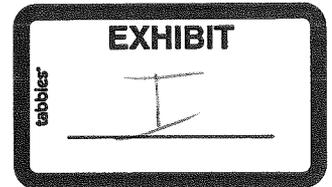


# GeoThermal Systems, llc

*Environmentally-Friendly, High Efficiency Heating & Cooling Systems for Quality Homes*

April 10, 2008



Commissioner Jerry Farrell, Jr.  
Department of Consumer Protection  
State Office Building  
165 Capitol Avenue, Room 103  
Hartford, CT 06106

Dear Commissioner Farrell:

This letter is in response to a request for comments pertaining to new regulations being drafted by the State of Connecticut Department of Consumer Protection concerning well drilling and geothermal installations. For your information, the author of this response is Scott E. Tiefenthaler, M.E. of Fairfield, CT. I am a mechanical engineer and owner of GeoThermal Systems, llc which can be found on the web at [www.geothermalsystems.com](http://www.geothermalsystems.com). I am certified by IGSHPA for water-based geothermal installations and am a factory-certified dealer/installer of EarthLinked® direct geexchange geothermal systems.

Inspection of said draft regulations reveals that there are several provisions contained therein that will be of disservice to the consumers and the environment in the State of Connecticut. It would appear that the regulations have been drafted to provide the water well drillers in the State of Connecticut a virtual monopoly on the installation of geothermal systems.

The water well drillers in Connecticut (who I understand proposed most of the draft changes) are attempting to prevent the introduction of new, more efficient geothermal technologies in this state by specifying water/glycol in plastic pipe as the only allowed underground heat transfer materials, by requiring backfilling/grouting methods and materials that are not used or needed by non-water-based systems and by overcomplicating the bore hole drilling licensing process. If approved in their current form, these regulations will greatly reduce competition in the geothermal market, significantly increase the installation costs of geothermal systems to Connecticut consumers and they will ultimately serve to decrease state-wide energy efficiency.

## **Water-Based and Direct Geoexchange Technologies**

By way of background, water well drillers use large, heavy drill rigs to install *water-based* geothermal loops. In most situations, a water well drill is used to bore 6-inch diameter holes 300 to 500 feet into the earth. Closed-loop heat exchange assemblies are installed in the bore holes using black HDPE pipe which is virtually identical to the piping material commonly used in

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lawn sprinkler systems. A water/glycol mixture is pumped through these plastic pipes to exchange heat with the earth. Heat is extracted from (heating mode) or rejected to (cooling mode) the water/glycol mixture via a heat exchanger in the heat pump and thus a building can be heated or cooled.

Direct geexchange is a simpler and more efficient technology that has been developed and applied since the early 1980s throughout the U.S. To install most direct geexchange systems, a rock drill (which is much smaller and economical than water well drilling machinery) or a skid-steer mounted drilling head is used to bore 3-inch diameter holes 50 to 100 feet length into the earth at an angle. Closed-loop heat exchange assemblies are installed in the bore holes using the same type of copper pipe which is used in virtually every air conditioning system currently in use throughout the world. Refrigerant is circulated through the copper pipe and the heat of the earth is *directly exchanged* with the refrigerant, thus the term "direct geexchange."

As copper/refrigerant loops are far more effective at transferring heat than plastic/water loops, and because there is no need to expend energy on water pumps and secondary heat exchangers, direct geexchange geothermal systems are commonly 25% to 30% more efficient than water-based geothermal systems.

## **Requested Modifications to the Draft Regulations**

Specifically, it is hereby requested that the following modifications be made to the draft regulations (presented in the order presented in the draft regulations):

### **Sec. 25-128-39a Geoexchange bore holes**

There is no benefit to consumers or groundwater protection in specifying minimum bore holes of four (4) inches. Some direct geexchange geothermal systems can easily be installed in shorter three (3) inch diameter bore holes which has the effect of reducing drilling, backfilling, the potential for groundwater contamination and overall system installation costs to the consumer. It would benefit CT consumers if this regulation were amended to allow for any size borehole which will suit the method and technology being used for each particular installation.

### **Sec. 25-128-39b Closed-loop geexchange system fluid**

As currently drafted, this section will grant water well drillers an effective monopoly on geothermal installations in the State of Connecticut. By allowing only water-based heat transfer fluids, CT consumers will not be able to install direct geexchange systems which have successfully and safely been used in other regions of the U.S. for over 28 years. The refrigerants used in direct geexchange systems boil at about 40°F below zero and are not water soluble, thus

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they instantly gasify if not kept under considerable pressure. The net effect is that *direct geexchange systems pose no meaningful, potential or demonstrable negative effects on the underground aquifer.*

Direct geexchange systems are more efficient than water-based systems, they cost less to install and in many situations are the only geothermal technology that can be practically used to retrofit geothermal to existing homes (which constitute the vast majority of potential geothermal installations in Connecticut) due to reduced loop requirements. In order to best serve the interests of CT consumers with appropriate protection of groundwater, this section should be amended to allow for the installation of copper/refrigerant direct geexchange systems.

## Sec. 25-128-39c Closed-loop geexchange system piping

As above, this section has clearly been written to serve the interests of the water well drillers and it would be detrimental to the interests of CT consumers to limit geothermal loop construction to plastic pipe. Copper pipe, which has been the material of choice for underground water piping and refrigeration applications for many decades, is a stable, naturally occurring material perfectly suited for use as direct geexchange geothermal loop material. The great majority of public water service to homes in Connecticut is delivered via buried copper pipe which has been proven safe and durable in tens of millions of installations throughout the U.S. It has been proven to be an extremely corrosion resistant material in underground applications.

Because copper and refrigerant are far better at transferring heat than plastic and water, as exemplified by their use in virtually *all* refrigeration systems, direct geexchange systems are more efficient than water-based systems and require less geothermal loop piping to be installed. With greater efficiency and less piping and drilling required, direct geexchange systems are a better value for consumers in Connecticut. The water well drillers are well aware of these facts and the current draft of the regulations is a blatant attempt to box a competing technology out of the market for their benefit and to the detriment of the consumers and the environment in the State of Connecticut without environmental benefit.

In addition, paragraph (c) should be modified to require a 24-hour pressure test as 30 minutes is not enough time to detect a pressure variation due a very slow leak in any type of large piping system.

## Sec. 25-128-48a Annular space

Paragraph (c) of this section specifies that all closed-loop geexchange bore holes must be backfilled with bentonite grout. This specification was written in by the water well drillers and arises from the fact that, a) the plastic tubing used in the water-based loops installed by water

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well drillers, while inexpensive relative to copper, is a poor conductor of heat energy and, b) water well drilling equipment typically drills bore holes six inches in diameter and (c) if such a large bore hole is not filled with a relatively conductive material, system efficiency will drop significantly. Thus, in order to offset these effects, water-based geothermal loops have to use these grouts in order to attain reasonable efficiencies.

The copper pipe used in direct geexchange systems, however, is highly conductive and can be installed in smaller bore holes. With a highly conductive loop material and with a much smaller space around the pipes, it is not necessary to go to the expense of using bentonite grouts to backfill a direct geexchange bore hole. Because direct geexchange boreholes are not as wide or deep as water-based bore holes and are easier to backfill, direct geexchange systems are more affordable than water-based systems in most applications, a definite benefit to homeowners.

In addition, paragraph (g) of this section specifies that tremie tubes must be used to grout geothermal boreholes. This proposed regulation is intended to benefit installers of water-based systems that use bore holes up to 500 feet deep. As direct geexchange installers often use bore holes just 50 feet in length, the tremie method of backfilling is not required and is of no practical benefit. Stipulating that tremie tubes must be used to backfill geothermal bore holes in all types of installations will only serve to increase the cost of geothermal installations in Connecticut.

Sec. 25-128-58d Contractor limited to geexchange bore hole drilling

This entire section has been written to reflect past practices of the water well drillers that served to govern licensing and methodologies pertaining to the drilling, plumbing and servicing of water supply wells. The drilling of geothermal boreholes, whether for water-based or direct geexchange applications, has nothing to do with “the installation, repair and maintenance of pumps, pump motors, pump piping, valves, wiring, electric controls and tanks.” These are all requirements for installing water supply wells and should be properly included in licensing language for water supply well drillers. Including this language in regulations pertaining to the drilling of geothermal bore holes, however, serves only to allow water well drillers to monopolize the geothermal drilling market to the detriment of consumers in Connecticut.

It is important to note that the drilling of geothermal bore holes and the installation of underground geothermal piping, which occurs outside the foundation of a building, is a distinctly different activity from the installation of geothermal pumps, air handlers and ductwork, which takes place inside the foundation of a building. All activities inside a building fall under the realm of the heating, ventilation and air conditioning (HVAC) contractor who must be properly licensed with the State in order to obtain work permits and perform this type of work. Requiring proficiency in water well construction or HVAC disciplines of geothermal bore hole drillers is of

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benefit to no one except the existing water well drillers. Enactment of the proposed drilling licensing regulations will serve to create unnecessary costs and impediments in the market to the detriment of consumers.

It is suggested hereby that a new drilling license be created that limits a geothermal drilling contractor to boring holes, inserting copper or plastic pipes and backfilling the bore holes as appropriate for the method of loop construction being employed for the particular installation. With a requirement for appropriate training, testing and licensing, there is no need for any extended period of training or apprenticeship for these activities. Indeed, there is no license required to operate a backhoe or excavator in Connecticut. Drilling holes in the ground is a similar activity and the creation of expensive and unnecessary barriers to entry to this field will only serve to make the adoption of beneficial geothermal technologies that much slower in the State of Connecticut.

## **In Conclusion**

It is the responsibility of the Department of Consumer Protection in the State of Connecticut to protect consumers by promoting competition while protecting the rights and safety of the residents of our state. The regulations in their current form will definitely increase the cost of geothermal installations to Connecticut homeowners and will significantly slow the adoption of geothermal technology in Connecticut. In this day and age, with our dependence on foreign oil and with global warming portending dire consequences for future generations, we should be doing everything reasonably within our power to save energy and to decrease carbon emissions.

Geothermal heating and cooling has the potential to make a real difference in our society and Connecticut regulators and legislators should be doing whatever they can to promote its rapid growth. I urge the Connecticut Department of Consumer Protection to redraft these regulations with this objective foremost in mind.

Respectfully Yours,

Scott E. Tiefenthaler, M.E.