Minutes: Submerged Closed Loop Heat Exchangers Advisory Committee

Date May 12, 2025, 1:00 – 3:30 p.m.

Location Hybrid Teams Meeting; Minnesota Department of Health, Freeman Building, 625 Robert St. N., Saint Paul, MN 55164

Attendees **In Person:** Danny Nubbe (Certified Representative), David Henrich (Advisory Council on Wells and Borings), Jeremy McConkey (Professional Association), Jim Lubratt (Geothermal Professional), Keith Larson (Geothermal Professional), Luke Hollenkamp (City Representative), Ryan SanCartier (Professional Association), Todd Bloomstrom (City Representative), Willy Miley (Geothermal Professional)

Virtual: Dave Traut (Certified Representative), Don VanKeulen (Delegated Well Program), Jay Egg (Geothermal Professional), Jeff Luehrs (Delegated Well Program), Luke Pickman (Professional Association)

MDH: Jon Olson (WMS Technical Unit Supervisor), Jennifer Weier (WMS Hydrologist Supervisor), Avery Guertin (WMS Regulatory Coordinator), Kara Dennis (WMS Hydrologist)

Acronyms and Terms

ROI – Radius of influence

SCLHE – Submerged Closed Loop Heat Exchangers

WMS – Well Management Section

Welcome and updates

Guertin expressed gratitude for the feedback and comments provided by members throughout the past four meetings. Members and MDH staff briefly introduced themselves and described their constituencies. Luke Pickman is present as an alternate for Aaron Meyer, representing a professional association.

To MDH's understanding, the Order of Adoption for the proposed SCLHE rule addressing the permitting and installation requirements remains with the Office of Administrative Hearings. Members will be informed of advancement of the current rulemaking.

Committee member discussion

Topic: Groundwater Radius of Influence Testing (Darcy Solutions Data)

Miley described Darcy Solutions' radius of influence (ROI) testing at high and low pumping rates across a typical range of wells in operation for a SCLHE system. These wells were tested at multiple pumping configurations (i.e. one well vs. multiple wells pumping) and in both unconsolidated and bedrock aquifers. Miley also shared information on lateral groundwater flow velocities induced from wells in the bedrock Prairie du Chien aquifer at a high pumping rate.

Traut asked how the vertical influence on the aquifer is measured. Miley responded that pressure transducers were installed within the wells and used to measure the vertical influence. Weier asked about the area of vertical influence on the groundwater and the amount of mounding that would occur with multiple wells pumping. Miley added that Darcy Solutions has not seen a change in the groundwater mounding from one well pumping to multiple wells pumping. Weier asked if they would be willing to share these data. Miley said that they would share these data with MDH but not with the whole committee.

Topic: Darcy Solutions SCLHE System Temperature Transport Model (Darcy Solutions Data)

Miley shared data from modeling performed by an external contractor and their internal team. Miley described the groundwater temperature results from the model and shared an image illustrating the modeled groundwater temperature distribution in the reinjection zones. He noted groundwater temperature in the pumping zones would not change. Nubbe asked about the temperature modeling for when multiple wells are pumping.

Miley provided an example of three dipole wells operating for a heating and cooling system over multiple years. Miley stated that Darcy Solutions are not concerned about their systems cooling an aquifer and are looking at possible warming effects on an aquifer. Hollenkamp asked Miley for clarification on the thermal battery effect. Miley said that the thermal battery effect is mostly influenced by the vertical separation between wells. Low groundwater flow would create a condition where the heat takes longer to dissipate. Larson asked what the separation distance is between the wells. Miley responded that the modeled wells are separated by approximately 100 feet. Larson asked if they had the entire thickness of the aquifer modeled. Miley said that they have not seen much of a thermal change outside of the vertical ROI. Henrich added that the most concentrated area of temperature change is right around the injection site.

Miley showed another example illustrating a 20-year model using four dipole wells operating only in cooling mode. These wells were modeled with injection and extraction zones in the Mount Simon sandstone aquifer. Larson expressed concern about the unbalanced load of operating only in cooling mode. He asked if the model accounts for the fluctuations in the heat exchanger. He also noted that the modeled wells were 200 feet apart and in many cases Darcy Solutions is proposing to space wells 50 feet apart.

Members asked about the vertical conductivity values used in the model, and Miley was unable to answer this question. Lubratt asked if there was a possibility that the water could freeze. Larson said that the heat exchanger would freeze before the water would. Henrich said that it was impossible that it would freeze with so much water in the system.

Weier asked where Darcy Solutions gets the hydrogeology information for their models. Miley said that they install a test well at each site, and they conduct a pump test and obtain information on hydrologic conductivity.

Larson asked if they have done any modeling on heating-only thermal loads. Miley said they have not looked into this. Miley said the SCLHE systems are designed to not raise the temperature too high to protect the health of the aquifer. Miley said that Darcy Solutions does not want their systems to raise the groundwater temperature above 90 F. Larson asked if MDH has a prohibition on how much groundwater temperature can be changed. Weier said that MDH does not have a limit on how much the temperature of groundwater can be changed. Henrich said that the temperature within closed loops systems usually gets up to 90 F.

Weier asked if Darcy Solutions are collecting any field data to measure the accuracy of their model. Miley said that they are collecting data from their existing SCLHE systems.

Topic: Screen Configurations – prevention of interconnecting aquifers

Henrich said a guiding principle of the well drilling industry in Minnesota is to assure that wells are constructed to not interconnect aquifers. Nubbe said that if contractors can identify aquifer units, most licensed well contractors are able to avoid interconnecting aquifers. Traut said that most licensed well contractors can identify different bedrock aquifer units. Henrich said that even in unconsolidated formations, Minnesota Rules is very clear about what constitutes a confining and aquifer units.

Weier said that prior to the SCLHE systems, generally the only reason to construct a well with multiple screens separated by a blank is to connect different zones to increase yield, generally connecting two different aquifers. Minnesota Rules prevent interconnection of aquifers and multiple screens separated by a blank as a “belt and suspenders” approach to preventing aquifer connections and spread of groundwater contaminants. Weier explained that wells used for SCLHEs are different because they often need multiple screens to function efficiently. Traut agreed and said that the original prohibition on multiple screens with a blank in between was to prevent comingling water from separate aquifers.

Weier asked the committee members how MDH would verify the rule prohibiting interconnection of aquifer is met for each well if there is no longer a prohibition on multiple screens. The variance process allows MDH to review each situation and the geology at the site to assure that aquifers will not be interconnected. Henrich said there are applications, other than for SCLHE systems, that could benefit from a rule change to allow for multiple screens separated by a blank. He added that using a blank could separate fines from an aquifer. Nubbe said there are methods within the existing rule framework

to achieve this and avoid violating the rule on multiple screens but added that it can be challenging in some situations to provide a sand-free well.

Weier asked the licensed well drillers if they would support a rule change to allow multiple screens separated by a blank for all water-supply wells. Olson clarified the intended scope of this discussion is limited to SCLHEs. Traut and Henrich said that they would like to have a conversation about this application to all water-supply wells at some point in time because there could be benefits to allowing this screen configuration for water-supply wells.

McConkey asked how MDH verifies well construction. Weier said that MDH staff inspect approximately 25% of all new water-supply wells, but they also rely on the well construction record to verify that the well was constructed according to Minnesota Rules and Statutes. Miley asked why a possible change to rule cannot apply to all water-supply wells. Guertin clarified that this expedited rulemaking process is only applicable to SCLHEs.

Miley suggested that if a split-screen configuration could be allowed by Minnesota Rules then that well could not be used as a potable water-supply well. Nubbe asked if we are still considering multiple uses for these SCLHE wells. Guertin and Olson said that if we want to expand the focus of this rulemaking effort, it will need to be handled outside of a possible expedited rulemaking for SCLHE systems.

Egg said that in most states in the U.S., they are able to pull nonconsumptive water use permits to model and install aquifer thermal exchange wells. Egg suggested that many of these conversations could be applicable to thermal exchange wells. Miley clarified that the change in rule language to extend the setback distances for SCLHEs only, and a conversation about isolation distances for other wells and borings could occur with a separate rulemaking effort. Larson said that the focus should be specifically on SCLHEs. Henrich agreed and added that we should consider other applications to these SCLHE systems to offload the thermal load more efficiently. Miley suggested the variance process for other non-potable uses of water from SCLHE wells.

SanCartier asked what the current penalty is for a licensed well contractor that constructs a well interconnecting aquifers. Olson provided a brief overview of the enforcement process. SanCartier asked if this happens often. Weier said that in the time that she has been in this position this type of violation comes up occasionally, about once every few years. Weier also said that it can be costly to correct, since it usually includes sealing and reconstructing a well. SanCartier suggested maybe a harsher penalty to help assure compliance with this rule requirement. Nubbe and Traut said that the penalties are sufficient. Luehrs said that the deterrent is the cost associated with the correction. Nubbe also provided some background on the bond requirement and how that also assures compliance. Henrich asked MDH what percentage of correction orders are not complied with. Weier said that most of the time correction orders are complied with. Henrich said that compliance is fundamental for this industry.

Weier asked if there are steps besides prohibiting multiple screens that MDH could build into new rule language to assure that aquifers are not interconnected, such as requiring test drilling. Traut said that

the gamma log data would be helpful for determining separate aquifers within bedrock. Weier said that the Minnesota Geological Survey (MGS) has communicated that gamma logging is not accurate for determining unconsolidated aquifers. Miley said that he is opposed to additional requirements, but if a well construction record shows that aquifers are interconnected then the well should have to be sealed. Luehrs said that he has talked with MGS many times, and they are unwilling to call out clay layers in the gamma log data.

Open Forum

Dan McCarty asked how Darcy Solutions verifies that a packer seal does not leak. Miley responded that systems are pressure tested and a leak would be detected by pressure sensors.

Adjournment

Next meeting: June 2, 2025, from 1 – 3:30 pm

Meeting will be held at:

Freeman Building, Room B145
625 Robert St. N,
St. Paul, MN 55164
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5/27/2025

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