

Overview of Dandelion Response to Proposed Regulations

We appreciate the thoughtful and thorough approach that Connecticut is taking in revising the regulation of Well Drilling and Geothermal Systems and its willingness to engage geothermal drillers such as Dandelion on these critical issues.

The Dandelion team has consulted with multiple engineers and well drillers in crafting our updated response and incorporated feedback from staff at the Department of Consumer Protection, particularly as it relates to setback distances. We've limited our below comments to language that will have a high impact on geothermal system eligibility in Connecticut and aligned our recommendations with other jurisdictions, such as Long Island.

One primary concern is that the proposed requirements for closed-loop system design are very rigid. By specifying materials and methods, they prevent installers from innovating on system design to improve performance and reduce costs for homeowners. Our goal in suggesting improvements is to provide flexibility for installers to improve system performance and design while keeping bad actors from using rule of thumb design to create ineffective systems.

The requirements should allow for the adoption of innovative new products, configurations, or designs so long as they follow industry standards and use industry accepted methods and materials and result in the intended outcomes. At Dandelion, we've focused significant effort on developing software and equipment to safely install ground source heat pumps on smaller lots and broaden eligibility for single-family homeowners.

If the requirements are implemented in their current form, it will limit geothermal growth and disproportionately impact less affluent homeowners with smaller lots, for whom a couple of feet could mean the difference between lot eligibility and ineligibility.

In general, our comments fall into two categories, with the vast majority falling into category one:

- 1. Replace specific definitions developed by the Department of Consumer Protection with definitions approved by industry standard associations such as the International Ground Source Heat Pump Association (IGSPA), the American National Standards Institute (ANSI), and the CSA Group (CSA).** In each case, the focus should be on ensuring an expected outcome rather than specifying the methods and materials. In particular, the limit of glycol concentration in Sec. 25-128-39b to 20% will have a significant impact on operations, and is out of alignment with CSA guidelines.
- 2. Reduce proposed setback distances in specific circumstances including sealed wastewater tanks and septic tanks (Sec. 25-128-41a1), as well as leaching systems (Sec. 25-128-41a2), where closed-loop geothermal poses no risk of damage or contamination at closer distances.** The proposed setbacks in these categories would severely limit residential site eligibility and disproportionately affect homeowners with smaller lots.

Section	Dandelion Response
Sec. 25-128-36. Definitions	Recommendation: For the entirety of this section, either copy the definitions from C448.0-16, Section 3, or refer to them.
<p>Sec. 25-128-36.</p> <p>[(14)][(22)] Grout or grouting material: A low permeability material placed in the annular space between the casing and the formation or within [the borehole] <u>a geothermal bore hole</u> which is at least impermeable as the soil formation. The purpose of the grout is to resist the migration of pollutants into the annular space.</p>	Recommendation: Defer to the definition in CSA C448.0-16, Section 3 or define grout as a material with independently verified permeability rates less than 1nm/sec, and certified to NSF Standard 60/61.
<p>(NEW) Sec. 25-128-39b. Closed-loop geothermal system fluid</p> <p>A well contractor shall only use the following closed-loop geothermal system fluids for use in closed-loop geothermal systems:</p> <ol style="list-style-type: none"> 1. The refrigerants commonly referred to as R-134A, R-407C, and R-410A; 2. Drinking water, as defined in section 19-13-B102(a) of the Regulations of Connecticut State Agencies; 3. Heat transfer fluids containing potable water combined with a maximum of twenty (20) percent propylene glycol that has been approved by the federal Food and Drug Administration. All chemicals used or added to fluids circulating through a closed-loop geothermal system for heat exchange shall be those specified by the manufacturer and shall be subject to industry approved standards; and 	Recommendation: Defer to CSA C448.3-16 and manufacturer guidelines. In particular, 20% glycol concentration will severely limit system design and is at odds with both CSA guidance and most glycol manufacturers, who recommend a minimum of 25% to ensure proper inhibitor levels in order to protect against water quality issues.
<p>(NEW) Sec. 25-128-39c. Closed-loop geothermal system piping</p> <p>(a) The only acceptable materials for the</p>	Recommendation: Much of this is very prescriptive and will limit system design in the future as well as the adoption of new materials.

underground portion of a closed-loop geothermal system are as follows:

1. Copper, that has a cathodic protection system;
2. High density, polyethylene extrusion compound having a cell classification of PE 345434c or PE 355434c with an Ultraviolet (“UV”) Stabilizer of C, D or E as specified in Standard D-3350 of the American Society for Testing and Materials (“ASTM”) with the following exception: This material shall exhibit zero (0) failures when tested for one hundred ninety two (192) hours or more under ASTM D-1693, Condition C, as required in ASTM D-3350. This material shall maintain a one hundred sixty (160) pounds per square inch (“psi”) hydrostatic design basis at 73.4 degrees Fahrenheit per ASTM D-2837, and shall be listed in PPI TR4 as a PE 3408 piping formulation; and
3. Those materials approved by the Department of Consumer Protection in consultation with the

For this entire section, defer to CSA C448.0-16, Sec 5.4

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Department of Public Health and the Department of Energy and Environmental Protection.

(b) The only acceptable methods for joining sections of buried geothermal piping are as follows:

1. For copper piping assemblies, by the use of brazed joints;
2. For polyethylene piping assemblies, by use of the heat fusion process in accordance with the pipe manufacturer’s specifications, or by use of mechanical stab fittings approved by the International Ground Source Heat Pump Association (“IGSHPA”); and
3. For piping made of materials approved pursuant subsection (a)(3) of section 25-128-39c of the Regulations of Connecticut State Agencies, by the use of those methods approved by the Department of Consumer Protection in consultation with the Department of Public Health and the Department of Energy and Environmental Protection.

(c) All geothermal systems shall be pressure

<p>tested with water, air, or an inert gas to a minimum of one hundred fifty (150) percent above the heat pump manufacturer's operating specifications for a minimum period of thirty (30) minutes before being put into service. Any system found to leak shall be repaired or replaced and then retested before being put into service.</p>	
<p>(NEW) Sec. 25-128-41a. Location of closed loop geothermal systems</p> <p>(a) The following are the separating distance specifications for all closed loop geothermal systems. Distances cited are minimum separating distances based on horizontal measurements:</p> <p>1. 25 feet from a wastewater tank, septic tank, grease interceptor trap/tank, pump chamber, or sewage or wastewater piping that is not approved tight pipe per Section 19-13-51d of the Regulations of Connecticut State Agencies; however the distance for geothermal piping from the building served to the bore hole, trench, or closed loop surface water system shall be at least 10 feet.</p>	<p>Recommendation: This distance should be reduced to 15 ft from a wastewater tank or septic tank as there is no risk of damaging sealed wastewater tanks and/or septic tanks.</p> <p>When a load is imposed on soil by the tracks or wheels of a drill rig, that load is distributed throughout the soil at an angle (or an upside down vertical cone, in 3D) called the angle of influence.</p> <p>The soil conservatively distributes the stress from an external load (drill rig's weight) through an angle of 45 degrees. This affected area is known as a zone of influence.</p> <p>With a 15ft setback and a conservative 45 degree angle of influence, the zone of influence (stress distribution) will pass 15ft below natural ground level at the location of the closest septic tank wall.</p> <p>We have encountered no instances where a septic tank is buried to a depth exceeding 13ft.</p> <p>Dandelion is happy to follow up with additional calculations as needed to demonstrate.</p>
<p>Sec. 25-128-41a. Location of closed loop geothermal systems</p>	<p>Recommendation: Leaching systems should be 25 feet regardless of whether</p>

<p>2. 50 feet from a sewage or wastewater leaching system, or cesspool located up-gradient of a bore hole or trench; however the distance for geothermal piping from the building served to the bore hole, trench, or closed loop surface water system shall be at least 10 feet.</p>	<p>it's located up-gradient or down-gradient of a bore hole.</p> <p>Dandelion requires that our bores be grouted within 24 hours of drilling in accordance with CSA C448.0-16, Section 3.</p> <p>The primary goal of full length, pressure tremie grouting is to provide an environmental seal to protect groundwater. When this practice is followed, the risk of contamination from sources at or near the surface is non-existent.</p> <p>This requirement, if implemented as written, will make it very difficult for residential contractors to find feasible drilling locations in smaller lots, which will disproportionately hurt lower and middle class homeowners.</p>
<p>Sec. 25-128-43. Casing of drilled wells</p>	<p>Recommendation: clarify that this section only pertains to permanent casings. For example, Dandelion increasingly uses sonic rigs which do not require the installation of a permanent casing.</p>
<p>Sec. 25-128-48a. Annular space</p> <p>After installation of piping, the bore hole shall be covered with a protective layer of grout at least one (1) foot thick and three feet in diameter, centered over the bore hole. Detectable underground tape shall be installed above all bore hole locations.</p>	<p>Recommendation: remove this requirement as this has no bearing on safety and does not align with industry standards.</p> <p>CSA guidelines require full length, pressure tremie grouting to protect groundwater.</p>
<p>(NEW) Sec. 25-128-49a. Geothermal bore hole termination</p> <p>Geothermal bore holes shall be terminated a minimum of four (4) feet below the proposed</p>	<p>Recommendation: Remove this requirement as it would have a potentially huge impact on system costs in circumstances where bedrock is hit at</p>

<p>finished grade and shall be fed to the point of termination, as shown by Figure 6 in Section 25-128-64 of the Regulations of Connecticut State Agencies, except that bore holes terminating in a structure shall be terminated a minimum of six (6) inches above the finished floor, as shown by Figure 7 in Section 25-128-64 of the Regulations of Connecticut State Agencies. Casing, if used during bore hole drilling, shall be capped from the time of installation until the installation of the geothermal system piping. As the bore hole is being grouted, the casing may be withdrawn.</p> <p>Sec. 8. Sections 25-128-51 through 25-128-55, inclusive, of the Regulations of Connecticut State Agencies are amended to read as follows:</p>	<p>shallow depths of less than 4ft.</p> <p>In cases where we cannot excavate 4ft, Dandelion insulates the supply-return piping and associated connection points with R10 closed-cell insulation that is rated for direct burial.</p> <p>Dandelion is happy to demonstrate through calculation that R10 insulation is the equivalent of 60 inches of additional pipe burial depth.</p>
<p>(NEW) Sec. 25-128-57a. Abandonment of geothermal systems</p> <p>When abandoning a geothermal system, closed-loop geothermal fluid shall be displaced with bentonite grout or a substance approved by the Department of Consumer Protection in consultation with the Department of Public Health and the Department of Energy and Environmental Protection, or otherwise be evacuated from the geothermal system by a process approved by the Department of Consumer Protection. After displacement or evacuation of the fluid, the bore hole and excavation shall be filled and covered with grout to provide a cap at least twelve (12) inches thick over the bore hole. All fluids or gases shall be contained and properly disposed of. Sec. 11. Sections 25-128-58a through 25-128-62, inclusive, of the Regulations of Connecticut State Agencies are repealed.</p>	<p>Recommendation: Defer to CSA C448.0-16, decommissioning and abandonment section</p>