

Maple Plain, MN 55359

## Notes for MN Veterans Home in Bemidji

#### General Contractor:

Adolfson & Peterson Construction

Matt Adolphson - <u>madolfson@a-p.com</u> Matt Mongeon - <u>mmongeon@a-p.com</u> Ben Bowman - <u>bbowman@a-p.com</u> Adam Clark - <u>adamclark@a-p.com</u>

## HVAC Contractor:

- Contact: Manager Jaime Quello jaimeq@psmhvac.com Office - Anna Wellcome anna@psmhvac.com A/P - Elizabeth Kahlstorf elizabeth@psmhvac.com Site Supervisor – Justin Wellcome – 218-556-7508 Fusion Worker – Cody "Cooter" 218-407-2022 Drilling Worker – Trevor 218-368-3491 (Locating) Borstad Drilling – Willie 218-556-7179 williecc2014@gmail.com Mineral Services Plus – Nick Milbrandt – 800-928-3771 nickm@mineralservicesplus.com (Flushing and filling) Chris Prokosh – MDH 218-308-2114 chris.prokosch@state.mn.us Reed Paitich – PE - Wold Architects and Engineers - rpaitich@woldae.com
- Phone: 218-751-4502
- Address: Peterson Sheet Metal 3728 Bemidji Ave N Bemidji MN 56601
- Job Site: 900 Anne Street NW, Bemidji, MN 56601
- 3/21/2022 First contact by email regarding job.
- 3/21/2022 Advised Jaime by email that I would be back in town on 3/24 and would call
- 3/24/2022 Intro call. I asked Jaime about who the drilling contractor would be. Advised that it was North Central Services. They want to start 4/4 in order to get the work done because North Central does primarily fiber and cabling jobs and need to get on the road before road restrictions were over. Jaime described the job and mentioned that it was 16 stacks of three bores at various levels and that it was unusual. Advised Jaime that it was not unusual at all to have

offset runs at three levels. Asked about the length of each run -500 feet. Jaime indicated that they were buying 5,000-foot bulk HDPE and making their own loops in their shop and that he was getting some of their guys certified for fusion work. I requested access to the plan portal to pull the specs and estimated that we would need to make 5-10 trips over the course of the job. Jaime said that he would make sure that they took photos.

- 3/25/2022 Jaime called regarding what size tracer wire was needed. Advised to check the spec that it needed to be strong enough to hold up during installation.
- 3/25/2022 Received access and downloaded plans.

https://www.bidtracer.com/secure/docview\_v2.aspx?ParentID=584321&Type =Plans&ID=21-0180&Project=1&Name=Return%20To%20Bid&Supercede=Hide&Folder=PI ans&JobID=CC2141&DivID=0&SubmittalLogID=1039937&ReturnURL=vend orproject.aspx?JobID=CC2141%26DivID=0%26SubmittalLogID=1039937

Received email with manufacturer information – Centennial – for factory fabricated loops. Responded by email that I would ignore initial discussions about field fabricated loops and use the information from Centennial. Also requested licensing information for the driller – North Central Services – as the job requires license BGHE driller for jobs deeper than 15 feet. Couldn't find North Central Services on the MDH website as a licensed driller. <u>https://ewells.web.health.state.mn.us/searchState.jsf</u> Downloaded the MDH guidelines for BGHE requirements. Will send quote for commissioning services by next week. Requested licensing confirmation from MDH.

- 3/27/2022 Sent quote documents to Jaime Quello. \$29,500 + \$165/hr and expenses for items that are caused by delays or additions.
- 3/28/2022 Received link for plans and specs.
- 3/29/2022 Traveling away from office until 4/7/22 and unavailable.
- 4/19/2022 Received subcontractor/new vendor forms from Peterson Sheet Metal-Anna Wellcome. Completed W9; ACH payments form; Vendor info form and returned to Anna Wellcome on 4/22/22.
- 4/27/2022 Received contract forms from Elizabeth Kahlstorf for signature. Forwarded to David for signing.
- 4/29/2022 Met with David at office to discuss the spec and potential issues with the project.
- 5/2/2022 Phone call with Jaime Quello. Advised that the subcontract paperwork would be returned today and that the boilerplate was probably for a subcontractor doing construction as opposed to commissioning. Will make modifications before returning.
  - Per Jaime, Willie Borstad will be running the horizontal drill rig.
  - They will be pulling a tremie pipe for the grout.
  - According to Jaime, the drill rig is licensed and I requested a copy of the paperwork. Borstad is renting the drill rig from North Central.

- Discussed the variance for the piping that was approved by the MDH.
- Jaime says his workers are fusion certified and will be doing the fusions. Requested copies of the fusion certifications.
- They are using 500-foot factory u-bends so only the fusions that are done on site need documentation and testing. Advised that I would need to take a destructive test.
- They plan to start on 5/16 and I told Jaime that I can't be there until after 5/24 when I return.
- Requested a list of contacts for all subs working on the geo installation along with IGSHPA certifications and fusion certs.
- Need to take grout samples from the first three holes along with amount of grout used.
- Photos of the markings on the ends of the loop to show the lengths will be needed.
- Conference call with Jaime and Willie on 5/4/22 2PM.
- Sent email to confirm call discussions.
- 5/04/2022 Conference call with Jaime Quello, Willie Borstad and the Peterson field manager, Jeff Wellcome(?). Explained the needs for documentation before work starts based on 1.12 A and B. Jaime said that there would be no problem getting the fusion cards for his workers and that they were working with Goodin to get copies of the cards. In terms of IGSPHA Installer certifications for Willie Borstad, Jaime said that they would make sure that they got that "completed". My impression is that Willie or his operator may not currently be certified at this time. Jaime said it was no problem since they had a couple weeks to take care of it.

Willie Borstad phone number: 218-556-7179 Willie says that the drill unit is registered and will have the MDH decal.

Advised Jaime that we would visit on 5/13 and wanted to look at the site and document materials for loops and grout. Asked for photos and a grout sample for the first three loops. Loop ends should be capped after installation and air pressure testing. We will check the pipe markings and run a fish tape to verify the loop length.

Received submittal for the Centennial loops and Kristech Tracer Wires.

- 05/06/2022 Signed subcontractor agreement with markup returned to Elizabeth Kalsdorf
- 05/13/2022 Onsite visit David H. and Jeff W. met the Site Manager, Justin Wellcome. Justin walked the site with us and showed us the materials that were stockpiled on-site. Photographed the 1 ¼" pipe; Grout and graphite enhancer. Discussed the fact that the loops were not the factory tested items that we received the manufacturer information regarding. Noted the loops are too small to allow proper finishing and connection and will have to have field assembly and testing prior to installation. Will require extensions to be proper length.

The driller just bought a new grout pump made by Rosewall that is a paddle style mixer with 2 hoppers. Observed ~18 pallets of grout and ~4 pallets of graphite. The installers are planning for a 0.8 TC value with 20% solids.

Met with Jaime Quello at the PSM Office and were provided with resume information for the staff. Will look through it. Jaime took us through the shop and showed us the factory assembled U-Bends that were purchased for assembling the loops. Photos of the U-Bends and tracer wire were taken.

After returning back to the office, sent an email request to Jaimie requesting a step-by-step explanation of how the loops would be assembled and tested and how the extra required lengths would be determined. David spoke to the consulting engineer about assembling and testing the loops in the field as well as the extra splices. Was advised that was not part allowable steps in the original documents and the main engineer would be asked for guidance

05/18/22 Received a follow-up email from Jaime regarding the procedure for installing the field fabricated loops. While 3.06 D.1 requires that the pipe assembly must be pretested, there is a conflict in the spec regarding the use of field fabricated loops and the fact that factory loops are already pre-tested and pressurized.

Per Jaime: "We will do as per section 2.07.C "The HDPE U-bend assemblies or equivalent fitting for the horizontal boreholes may be assembled on site as the boreholes are completed. ...... Assembly must be pressure tested immediately after insertion..."

The description from Jaime:

- 1. We will add on the add the additional needed pipe to the 500-foot pipe via fused coupling.
- 2. We will pull the full run of additional and 500-foot pipe into the bore hole and then fuse on the manufactured U-bend.
- 3. Once fully in the bore hole the pipe and U-bend we will immediately pressure test the piping to 80 psi and leave that pressure on until we do permanent fusing onto the header.

Will visit on 5/31 to view and inspect progress.

05/31/2022 Arrived on site around 10:15.

The drill crew had progressed to approximately 200' in their fourth boring and Petersen Sheet Metal was pressurizing the first three loops. Two of the loops were previously manifolded together, the third loop was tested independently, all to 100 psi.

Observed that another hole had been started then abandoned due to interference from adjacent utilities. Drill crew is sourcing a more advanced locating system to help mitigate the interreference.

Other initial observations:

- Drill crew is working around a lot of obstacles. Other trades have placed trailers, materials and other items directly over the path of where they are trying to drill.
- Personnel from Borstad Drilling, NCS and PSM were all on site.

- Three borings had been completed.
- The three entry points for the completed borings were spread out. We estimate there was around 30' from the shallowest bore to the deepest boring entry points.
- 5 rows were staked and appeared to be properly placed.

The middle loop in row 8B was measured with a fish tape, which was easily installed all the way to the U-Bend. It indicated that there was 524.5' of pipe, 5' appeared to be sticking out from the boring leaving 520' below ground. The shallower loop appeared to have at least 25'+ of pipe exposed, meaning there may be less active heat exchanger in that boring, particularly below the 8' bury depth. The engineer has indicated that the additional couplings that have been used to extend the pipe lengths for the purpose of installing the heat exchangers should not be included in the final system. More care needs to be taken to ensure the maximum amount of pipe remains in the borings. The completed series in 8b shows that it is necessary to understand the bury depth, bore path and the necessary amount of piping to ensure the maximum amount of active heat exchanger. It may be necessary to add additional piping to each loop to ensure proper lengths at the bury depth. This was a concern that was covered during preconstruction meetings and still remains a concern. Will contact someone on-site to confirm the length of the added tails for each loop and to ensure consistency for all loops moving forward. (6/1 - confirmed that tails added are 50 ft to each reel)

On this day, the drill crew was not able to complete a boring and install the loop within the same day. We were also unable to witness the grouting procedures. In speaking with Willie Borstad, we understand that the previous three borings all required 18 bags of grout and 6 bags of graphite. According to manufacturer product data, this would yield approximately 318 gallons. The drill crew indicated they are drilling a 5" pilot bore and then an 8" back reamer when pulling the loop and tremie through the boring. An 8" boring, 520' has an approximate volume of 1,250 gallons. Grouting horizontal bores is an inexact science, but our observations and calculations raise some concerns whether this this is a sufficient amount of grout to satisfy both state codes and the intents of the project design documents. It is also worth noting that we did not see much if any evidence of grout on the entry side of the borings.

We also inspected the fusions on the joints used to pressure test the loops. The pressure in the loops was holding at 100 psi and the fusions all appeared to have all of the indications of properly joined pipe.

Will need to visit again to observe the grouting process; U-Bend fusion process and retrieve grout samples to submit for testing.

06/1/2022 Text confirmation that the lengths being added to the ends of each reel are 50 feet for each.

Spoke to Chris Prokosch at MDH. He has not yet been on site. Expecting to visit on Friday, 6/3. Shared observations regarding grout coverage on the first three boreholes and suggested that the entry holes by the exposed loop ends needs to show more evidence of grout/graphite to assure that there is sufficient displacement of the borehole drilling fluids. He will keep in touch.

6/8/2022 Spoke to Chris Prokosch (MDH) regarding his visit on 6/3 to the site. He watched the grouting process of one borehole and indicated that for his observation the process seemed to be getting good grout flow from the entry hole with evidence of cuttings being displaced by the grout. He said that the fact that they were working in sand made it more difficult to gage the proper amount of grout displacing cuttings vs a clay boring. He is asking others about the amount of grout, as the process is fairly new to him. Overall, he seemed to be OK with what he saw with the process.

6/13/22 Per Willie Borstad text, Will be doing a deep boring on Tuesday 6/13. Expect to pull pipe after lunch. Borehole #11. Will be onsite late AM and observe for the afternoon. Will take grout samples x3.

6/14/22 Observations - On site ~10:15AM.

**Status:** Drilling on 32-foot depth borehole of group 6B had progressed to about 300 feet on arrival. Noted that the drilling order of the borings was not sequential due to issues with locations around some 6' diameter steel culverts that were installed last fall. This is the twelfth boring.

**Locating Equipment:** The current locator tool being used is a Digitrak F5+, which is different from the first observation. The operator indicated that it was the 4th different locator that was tried and used in order to get satisfactory readings with the interference from the steel culverts. Locator photos taken.

**Borehole Conditions:** The borehole tailings being washed out of this loop were definitely different than the previous observed tailings from the 15-foot depth boring, which was mostly sand. This deeper borehole was yielding a bluish material – likely a lot of clay. Observed that the material encountered caused the drilling operator to need to clean out the borehole by pulling back 30-50 feet and adding more water to make the drilling less sticky after about 400 feet of progress into the bore. No other unexpected conditions were observed. Noted the drilling angle for the deeper hole is initially about 27-29 degrees. Photos of the borehole tailings taken.

**Overall Installation Progress:** Observed that there were 9 installed borehole loops under pressure of 100 PSI. Photos taken. There were two completed loops waiting to be pressurized as required. The pipes were properly capped. On a day without unexpected obstacles, it looks like one borehole completion per work day can be expected.

**Loop Tail Splices:** Noted that the completed and exposed loop pipes were cut to different lengths to facilitate connecting and testing the loops in groups. The pipe trimmings, discarded nearby, were all different length and discarded in a pile by the pressure testing manifolds. Based on the different lengths, I inquired about the difference and was advised that they had switched to 30 ft tailpieces for the 15-foot bores; 50-foot tails for the 24-foot depths; 70 feet tails for the 32' deep borings. The different length tailpieces were used to make sure that each of the different loop levels had 500 feet of usable length at 8 feet or greater, as required by specification. The crew advised that the expected trench for connecting the headers is planned for about 60 feet wide and 8 feet deep to make the loop connections.

**Staging of Loop Materials:** Observed the reels of HDPE pipe for this borehole were prepped with 70-foot tail couplings added to each reel. Requested and received a fused coupling sample for destructive test. Took photos of the staged tailpiece couplings. Everything looked good in terms of the coupling fusions.

There was grout and graphite staged by the grout pump for the current loop. Observed 33 bags of grout and 11 bags of graphite.

**Overall Site Condition:** The overall site had been tidied up since the previous visit with a number of vehicles, palleted materials and dumpsters relocated. There is still equipment and trailers that make the locating process more difficult than it needs to be. The borings will continue to get closer to the facility and the work is right at the edge of the temporary road. Based on observed progress, the traffic and staging on that side of the building will need to be relocated in order for drilling to continue.

**Drilling Progress in the Afternoon:** The Group 6B, 32-foot depth boring, was completed about 1:30PM. They used 580 feet of drilling rod to do the installation. Pulling of the loops, tremie pipe and tracer wire into the borehole commenced about 3PM. A factory U-Bend was assembled just before the end of the pull. At 5:20PM, the loop was completely in the borehole.

**Field Assembly of the U-Bend for the Loop:** Just prior to the completion of pulling the lines completely into the borehole, the factory U-Bend was fused to the loop ends using a generator and fusing tools. Observed the fusing tools being heated until correct temperature was reached and pipe ends and connectors being prepped prior to fusing. The process was timed by a third worker as two workers held the connections for the required time for proper fusion. The connections looked uniform and proper. Photos were taken and a sample was made for destructive testing. The process took about 15 minutes to complete.

**Borehole Grouting:** Grouting started at 5:28PM and was completed at 5:55PM. The tremie line was pulled about 3 feet into the borehole and grout/fluid was pumped until there was evidence of grout/graphite exiting the hole. At that point the tremie line was manually pulled as the grout was pumped. The grouting of the borehole is accomplished by a group of seven workers pulling the tremie line under pressure. I observed a total of 8 bags of graphite and 24 bags of bentonite actually mixed for pumping. Three grout samples were taken from different batches during the grouting process. At the completion of grouting the borehole, some left over grout was pumped into the openings of neighboring completed holes to use it up. Compared to a hydraulic reel line pulling the tremie, this method seemed to pull the tremie out faster than expected and at a less even pace. As it neared the end, the line was actually pushing itself out of the borehole.

**Grout Sample Collection:** Will collect (3) samples of observed grouting from beginning, middle and end of the grouting process. The drilling contractor, Willie Borson, collected a single sample on 6/13 from the previous 15-foot depth borehole of group 7A and it was given to TDI for testing.

**Grout Testing:** Initial testing of the grout using a KD-2 Pro tester showed the following results:

Group 6B initial sample from 6/14 boring: 0.67 TC value Group 6B middle sample from 6/14 boring: 0.765 TC value Group 6B end sample from 6/14 boring: 0.748 TC value

Group 7A sample provided by the driller from 6/13: 0.689 TC value Samples from 6/14 will be shipped to GeoPro for independent testing.

Left the site about 6:30PM.

- 6/15/22 Invoiced first half of project
- 6/17/22 Three Grout samples sent to GeoPro for testing: GeoPro, Inc 302 East Warehouse Street Elkton, SD 57026 Attn: Tyler

6/21/2022 Willie advises that they completed borehole #15 as of the end of 6/21.

6/24/2022 Grout tests received from GeoPro. Results range from 0.836 - 0.926 TC values, which is within the expected range. Reports forwarded to PSM and others.

7/01/2022 Per Willie: Drilling unit broke down. Awaiting cable repair. Expect to be ready to go on Tuesday or Wed next week. Will visit the week of 7/4.

7/05/2022 Running again. Will visit AM on 7/7.

7/07/2022 Arrived onsite 11:00AM. Working on 15ft hole in group 8. About 400 feet progress since 7AM start. Work is progressing a little bit faster and they are completing 1+ boreholes per day. Site is less cluttered than in the beginning. The drilling is moving into the drive area and noted that there is much less parking on drilling side of the building. Anticipate that the drilling will be under the temporary roadway within the week.

Noted that there is a watermain that is in the path of the drilling and it has been located. They will complete hole 24 today. Drill rig working better after being repaired with the drill rod handling system being adjusted; wiring harness replaced and broken welds on the drive system repaired. The site has provided a water connection for the drilling and the process is much smoother without the need to truck water multiple times per day.

No other complications reported. Observed all previous loops are connected and properly pressurized.

07/07/2022 Observations - On site ~11:00AM.

**Status:** Drilling on 16-foot depth borehole of group 8A had progressed to about 250 feet on arrival. This is the twenty-fourth boring. Drill rig working better after being down on

6/30/22 and repaired with the drill rod handling system being adjusted; wiring harness replaced and broken welds on the drive system repaired.

**Borehole Conditions:** The borehole tailings being washed out of this loop were consistent with previous observations for the shallow boreholes. No unexpected conditions were observed. Photos of the General area taken.

**Overall Installation Progress:** Observed that there were 18 installed borehole loops under pressure of 100 PSI. Photos taken. There were five completed loops connected to a manifold waiting for the current loop to be completed and waiting to be pressurized as required. The pipes were properly capped. All installed loops on other manifolds were properly pressurized and holding. Work continues at a pace of one borehole completion per work day. Measured the spacing of all groups of loops and the spacing was 8 feet between each group.

**Loop Tail Splices:** Confirmed that tailpieces of 30 ft for the shallow boreholes and 50 feet for the center and 70 feet for the deepest boreholes were being added to achieve the necessary installed length.

**Staging of Loop Materials:** Observed the reels of HDPE pipe staged for Borehole #43, which will be a deep borehole, and the reels were prepped with 70-foot tail couplings added to each reel.

There was grout and graphite staged by the grout pump for the current loop. Observed 21 bags of grout and 7 bags of graphite were mixed prior to cleaning up the grout machine.

**Overall Site Condition:** Drilling is now beginning to enter the construction roadway. The construction roadway and traffic will need to be moved in order for drilling to continue unimpeded. Location stakes need to be added for the next series of boreholes. The driller is measuring from previous stakes to get new locations. Once the loops are installed for the next boreholes, traffic must NOT be allowed to move back over the areas with exposed loop tailpieces and it will be necessary for the tailpieces to be protected until the borings are completed and the trenches for the header operation are completed and covered. Noted that there is a watermain that is in the path of the drilling and it has been located. The site has provided a water connection for the drilling and the process is much smoother without the need to truck water multiple times per day. Borehole locations were adjusted slightly to avoid the placement of the watermain. Working around the watermain has caused the tremie line removal to become more difficult due to extra curves in the path around the watermain.

**Drilling Progress in the Afternoon:** The Group 8A, 16-foot depth boring, was completed about 1:30PM. They used 550 feet of drilling rod to do the installation. Pulling of the loops, tremie pipe and tracer wire into the borehole commenced about 2:10 PM. A factory U-Bend was assembled just before the end of the pull. At 4:15PM, the loop was completely in the borehole.

**Field Assembly of the U-Bend for the Loop:** Just prior to the completion of pulling the lines completely into the borehole, observed the factory U-Bend being fused to the loop

ends using a generator and fusing tools. The fused connections looked uniform and proper. Photos were taken. The process took about 15 minutes to complete.

**Borehole Grouting:** Grouting started at 4:35PM and was completed at 5:15PM. The tremie line was pulled about 3 feet into the borehole, using a tractor to pull the line and grout/fluid was pumped until there was evidence of grout/graphite exiting the hole. Due to the resistance on the tremie line, a tractor needed to pull the line about 40 feet before the workers could move the line. At that point the tremie line was manually pulled by seven workers as the grout was pumped. I observed a total of 8 bags of graphite and 24 bags of bentonite actually mixed for pumping. Three grout samples were taken from different batches during the grouting process.

**Grout Sample Collection:** Collected (3) samples of observed grouting from beginning, middle and end of the grouting process. These samples were taken from the tremie line and will be tested and results will be shared when available.

**Grout Testing:** Initial testing of the grout using a KD-2 Pro tester showed the following results:

Group 8A initial sample #1 from 7/7 boring: 0.835 TC value 4:38PM Group 8A middle sample #2 from 7/7 boring: 0.729 TC value 4:51PM Group 8A end sample from #3 7/7 boring: 0.891 TC value 5:05PM

Samples from 7/7 were shipped to GeoPro for independent testing.

Left the site about 6:00PM.

07/19/22 Grout tests received from GeoPro. Results range from 0.888 to 0.923 TC values, which is within the expected range. Reports forwarded to PSM and others.

08/03/22 Observations - On site ~ 08:30AM.

**Status:** Borehole #42 drilled and pipes being pulled into the borehole. This is the 16' deep borehole and completes the 14<sup>th</sup> group.

**Borehole Conditions:** The drilling has been proceeding smoothly and no obstacles have been encountered since the last visit. Photos of the General area taken.

**Overall Installation Progress:** Observed that there were 42 installed borehole loops. The first 36 are under pressure of 100 PSI. Photos taken. There are six completed loops partially connected to a manifold and a valve set to complete the manifold assembly. waiting for the current loop to be completed and waiting to be pressurized as required. The pipes were all properly capped. All installed loops on other manifolds were pressurized to 100 psi and holding.

Noted that the 16-foot borehole in the 8<sup>th</sup> row was missing the tracer wire. The crew advised that it came off or broke during the pullback of the pipes. All other boreholes had intact tracer wires.

They are expecting to complete the final boreholes next week and will begin the excavation process for the run-in piping and connection to the loops. Need to coordinate to be on-site to observe the connection process. *Note: Will need the drilling logs from the horizontal drill upon completion of the drilling.* 

**Loop Tail Splices:** Continuing to add 30, 50 and 70 foot tailpiece extensions to each loop. Connection splices clearly visible on the exposed loops under test.

**Overall Site Condition:** The construction roadway will be blocked with the beginning of the next group of boreholes and traffic appears mostly to be on the opposite side of the job site. Exposed loops are coned and marked for protection from being accidentally hit.

The last six boreholes will need to be adjusted for depth as they pass near the electrical utility area and the excavation for the access to the building for construction. The power conduits and floor of the ditch appear to be 10-12 feet down and the driller plans to lower all of the boreholes about 6-7 feet below the levels of the ditch and electrical conduits near the building. The depths will return to normal levels after clearing the ditch and conduit areas. Photos taken and discussed with the driller and locator. The area around the horizontal drill has been kept clear and there are a few piles of excavated material that the locator has needed to work around.

**Drilling Progress:** Setup to begin hole #43 in the fifteenth group was ready by noon. They are working to complete drilling by late afternoon with pipe pulling and grouting to take place the following morning. They are completing 5-6 bores per week.

**Field Assembly of the U-Bend for the Loop:** Just prior to the completion of pulling the lines completely into the 42<sup>nd</sup> borehole, observed the factory U-Bend being fused to the loop ends using a generator and fusing tools. The fused connections looked uniform and proper. Photos were taken. The process took about 20 minutes to complete.

**Borehole Grouting:** Grouting started at ~10:20AM and was completed at ~10:55AM. The tremie line was pulled about 10-12 feet into the borehole using workers to pull the line. Grout/fluid was pumped until there was evidence of grout/graphite exiting the far end of the borehole. Photos of the graphite/grout mix were taken. The tremie line was manually pulled by seven workers as the grout was pumped. I observed a total of 7 bags of graphite and 21 bags of bentonite actually mixed for pumping into this borehole. Three grout samples were taken from different batches during the grouting process.

**Grout Sample Collection:** Collected (3) samples of observed grouting from beginning, middle and end of the grouting process. These samples were taken from the tremie line and will be tested and results will be shared when available. Samples were all from different batch mixes.

**Grout Testing:** Initial testing of the grout using a KD-2 Pro tester showed the following results:

Group 14 initial sample (#1) from 8/3 boring: 0.802 TC value (taken ~10:25 AM) Group 14 middle sample (#2) from 8/3 boring: 0.779 TC value (taken ~10:35 AM) Group 14 end sample (#3) from 8/3 boring: 0.775 TC value (taken ~10:45 AM) All values within expected range. Samples from 8/3 were shipped to GeoPro for independent testing.

Left the site about 12:30 PM. Light rain occurring.

08/25/22 Observations - On site ~ 09:15 AM. Jeff and David from TDI visited.

**Status:** All borehole/drilling work is complete and the construction has moved to the building tie-in and header work phase.

**Overall Installation Status:** The area for the header work has been completely excavated to ~8-9 ft below final grade and all loops are exposed. The tie-in to the building consists of (6) supply and (6) return headers and those supply/return headers are complete. Observed that the watermain that crosses the space is about 12-18 inches below where the loopfield piping connections are being made.

During this visit, we observed that all of the 3" HDPE pipes for the supply/return circuits were properly routed into the building through a trench that led to the main excavated area. The runs to the building are very neatly placed and the connected loops were properly marked and identified. The first two 3" HDPE header supply pipes were being fused to the loops and the shallow loops were being alternately connected as called out by the spec. Observed that the connections were properly spaced with the correct reverse-supply/return header pipe sizes were utilized per the spec.

The soils that were excavated from the area consist of a uniform grade sand with no large pebbles/rocks and the material is very suitable for proper bedding of the pipes and will make excellent backfill.

Photos were taken of all of the piping and connections back to the building.

**Borehole Loops:** All (48) loops were exposed and present at 8' below finish grade. The shallow loops (15' depth) were in process of connection to the header pipes. We selected two unconnected loops for random length testing. Using a 600-foot fiberglass tape, measured the lengths to assure 500 feet of exchanger. The tape was inserted into each loop until resistance prevented further insertion. One circuit measured ~497 feet and the second circuit measured ~501 feet. Factory pipe markings were not usable since the loops and U-Bends were constructed onsite from 500 ft bulk hose reels. Extra tailpieces were fused to each I for pulling and placement purposes to assure the final working length would meet specification. Advised the contractor to avoid leaving the tailpiece connections in the circuit and terminate as close to the connectors as possible to minimize leaving extra connectors in the loop. Based on observation and testing of loops during the loop installation process, the circuits appear to be the correct length and the placements of the shallow, medium and deep loop ends are all spaced uniformly for installation.

**Pipe Fusions:** There are a large number of fusions of HDPE pipe involved with this phase of construction. Destructive samples of the 3" butt fusions were taken and examined on site. Findings were shared with the workers that were performing the work. We observed as several additional fusions were performed and used the readings from

the equipment, and verified temperatures shown on the equipment with a temperature gun. The fusions were created per the temperature recommendations of Centennial Pipe, the manufacturer of the HDPE pipe being used. We observed that a timer was used for the fusion process and resting time.

Two 3" butt fusions were destructively sampled and looked good, showing complete fusion and good material roll at the site of the fusion. We shared our observations and suggestions for subsequent fusion work. Overall, the butt fusions of the 3" HDPE and the observed socket fusions of the HDPE reducers were very neatly done and we saw no issues with any of the fusions. Photos of the destructive samples were taken and random selections of other joints were photographed.

**Schedule:** Based on work completed with the tie-in phase of the project, another 1-2 weeks should be sufficient to complete this phase. We estimate that the tie-in work, barring any weather or unforeseen issues, should be completed within this time estimate.

**Summary:** Will visit again in about one week to inspect the connections before bedding and backfilling. We will need to observe the bedding and backfilling. After that, one additional visit to observe the system purging process begore completion is needed. The tie-in work that we saw during this visit was very neat and well planned. The workmanship and conditions in the work area is very good.

Left the site around 12:30 PM.

9/6/22 Observations - On site ~6:30AM.

**Status:** All borings completed and the tie-in to the building was completed on 9/2/22 per the on-site personnel. The lines were filled with water and placed under pressure as of 9/2/22.

**Fusions and System Tie-Ins:** All of the loops in the boreholes were fused to the (6) supply/return tie-ins to the building and terminated in the interior of the building. Protective inserts for a couple of the opening for the pipes were observed. There were only a couple as the rest are on back-order. Pieces of foam were used to keep the pipes centered in the building openings.

Fittings were made for all of the supply/return lines and fitted with pressure gauges and valves to allow for proper filling of the lines. The supply/return circuits are all properly labeled within the building as well as at intervals along the path of the trench to the main excavation. Each return line also included a wire tracer that is tied to the boreholes that are connected to the circuit. Numerous photos taken of the pressure gauges, pipe markings and the overall layout.

In the main excavation area, each borehole loop was examined for proper connection to the appropriate supply/return as called out in the spec and the pipe sizes were checked for the proper reverse supply/return layout for balanced flows. Tracer wire connections were noted for each circuit and all wires were connected as expected. Pipes were lifted and photos were taken of saddle fusions, butt fusions and coupler fusions. Fusion work looked good.

The circuits were pre-pressurized (more than the required 24 hours) to 100 PSI and checked again at 8 AM to confirm that there were no leaks. No leaks of any kind were observed at the gauges or when examining all of the connections in the main excavation area. The driller was given the findings so that the excavation work could commence. We discussed that all HDPE pipes that crossed would need to be bedded by hand to provide that pipes were not touching and were separated by a protective layer of sand. Numerous photos were taken of the excavation areas and the layout of the pipes.

**Excavation Work:** The trench to the building was covered first with an excavator dropping loads of sandy fill on top of the pipes. A small dozer was used to spread the fill once the pipes were covered with ~3 feet of cover. As the work proceeded to the openings into the building, workers did the bedding by hand to assure that the pipes and openings were protected. Each of the supply/return pipes were centered in their respective openings with foam. The layers of fill were compacted with a roller when the entire supply/return trench was completely bedded with several feet of cover. Numerous photos were taken.

A small Bobcat with a bucket was used to cover all of the exposed pipes in the main excavation and several workers with shovels bedded and positioned the pipes as the process moved through the excavated area. Sufficient care was demonstrated to protect and properly bed each of the pipes that crossing or if the surface below was not sufficiently flat. By about 11AM, a two-to-three foot cover was established on the bottom of the entire excavation and all pipes were fully covered. Pressure gauges in the building were again checked for any indication of leaks or damage during the bedding process and all readings were holding as initially observed.

With about 4 feet of cover, a yellow caution tape was laid over the supply/return trench and covered with more fill and compacted again. In the main excavation area, the three main runs of supply return sets were also covered with a yellow caution tape and covered. Photos were taken.

**Overall Progress:** Observed the work until about noon and watched as the soils were filled in and compacted. I left the site about 12:30PM after all of the excavated area and supply/return trench had been compacted once or twice.

The work observed was very neat and well planned. Will need to return to observe the purging of the pipes and filling with the proper glycol solutions. The driller indicated it may be a couple months before that occurs because the building systems will need to have made more progress with their equipment and installation.

Left the site about 12:30PM.

9/30/22 Sent reminder request about drilling logs to Willie and Jamie Quello.

2/24/23 Requested information regarding purging spec requirements for the 3" runouts in terms of flow and pressure. The spec is missing this number.

2/27/23 Bemidji has 8 x 1.25" circuits and the field designer recommends flushing at 90 gpm and 35' head.

4/14/23 Jaime Quello advised that the purging and flushing of the system would be performed by Cory Freholtz. Willie Borstad will not be involved. Cory has the required IGSHPA credentials but not the (5) demonstrated completions of commercial geothermal systems as required by spec. Requested information on the purge pump unit and the performance curves as required by spec. Apparently, there is a change order on the fluid pre-mix concentration raising the glycol percentage from 20 to 25%. Will need to take a sample at the time of the purge and fill. Advised Jaime that this would be the last visit needed and a report would be issued after the final visit. Requested a starting date and also reminded that we are still missing the logs for the first 9 boreholes.

04/28/23 Requested confirmation from Jaime and Cody Freholtz that the flushing and purging would be happening on Monday, May 1. Planning to be there to observe and take fluid samples of the solution.

05/01/23 They are not ready yet. Advised Cody and Jaime that I am available this week but will be unavailable for 10 days beginning next week.

06/27/23 The power connection that was not available for the mechanical room is now ready. Will observe the flushing operation on Thursday, June 29.

06/28/23 Photos were requested for planning the visit and based on what was received, it was learned that PSM was planning to use the building pumps to purge the loopfield, which is not per the spec. A separate, purpose-made purge cart was expected. After last minute consultation, the contractor was advised that there were questions regarding the spec 3.07 that needed to be answered by the engineer before proceeding. Photos and the specific questions were sent by email to Reed Paitich, the engineer, regarding whether the contractor plans were acceptable meet the specification.

06/29/23 Received an unpleasant call from Justin Wellcome of PSM regarding the purging and flushing. Was informed that the spec was overkill and the State always requires more than is needed. I advised that unless the Engineer wanted to allow something different, that the building systems could not be used and a purge/flush cart system was required. Advised the engineer, Reed Paitich, of the pushback and requested a written response to PSM regarding their request to use the building system to perform the requirements of 3.07.

06/30/23 Reed advises that he will discuss the flushing requirements with Ed Lohrenz, the designer, and will decide what to require. The designer advised by email and copied all parties that the spec needs to be followed as written. The engineer confirmed to all that we needed to follow the specification regarding the purpose-built purge pump system

07/11/23 Advised the engineer that there was no follow up from PSM regarding the next steps or timing. Engineer reminded all parties of the need to move ahead and coordinate the timing. My calls to Cody's cell are being dropped immediately.

07/14/23 Emailed Jaimie Quello and Cody Freholtz requesting a response to the requirements and my schedule and dates that I was not available. Sent texts and emails to Cody on 7/17; 7/19; 7/20; requesting update and tried to leave voice mails but calls were not accepted.

07/20/23 Spoke again with engineer Reed Paitch requesting that he needed to intervene regarding the scheduling and possibly work with the General Contractor regarding spec compliance and scheduling.

07/24/23 Received email from Jaime Quello that Mineral Service Plus was hired to do the purging and filling. Advised that they plan to do the work 8/1/23. Received email approval from Reed Paitch to use notes and photos from PSM as the basis for the Commissioning Report on the flush/purge and fill operations.

07/25/23 Received text from Cody Freholtz that flushing would be started 8/1. Advised Cody of my schedule and that the engineer had OK'd using photos and information from Cody as documentation of the process. Cody agreed that he would be present and I told him I would email a requested list of photos to take. Sent an email to him on 7/25 and copied Jaime and the engineer regarding suggested photos and notes to provide.

07/27/23 Talked to Nick Milbrandt at Mineral Services Plus regarding the flushing and purging at the Bemidji Veterans Home. Nick will send copies of the IGSHPA certifications and the information on the purge pump that they will be using. A copy of 3.07 was sent to Nick Milbrandt for reference. (IGSHPA cert for Danny Nubbe received)

08/15/23 On return to town, I received photos and notes from Connor Gotvald, PSM, which showed some of the purge/flush and filling operation. The flushing and purging appears to have been completed with a portable purging pump unit and 2-1/2" or 3" hose as required. The photos provided do not show the supply/return pressures and the flows as needed to fully confirm the spec compliance. There appears to be a flow meter on the purge pump. The operation does appear to meet the 45 min flush requirement of all circuits in each direction. Photos show the air separation and filtering as required by the spec. There is no confirmation that the system is filled with treated/DI water. Need confirmation that the system fluid was treated DI water.

I spoke to Nick at Mineral services and asked for any photos that they took. He indicated that his crew was there only for the purging and flushing and that they did not participate in filling the system. We received three more photos directly from Mineral Services which show the connected purge pump and reversing valves.

From Connor's photos, it appears that totes of glycol concentrate were used to charge the system and that an air compressor might have been used to displace the water and draw in the glycol using a small electric fluid pump. Was expecting a complete fluid replacement as required in: (Spec: 23-21-13 3.10 D part 2: pre-mixed glycol/DI water solution) using a positive displacement pump to exchange the initial fill water with pre-mix. The glycol used is reported to be clear and a request was made to PSM for submittal verification of the fluid. The labels on the totes were not visible enough to gather

information on concentration and etc. There were only eight glycol totes visible in the photo.

Requested the following information from PSM:

## Flushing/Purging: (from 8/1)

- 1: Photos of the flowrate and supply/return pressure used to flush? Spec: 80 gpm at minimum pressure drop of 31 ft.
- 2: Photos of the hose sizes used to flush? 3" expected
- 3: Photos of the entire purging system connected?
- 4: How was flow reversed for flushing each circuit?

# Filling: (from 8/2)

- 1: Was the glycol premixed or concentrate? Spec: 23-21-13 3.10 D part 2: premixed glycol/DI water solution
- 2: How was the glycol installed into the system?
- 3: Was any air introduced into the system after the flushing and purging operation?
- 4: Submittal information details for the Glycol product used

08/17/2023 Contacted Reed Paitich at Wold Engineers regarding questions about what I was seeing and requested assistance with getting responses to my questions before proceeding further.

Received a response from Connor Gotvald that the totes were 30% concentrate and that they ran one tote short of fluid. They have put in 3,075 gallons of glycol solution mixed onsite so far. Questions remain about the method of installation of the glycol. The specification calls for ~4,800 gallons of pre-mixed glycol.

08/18/2023 Jaime advised that Connor is an apprentice and communications should not be done with him. PSM is resisting efforts to answer questions and the situation may need to be elevated to the General Contractor for assistance. The engineer was advised in the last phone call that the Commissioning should probably be under the General Contractor and not the HVAC contractor that we are specifically trying to do the verification inspections with. The job requires cooperation and a working relationship. If things become adversarial due to following the spec requirements, the commissioning agent should not be beholding for payment and cooperation by the same contractor that is having issues the specifications.

08/21/2023 Webex meeting with Reed Paitich, Engineer and David Henrich. All agreed that things need to be resolved sooner than later and that it does not appear that the spec is being followed as needed. Reed wants the report done and if there are issues with specification compliance, they need to be documented.

Things done during 2022, which include all construction of underground utilities, seem to be in good order, but the 2023 progress is not well coordinated. Some questions linger as to the reasons that the contractor hired to oversee the geo construction, Willie Borstad

Drilling, was no longer involved in 2023. The project from the point of filling the system and pressurizing over the winter is in question.

The purging and flushing was going to be done incorrectly and PSM needed to hire Mineral Services to do the work per specification. The photos sent from PSM after they the flushing and purging also seem to show filling the system by injection of glycol concentrate as opposed to the premix requirements. At this point, questions remain unanswered and the Engineer has been asked to intervene.

Reed will contact the General Contractor, Adolphson and Peterson to schedule a conference call on how to proceed. Scheduled for 1PM, Wed, August 23.

Early Questions to PSM:

• Information on the initial fill of the system with DI water (Fall 2022?)

#### For the flushing operation:

- The purge pump setup of Mineral Service Plus. Please ask them for a pump curve or give me a contact and I can ask them directly. (Min 80 GPM, min pressure drop 31 feet per 3" circuit needed to assure min 2 ft/sec flow rate through each circuit) Pump information received from Nick at Mineral Services
- If the purge cart is a commercial model, please provide the manufacturer and model number. If not a commercially supplied unit, need the pump used and motor horsepower. **Pump information received from Nick at Mineral Services**
- On the purge cart, while flushing each circuit 45 min in each direction, please provide a photo of the meters showing the GPM and Pressure being used. Also, the connecting hoses need to be 3" minimum with valves. Video received from Connor (PSM) on 9/19/23
- Please photograph the filtration bags and assembly. They will have a marking of the filtration grade 5 micron or better **Photo of filter bag rcvd from Connor (PSM)**
- Please photograph the purge pump fluid reservoir that is used to remove air. Looking for less than 1" level drop when flow is stopped to assure air purge is complete. Air separation tank photo received from Connor (PSM)

#### For the filling operation: Still need all information

- Please photograph the setup used to fill the system. Are you using a tanker truck or do you have glycol premix on-site? If the premix is in small tanks, please photograph the labels and tanks that you are using that supply the glycol.
- Please photograph the evidence of the glycol displacing the water in each circuit. Before and after photos of discharge hose showing evidence of water to start and glycol to finish. Un-dyed Food Grade glycol concentrate used
- Please provide the total gallonage of Glycol delivered into the system (3075 gal?)

• Please photograph the pressure gauges of the circuits showing the pressure that is left on the system after filling. ie: 30 PSI (Will take photo on final visit)

## Questions presented to PSM on 8/15 after receipt of photos from 8/8

#### Flushing:

- 1: Photos of the flowrate and supply/return pressure used to flush? Spec: 80 gpm at minimum pressure drop of 31 ft.
- 2: Photos of the hose sizes used to flush? 3" expected
- 3: Photos of the entire purging system connected?
- 4: How was flow reversed for flushing each circuit?

### Filling

- 1: Was the glycol premixed or concentrate? Spec: 23-21-13 3.10 D part 2: premixed glycol/DI water solution
- 2: How was the glycol installed into the system?
- 3: Was any air introduced into the system after the flushing and purging operation?
- 4: Submittal information details for the Glycol product used

08/23/2023 1:00PM - Zoom meeting with Reed Paitich, Engineer; Payne Quick (Wold); Adam Clark, Adolphson Peterson and Jeff Walton. Discussed the issues observed since the system was covered in the fall of 2022.

Main concerns:

• We don't know what is in the system. It needed to be flushed and purged with treated water, per spec. Need submittal of the source and amount to the DI water which documents compliance to the spec.

• The system had Glycol concentrate added using a small electric pump. Photos are confusing and also show an air compressor being used, which would undo the purging work done by Mineral Services Plus.

• The gallonage of glycol used reported at 3,075 gallons of 30% concentrate.

• Expected the process to fully displace ~4,800 gallons of installed water with a premix that would be certified by submittals. Need submittals to show that this was done.

• The process was expected to be overseen by an IGSPHA certified installer with at least (5) demonstrated commercial systems. That might have avoided the problems that we see now.

• Peterson Sheet Metal should be easily able to respond to the questions and requests for documentation. They have not been fully cooperative at responding to the questions that are needed prior to pulling the final system fluid sample.

Adam Clark (General Contractor) indicated that he would make the contacts with Peterson Sheet Metal regarding the outstanding questions and report back. Meeting ended 1:15PM

## 08/23/2023 From Adam Clark -

"My understanding is that you are contracted through PSM to do these tests/reports. Have you been to the site to do these yet? Sounds like we need you and Cody to link up on-site to finalize these reports.

PSM & Ground Loop Design please coordinate accordingly."

08/28/2023 Advised Reed Paitich, Cody Freholz and Adam Clark, by email, that I would visit the site in Bemidji on Thursday, August 31, to obtain final fluid samples and discuss any missing information regarding the final Commissioning report. Also texted Cody to confirm my plans.

# 08/31/2023 **Observations** - On site ~8:45AM.

**Status:** Much has occurred with the overall project since the last visit. The parking lot is constructed as well as the landscaping in the entire area which contains the loopfield. Everything looks really nice and nearly finished condition.

The GHX system is completed and the Mechanical room is fully built out. At the time of arrival, Cody Freholtz, PSM was waiting on-site and was pumping a glycol solution from an outside tote to a partially filled glycol tote in the mechanical room using a small electric transfer pump. There were still a couple partial/empty glycol totes remaining outside of the building. When arriving in the Mechanical room, I observed that the building system and pumps were operational.

# Outstanding items discussed:

**Flush and Purge:** Explained to Cody that we had no photographic evidence of the flow rate used for flushing the system. Cody said that he thought that the purge pump was flowing at ~85 GPM and that there was a 1-minute video taken by Connor Gotvald which would show the flow rate. Cody did not have the video and reported that Connor is in school and they would need to retrieve it. I requested that any photos or videos that were taken should be shared and that Mineral Service had provided all photos that they had.

**System filling:** A new piece of information came up regarding the water that was used after the flushing and purging. Cody advised that after the flush/purge was complete, the water in the system was "replaced" by DI water. Cody showed me (9) free-standing filter canisters which were used to process the water which was pushed into the system after Mineral Services was finished. There were no metrics regarding gallonage or any testing of the water coming out of the filters. It would have been helpful to have received this information when the photos and notes were received from Connor, or after the written questions were posed to PSM. Without this useful information, the presumption was that the city water was completely untreated.

**Glycol:** All of the glycol that was put into the system was from 250-gallon totes of Glycol concentrate using a small electric transfer pump. It was not a manufacturer "pre-mix". We still have no submittals on the glycol and need that information from the manufacturer.

The totes were all from April of 2023 except for one that was dated in August 2023, which must be the tote that was earlier reported as being short for doing the system fill on Aug  $2^{nd}$ .

Cody advised that the glycol was mixed in an empty tote and pumped into a port in the GHX system using a small electric transfer pump. The circuits were valved off and filled one at a time. When asked how they could tell if the circuit was full, Cody said that you could tell by feel and that it was confirmed with a refractometer. Note that the glycol was NOT dyed, so there was no visual confirmation of glycol presence. A 1-inch hose was used between the small electric transfer pump on the tote to push glycol in and water out.

I showed Cody example photos of 3" hoses used in another large commercial job where there was full circuit displacement at high flow rate from a large tanker truck using a piston type pump to supply a manufacturer supplied premix glycol to displace the water. The glycol was dyed for visual evidence, and was example of what we were anticipating for a system fill as large as this. PSM has interpreted "pre-mix" to mean any form of glycol as long as they mixed it before pumping it into the system. The disadvantage of using a very small hose and pump to fill a 3" circuit and loop is that there may not be full displacement of fluid and mixing with only small laminar flows. A turbulent flow using a larger diameter hose and flow rate is a faster and more effective way to displace fluid in circuits that hold large volumes. In terms of the "pre-mixing" in the tote, it is not known whether there was any kind of mechanical mixing performed before pumping into the system. Also, were any tests made of the treated water?

Samples were taken from three different locations: two return lines and one supply line. Since all supply/return valves were open and the pumps were operating (unknown running time) there would likely be little difference in the concentrations. The samples spanned about 5 minutes from first to last. Testing by refractometer at the office measured ~30% glycol concentration for all three samples. Will need to submit a sample for analysis of the glycol solution using the on-site treated water.

## Action Items from PSM:

- Gycol submittal documents from manufacturer. Need to confirm that the glycol is approved for MN use per MDH rules
- Additional photos that Connor took of the flush/purge and fill process especially video that shows purge pump flow rates.

**Side Note:** I also advised Cody that all of the visual and observed work of installing and constructing the GHX system was really nice looking and that the only issues that we are addressing are based on the sub-contractor interpretation of the spec requirements for the job and not from any issues with workmanship on Cody's part. These are all questions that are being addressed at the engineering level and ideally would have been resolved before any work was done. There have been several spec items on the Geothermal system that have been addressed and resolved as the project has moved along and at no time was there ever an issue with observed construction.

Left the site at ~10:30AM.

08/31/2023 Made email request for follow up items.

09/01/2023 Re-reading the intention of the specification for the glycol refers to the need for make-up water analysis prior to introduction to the system. A factory pre-mix would meet this requirement in the submittals. A "field-mix" would require a water analysis prior to introduction into the system:

# 2.07 CHEMICAL TREATMENT

A. Provide the services of a water treatment consultant to provide the make-up water analysis, systems testing, and treatment plan required in Part 3.0 of this specification. The treatment consultant shall provide all cleaning agents, corrosion inhibitors, and other chemicals as recommended in the treatment plan.

B. Provide a pre-mixed solution of deionized water and industrial grade inhibited propylene glycol for final fill of the system. The glycol shall meet the minimum concentration listed in part 3.0 of this specification and shall include corrosion inhibitors and environmental stabilizer additives. The final fill solution shall be approved by the water treatment consultant and be provided by the mechanical contractor for the interior piping as indicated in Part 3.0 of this specification. The exterior portion of the geothermal system shall be identical to the interior solution – coordinate all requirements with geothermal contractor.

09/06/2023 Spoke to Brett Alsleven at Kurita America regarding the Glycol analysis. He is sending the form to have an analysis completed. 866-663-7633 Direct 612-719-4150

09/07/2023 ~12 oz sample of fluid sent to Kurita America in Minneapolis for full analysis of fluid, including makeup water analysis.

09/18/2023 Report received regarding the fluid analysis from Kurita America. Requested comparative report for a premix of 25% concentration to compare the chemical make-up.

09/19/2023 Received a video from Connor of PSM, which displayed a flow meter during the purging operations on 8/1/ a one minute timing of the counter gauge showed a purge/flush rate of 104GPM, which is above the minimum 80GPM requirement.

10/02/2023 Received an email from Brett at Kurita America regarding a comparative analysis of their premix solution. Apparently, they are having some hesitation at providing the complete analysis of their pre-mix and have indicated that they do not have a food grade premix of the 9134 glycol at 25%. Forwarded the thread to the engineer, Reed Paitch and suggested that we should just wrap this up. The project engineer and contractor will need to decide what to do with the field mixed versus factory premixed question on the glycol solution.