shall be monitored through special monitoring wells or existing water wells in the area of impact, as determined by the department.
2. Monitoring shall be performed and reported to the division director daily on both water quality and piezometric head for the first 30 days of geothermal production. Thereafter, quarterly tests for piezometric head and for water quality shall be reported to the division director.
  3. The monitoring of groundwater shall meet the following conditions:
    - a. A minimum of one monitoring well per production or injection well is required. Monitoring wells shall monitor those significant potable aquifers through which the well passes as required by the department.
    - b. The monitoring wells shall be located within the first 50% of the projected cone of depression for the geothermal production well.
    - c. The wells shall be constructed to measure variations in piezometric head and water quality. Groundwater shall be chemically analyzed for the following parameters: mineral content (alkalinity, chloride, dissolved solids, fluoride, calcium, sodium, potassium, carbonate, bicarbonate, sulfate, nitrate, boron, and silica); metal content (cadmium, arsenic, mercury, copper, iron, nickel, magnesium, manganese, and zinc); and general parameters (pH, conductivity, dissolved solids, and hardness).
    - d. The department may require additional analyses if levels of the parameters in subdivision 3 c of this subsection indicate their necessity to protect groundwater supplies.

B. 1. Chemical analyses of geothermal fluids shall be filed with the division director on an annual basis.

2. Samples for the chemical fluid analysis shall be taken from fluid as measured at the discharge point of the production well at the conclusion of a two-hour production test.

3. The production fluid shall be chemically analyzed for the following parameters: mineral content (alkalinity, chloride, dissolved solids, fluoride, calcium, sodium, potassium, carbonate, bicarbonate, sulfate, nitrate, boron, and silica); metal content (cadmium, arsenic, mercury, copper, iron, nickel, magnesium, manganese, and zinc); gas analyses (hydrogen sulfide, ammonia, carbon dioxide, and gross alpha); and general parameters (pH, conductivity, and dissolved solids).

4. The department may require additional analyses if levels of the parameters in subdivision 3 of this subsection indicate follow-up tests are necessary.

C. 1. Subsidence shall be monitored by the annual surveys of a professional engineer or certified surveyor from vertical benchmarks located above the projected cone of depression, as well as points outside its boundaries. The surveys shall be filed with the division director by the operator or designated agent.

2. The department may order micro-earthquake monitoring, if surveys indicate the occurrence of subsidence.

D. 1. The operator, owner, or designated agent shall maintain records of any monitoring activity required in his permit or by this chapter. All records of monitoring samples shall include:

- a. The well identification number.
- b. The date the sample was collected.
- c. Time of sampling.
- d. Exact place of sampling.
- e. Person or firm performing analysis.
- f. Date analysis of the sample was performed.
- g. The analytical method or methods used.
- h. Flow-point at which sample was taken.
- i. The results of such analysis.

2. The operator, owner, or designated agent shall retain for a period of five years any records of monitoring activities and results, including all original strip chart recordings of continuous monitoring installations. The period of retention will automatically be extended during the course of any litigation regarding the discharge of contaminants by the permittee until such time as the litigation has ceased or when requested by the division director. This requirement shall apply during the five-year period following abandonment

of a well.

Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-13 § 7, eff. May 1, 1984; amended, [Volume 29, Issue 02](#) , eff. October 24, 2012; [Volume 33, Issue 21](#) , eff. July 27, 2017.

#### 4VAC25-170-80. Abandonment and Plugging of Wells.

A. Notification of intent to abandon any exploration, production, or injection well shall be submitted to the division director at least 48 hours before the beginning of plugging operations. When notification of intent to abandon an exploratory, production, or injection well is received, the division director may send a departmental representative to the location specified and at the time stated to witness the plugging of the well.

B. 1. Any drilling well completed as a dry hole from which the rig is to be removed shall be cemented unless authorization to the contrary has been given by the division director.

2. The bottom of the hole shall be filled to, or a bridge shall be placed at the top of, each producing formation open to the well bore. Additionally, a cement plug not less than 100 feet in length shall be placed immediately above each producing formation.

3. A continuous cement plug shall be placed through all freshwater-bearing aquifers and shall extend at least 50 feet above and 50 feet below said aquifers.

4. A plug not less than 100 feet in length shall be placed at or near the surface of the ground in each hole.

5. The interval between plugs shall be filled with a nonporous medium.

6. The method of placing cement in the holes shall be by any method approved by the division director in advance of placement.

7. The exact location of each abandoned well shall be marked by a piece of pipe not less than four inches in diameter securely set in concrete and extending at least four feet above the general ground level. A permanent sign of durable construction shall be welded or otherwise permanently attached to the pipe and shall contain the well identification information required by [4VAC25-170-50](#) A and the date the well was plugged.

8. When drilling operations have been suspended for 60 days, the well shall be plugged and abandoned unless written permission for temporary abandonment has been obtained from the division director.

9. Within 20 days after the plugging of any well, the responsible operator, owner, or designated agent who plugged or caused the well to be plugged shall file a notice of intent to plug or abandon and an affidavit with the department indicating the manner in which the well was plugged.

Statutory Authority

§ [45.1-179.7](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-13 § 8, eff. May 1, 1984; amended, [Volume 29, Issue 02](#) , eff. October 24, 2012; [Volume 33, Issue 21](#) , eff. July 27, 2017.

#### 4VAC25-170-90. Environmental Protection; Impacts; Noise Abatement.

A. In the absence of coverage by any other section of this chapter, the department shall require operations under this chapter to be conducted so as not to pollute land, water, or air. Federal and state air and water quality standards shall be followed unless more stringent requirements are stipulated by the department. More stringent requirements, if stipulated, shall be made during the permit process. Notices of such requirements will be sent to the applicant and a notice published permitting 30 days for written comments. The review of operations plans shall take into account any adverse effects on groundwaters, streams, plants, fish and wild-life wildlife populations, atmosphere, or any other effects which may cause or contribute to pollution. Should environmental conditions warrant, owners, operators, or their designated agents may be required to conduct special environmental studies or monitoring.

B. Noise output from geothermal sites shall be limited to 65 dB/A at the lease boundary or within one-half mile of the source, whichever is greater.

Statutory Authority

§§ [45.1-161.3](#) , [45.1-179.6](#) and [45.1-179.7](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-13 § 9, eff. May 1, 1984.

#### Forms (4VAC25-170)

Registration Form for Drillers, Owners and Operators of Geothermal Wells, DGO-G-01 (rev. 6/09).

Application for Exploration Permit, DGO-G-02 (rev. 6/09).

Appendix for Exploration Permit if the Well Work Involves Drilling, Redrilling or Deepening, DGO-G-02A (rev. 6/09).

Geothermal Resource Well Operator's Bond, DGO-G-03 (rev. 6/09).

Release of Geothermal Resource Well Operator's Surety Bond, DGO-G-03A (rev. 6/09).

Geothermal Well Plat, DGO-G-04 (rev. 6/89).

Certification of Location of New Well, DGO-G-04A (rev. 6/09).

Report on Completion of Well Work, DGO-G-05 (rev. 6/09).



Report of Completion of Work if Drilling, Redrilling or Deepening is Involved, DGO-G-05A (rev. 6/09).

Notice of Intent to Plug or Abandon, and Affidavit, DGO-G-05B (rev. 6/09).

Casing and Tubing Program, DGO-G-05C (rev. 6/09).

Driller's Log, DGO-G-05D (rev. 6/09).

Notice of Intent to Proceed, DGO-G-06 (rev. 6/09).

Geothermal Resource Production or Injection Report, DGO-G-07 (rev. 6/09).

Groundwater Monitoring Report, DGO-G-08 (rev. 6/09).

Geothermal Fluid Monitoring Report, DGO-G-09 (rev. 6/09).

Notification of Chemical Cleaning of a Geothermal Well, DGO-G-10 (rev. 6/09).

Surveyor's Report on Subsidence, DGO-G-11 (rev. 6/09).

Application for Reclassification of a Geothermal Area, DGO-G-12 (rev. 6/09).

Request for Permission to Engage in Sequential Utilization, DGO-G-13 (rev. 6/09).

Application for Exemption from Injection Requirement, DGO-G-14 (rev. 6/09).