
Kevin McCray, Executive Director
2009
Sponsors

- The Geothermal Heating and Cooling Systems State Regulatory Oversight Survey was funded in a collaborative effort.
Survey Compiled by:

Industry Insights, a research and consulting firm that specializes in conducting industry surveys and customized research services. Conducted, tabulated and analyzed the results of this report.
Survey Methodology

- The survey instrument used for this study was an online questionnaire that primarily requested geothermal heating and cooling regulatory data.
- An email containing a link to the online survey was sent to state contacts in mid-January 2010. If multiple contacts existed for a state, all contacts were copied on one email to encourage collaboration and discussion.
- The email also instructed the recipient to forward the survey link on to others whom may be were more qualified to answer the questions.
- To encourage participation, reminder emails were sent by both Industry Insights and the associations funding the study.
Survey Methodology

• Survey submissions were collected through early April 2010 with 34 states responding to at least a portion of the survey. Before the results were finalized, each respondent’s data was sent back to them in report-format for verification.
• All data were checked both manually and by a specially designed computer editing procedure.
• Final results were tabulated and the report was completed in early May 2010.
• Respondents to the survey were sent the final report, which was offered as an incentive to participate.
Interpreting the Results

- Throughout the individual state data an “X” denotes the response the state gave for all frequency questions.
- Most of the numeric measures and statistics included in the “All States” section of this study are reported on the basis of medians rather than arithmetical averages or means. Unlike the mean, the median is not distorted by a few unusually high or low values that may exist in the sample due to special circumstances. The "median" figure represents the mid-point of the figures for a particular measure, with one-half of the respondents reporting figures above it and one-half below. Each median has been independently selected from its own array of figures.
  - Smallest
  - Largest
  - Number
  - Reported Typical
  - Reported
  - Lower 25% of Reported Figures
  - Middle 50% of Reported Figures (or Middle Range)
  - Upper 25% of Reported Figures
  - Median
- All open-ended/text-based questions were removed from the “All States” section of the report.
Geothermal Heating and Cooling Systems State Regulatory Oversight Survey

• Most complete, accurate, and up-to-date information for geothermal system regulation available anywhere at this time.
• The report is designed to allow readers to easily compare state-by-state regulations, as well as aggregate data on all responding states.
Geothermal Heating and Cooling Systems State Regulatory Oversight Survey

- 637 page full-report
- 34 responding states

Available from NGWA
  - Free to regulatory personnel
  - Free to other NGWA members
  - $1,000 to non-members and non-regulators
34 States Responded (blue)
Survey Methodology

- Data was collected on nine geothermal system configurations. They were:
  1. Open loop – single well for water withdrawal, water returned to a surface source
  2. Open loop – single well for water withdrawal, water returned to a second well
  3. Standing column – single well for water withdrawal and water return
  4. Closed loop – vertical boreholes
  5. Closed loop – subsurface trenched, or other configuration, but not vertical boreholes
  6. Closed loop – surface water body emplacement
  7. Direct exchange (DX) – vertical boreholes
  8. Direct exchange (DX) – subsurface trenched, or other configuration, but not vertical boreholes
  9. Concentric pipe systems (heat exchange fluid flows to the bottom of the hole through a small diameter inner pipe)
Open Loop – Single Well (Open 1)

Image courtesy of: International Ground Source Heat Pump Association
Open Loop – Two Wells (Open 2)

Image courtesy of: Geothermal Energy Organization
Standing Column (Stand Col.)

Image courtesy of: Geothermal Energy Organization
Closed Loop – Vertical Borehole (CL 1)

Image courtesy of: Geothermal Energy Organization
Closed Loop – Subsurface Trenched (CL 2)

Image courtesy of: International Ground Source Heat Pump Association
Closed Loop – Surface Water (CL 3)

Image courtesy of: International Ground Source Heat Pump Association
Direct Exchange (DX 1 & 2)

Image courtesy of: Earthlinked Technologies
Concentric (Con.)

Image courtesy of: Jim Godbout Plumbing & Heating Inc., Biddeford, Maine

Industry estimates <10% of 325/330 installed in open loop or standing column configurations.

ARI-320= Water-Source
ARI-325= Groundwater-Source
ARI-330= Ground Source Closed-Loop
ARI-870= Direct Geoexchange

Source: U.S. Energy Information Administration, December 2010
Geothermal Heat Pump Domestic Shipments by Sector and Model Type, 2009 (Rated Capacity in Tons)

Industry estimates >90% are closed loop installations.

Source: U.S. Energy Information Administration, December 2010

3% average annual rate of growth since 1999

Source: U.S. Bureau of the Census, Current Industrial Report MA333M
Market Share by System Configuration: This Survey Only!

82% of reported installs were closed loop, vertical boreholes.

No response for Closed loop 2 & 3; Direct exchange 2, Concentric
## No. of Systems over 5 Years (median)

<table>
<thead>
<tr>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>45</td>
<td>58</td>
<td>552</td>
<td>nr</td>
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<tr>
<td>0.75%</td>
<td>6.7%</td>
<td>8.7%</td>
<td>82%</td>
<td>nr</td>
<td>nr</td>
<td>1.5%</td>
<td>nr</td>
<td>nr</td>
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</table>

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Percentage of Geothermal System Configurations Regulated by Responding States

- Open loop - 1 well
- Open loop - 2 wells
- Standing column
- Closed loop - vertical
- Closed loop - surface
- Direct exchange
- Concentric pipe

Percentage
Water well boards are the state board most likely to oversee geothermal system installation.
Which state boards have oversight?

<table>
<thead>
<tr>
<th>Board</th>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
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<tbody>
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<td>Electrical</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Water Well</td>
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<td>79</td>
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<td>67</td>
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<tr>
<td>HVAC</td>
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<td>5</td>
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<td>12</td>
<td>10</td>
<td>10</td>
<td>6</td>
<td>11</td>
<td>7</td>
</tr>
</tbody>
</table>

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Drilling professions most likely to be required to have a license among the responding states.
## License required?

<table>
<thead>
<tr>
<th>Profession</th>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td>27</td>
<td>27</td>
<td>29</td>
<td>37</td>
<td>37</td>
<td>12</td>
<td>36</td>
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<td>91</td>
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<td>47</td>
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<td>40</td>
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<tr>
<td><strong>Construction</strong></td>
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<tr>
<td><strong>System Operator</strong></td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>20</td>
<td>29</td>
<td>29</td>
<td>23</td>
<td>33</td>
<td>21</td>
</tr>
</tbody>
</table>

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Construction permits and fees most commonly requested for geothermal work.
## Permits and Fees?

<table>
<thead>
<tr>
<th>Permit or Fee</th>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>52</td>
<td>42</td>
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<td>29</td>
<td>44</td>
<td>43</td>
<td>44</td>
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<tr>
<td><strong>Geothermal Permit &amp; Fee</strong></td>
<td>37</td>
<td>36</td>
<td>35</td>
<td>33</td>
<td>29</td>
<td>25</td>
<td>27</td>
<td>17</td>
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<td>14</td>
<td>15</td>
<td>29</td>
<td>14</td>
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<tr>
<td><strong>Operate Permit &amp; Fee</strong></td>
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<td>29</td>
<td>30</td>
<td>17</td>
<td>22</td>
<td>22</td>
<td>27</td>
<td>25</td>
<td>19</td>
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<td><strong>Geologic Record</strong></td>
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<td>27</td>
<td>67</td>
<td>5</td>
<td>30</td>
<td>5</td>
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</tbody>
</table>
Water quality and water quantity permits most frequently requested.
## Environmental Permits or Registrations?

<table>
<thead>
<tr>
<th>Permit or Fee</th>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
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<tbody>
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<td><strong>Well depths</strong></td>
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<td><strong>Heat load</strong></td>
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<tr>
<td><strong>Water quality</strong></td>
<td>68</td>
<td>53</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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Less than a third of the states require installer training of any form for any profession associated with geothermal installations.
# Geothermal Installer Training?

<table>
<thead>
<tr>
<th>Profession</th>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
</tr>
</thead>
<tbody>
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<td>0</td>
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<tr>
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<td>13</td>
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<td>13</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>13</td>
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<td>13</td>
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<tr>
<td><strong>Operator</strong></td>
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<td>6</td>
<td>13</td>
<td>0</td>
<td>7</td>
<td>17</td>
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</tbody>
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Environmental impacts from thermal exchange are generally not monitored.
# Standards & Regulations?

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Open 1</th>
<th>Open 2</th>
<th>Stand Col.</th>
<th>CL 1</th>
<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
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</thead>
<tbody>
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<tr>
<td><strong>Operation</strong></td>
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<td>44</td>
<td>37</td>
<td>38</td>
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<td><strong>Limits to earth temp ranges over lifecycle</strong></td>
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<td>50</td>
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Setback distances are more often regulated than spacing of the heat exchange tubing.
## Specific Criteria?

<table>
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<th>Stand Col.</th>
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<th>CL 2</th>
<th>CL 3</th>
<th>DX 1</th>
<th>DX 2</th>
<th>Con.</th>
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<td>Setback</td>
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<td>88</td>
<td>68</td>
<td>71</td>
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<td>Depth</td>
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<td>57</td>
<td>43</td>
<td>33</td>
<td>61</td>
<td>50</td>
<td>56</td>
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<td>Spacing of loops</td>
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<td>Materials</td>
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<td>63</td>
<td>67</td>
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<td>71</td>
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</table>
State Regulations Governing Installation of GHP Systems

Personnel involved in the design and installation of geothermal heat pump (GHP) systems are frequently required to comply with local requirements for licensing and permits, and most regulations that govern the installation of GHP systems are adopted at the state or local level. Many jurisdictions are still in the early stages of addressing GHP technology. As the frequency of GHP installations has increased over the past decade, much additional attention has been paid to the performance and environmental impacts of GHP systems.

This database provides an inventory of GHP regulations relevant to design and installation of GHP systems, which will allow analysis that will facilitate the integration of GHP system regulatory requirements into the national GHP certification standard. This outcome may take the form of a generic regulatory component of the standard, or the overlay of local conditions on the national features of the standard.

Welcome to the GHPNCS Project

Welcome to the project to create a Geothermal Heat Pump National Certification Standard (GHPNCS)! This project is funded by the U.S. Department of Energy and we encourage you to review the Project Summary below, as well as the other resources under the above menu items.

We need everyone’s help! In order for this standard to make a difference, it needs to reflect the real-world circumstances that result in the design and installation of reliable and high-performance geothermal heating and cooling systems. Your participation and input is essential so we need you to:

- Review the materials posted on this website
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- Download draft proposals and distribute them to others for more feedback
- Help verify other drafts by examining draft proposals and submitting comments

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Project Description and Purpose

• The accepted objective of this project was to update previous research accomplished by the Geothermal Heat Pump Consortium (GHPC) and others to generate a current inventory of state government regulations applied to design and installation of ground-source heat pump (GSHP) systems. The work was to provide insight into existing and anticipated regulatory requirements that are appropriate for inclusion in a national certification standard for all primary personnel involved in the installation of GSHP systems (“the Standard”), in order to integrate GSHP system regulatory requirements into the Standard.
Project Description and Purpose

• We contracted with GHPC to develop a database of regulations in each state that are unique to the design, installation and operation of GSHP systems compared to conventional heating and cooling systems, including HVAC, ground heat exchange, aquifer protection, etc., for closed loop (water source and direct exchange) and open loop GSHP systems, including vertical, horizontal and directional boring configurations.
Methodology

• Our methodology included contracting law school students trained in regulatory research to investigate the regulatory environment in each state using Internet research to:
  • Identify regulatory agencies in each State with jurisdiction over design and installation of GSHP systems
Methodology

- Identify States in which such jurisdiction is delegated/reserved to local jurisdictions (counties, cites, etc.)
- Identify ongoing and/or planned regulatory processes designed to adopt such regulations
- Collect and document data on existing and anticipated regulations
- Our investigators conducted their work over the three month period between February and April 2012.
- Our compiled database reflects results obtained within that time frame.
Methodology

• Additionally, during the months of April and May, NGWA personnel compared the 2012 research to results found in the 2009 joint survey conducted by the Geothermal Heat Pump Consortium, the International Ground Source Heat Pump Association, the Ground Water Protection Council, and the National Ground Water Association, looking for inconsistencies in 2012 results to 2009 survey responses.

• Also, experienced installers of GSHP systems were asked to review selected state compilations for completeness based upon their personal experiences within state jurisdictions. While not every state compilation was tested, our findings were that our sample suggested our law student investigators had been thorough.
State Regulations Governing Installation of GHP Systems

Personnel involved in the design and installation of geothermal heat pump (GHP) systems are frequently required to comply with local requirements for licensing and permits, and most regulations that govern the installation of GHP systems are adopted at the State or local level. Many jurisdictions are still in the early stages of addressing GHP technology. As the frequency of GHP installations has increased over the past decade, much additional attention has been paid to the performance and environmental impacts of GHP systems.

This database provides an inventory of GHP regulations relevant to design and installation of GHP systems, which will allow analysis that will facilitate the integration of GHP system regulatory requirements into the national GHP certification standard. This outcome may take the form of a generic regulatory component of the standard, or the overlay of local conditions on the national features of the standard.

Select a state to view regulations governing installation of GHP systems that serve your area. Click here to view a text version.
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Groundwater Map - Indiana

Data Available: Yes
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State Jurisdiction: Indiana
Data Type: Additional Information
Additional Information Type: Groundwater Maps
Located in: Indiana | Additional Information

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E-mail (required, but will not display)
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as well as the East Fork, West Fork, and main stem of the White River are underlain by thick deposits of outwash sand and gravel capable of supplying over 1,000 gpm or 1.4 mgd to properly constructed, large diameter wells.

Generalized Ground-Water Availability

- 10 gallons per minute
- 50 gallons per minute
- 100 gallons per minute
- 200 gallons per minute
- 400 gallons per minute
- 600 gallons per minute
- > 1000 gallons per minute

Find groundwater information in your area >>

View a pdf version of map (417kb file size)
Indiana Department of Natural Resources

Data Available: Yes
Jurisdiction: State
State Jurisdiction: Indiana
Data Type: Licensing of Practitioners
Practitioner Type: Well Driller
Licensing Requirements:

"The IDNR is currently in the process of amending the Water Well Driller’s Rule (312 IAC 13) to accommodate the new provisions of SEA 358. With the passage of Senate Enrolled Act 356 (SEA 356) (SEA 358) by the 2010 Indiana General Assembly, “a person who installs or repairs water well pumps” must be licensed by the IDNR beginning in 2011. Until the rule receives final adoption by the Natural Resources Commission, an Emergency Rule has been implemented by the IDNR Director to regulate the new licensing and continuing education requirements for well drillers and pump installers. In summary, an individual is required to meet the following qualifications in order to obtain a license:

1) Be at least 18 years of age;

2) Furnish evidence from three (3) references, two (2) of whom are water well drillers, water well pump installers or licensed plumbing contractors familiar with the applicant’s work experience and professional competency;

3) Have successfully completed a competency examination prepared and administered by the department; and

4) Pay a $100 license fee.

Title 312, Emergency Rule, LSA Document #10-741(E) temporarily governs the licensure of water well drillers and water well pump installers, including water well pump installations and continuing education, includes standards to assist with the implementation of P.L.84-2010 (SEA 356-2010), clarifies existing language, and makes technical corrections. Emergency Rule, SECTION 1: This document assists in implementation of IC 25-39 and supplements 312 IAC 13. SECTION 3: (a) Notwithstanding 312 IAC 13-2-1, an initial application for a license as a water well driller or water well pump installer must be completed on a departmental form and must include the following:

1) The name, current address, telephone number, and birth date of the applicant. (2) The type of drilling or pump installation equipment the applicant uses, and the number of years the applicant has operated that type of equipment. (3) The applicable employment experience of the applicant. (4) The signature of the applicant attesting to or affirming the accuracy of the information on the application. (5) The license fee established under section 2 of this rule. (6) Statements by references under IC 25-39-3-3(a)(2). SECTION 4: (a) Notwithstanding 312 IAC 13-2-2, the fee to accompany any application for a license as a water well driller or water well pump installer is one hundred dollars ($100) for a calendar year. SECTION 10: The requirements applicable to a water well driller under 312 IAC 13-3-1 also apply to a water well pump installer. SECTION 13: (a) Notwithstanding 312 IAC 13-8-1, this SECTION establishes standards for drilling ground water heat pump systems that are in addition to the general requirements for drilling a well under 312 IAC 13 and this document. 312 IAC 13-2-4, Sec. 4. (a) A competency examination will be given by the division at least two (2) times annually. The examination will be given on a day specified by the division during the second full week of June and during the second full week of November.