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Subject: Co2 Injection Test Results
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Attachments: [IMG_3456.jpg](#)
[Weir 5 CO2 Injection Test #2 Data.xlsx](#)

Good day,
I hope all is well.

Please find attached a worksheet showing the parameters and results for the second CO₂ injection test conducted on site here in Thompson in support of the NOA.

Following the first CO₂ injection trial conducted in July 2020, test results confirmed that CO₂ was effective for pH control. However, it became immediately apparent to Vale that the size of the infrastructure (eight – 170kg liquid cylinders on manifold) was inadequate for the potential winter-time continuous need in Thompson for a few reasons:

- *The system would deplete its supply in a few days.*
- *Availability of liquid CO₂ from this supplier was scarcer than initially understood (in some cases can take several weeks to be delivered) and there was a real risk that more product would not arrive in time should a continuous 24/7 dosing be required for pH control over an extended duration.*
- *In winter time, when the system would likely be needed, the risks associated with product delivery were heightened given adverse weather.*
- *A heating mechanism would be required for winter injection which the original setup could not provide.*
- *Cylinder transport with the previous supplier could only be conducted when their drivers were available, adding even more risk to the delivery of product.*
- *The infrastructure was old and cylinder pressure gauges were questioned by Vale. Cylinders also leaked which Vale was not made aware of.*
- *Overall, Vale was not content with the supplier's ability to deliver sufficient product and support reliable infrastructure for the potential need.*

Vale has since demobilized this setup and engaged Air Liquide to design and mobilize a much larger temporary CO₂ storage tank that can supply continuous CO₂ for long durations should there be the need to do so. It should be noted that, conceptually, the injection/delivery mechanism, designed by Applied Water Treatment, which delivers CO₂ through hose and sparging unit remains the same as does the type of product (liquid CO₂). Simply put, the capacity of stored volume on site and ability to deliver in winter is what has changed based on Air Liquide's design which reviewed the specific flow and desired pH criteria for the site.

Specifications for the new system are as follows:

- *Vessel: Air Liquide 50T Queen (capacity of 54,300 kg of CO₂)*
- *Operating pressure: 75 psi*
- *Normal flow rate capacity: 12 kg/hr, 24 hr/day, 7 days/week (based on average historical flow rates would bring pH of 9.5 down to 9.0)*
- *Peak flow rate: 57.5 kg/hr capability (based on average historical flow rates would bring pH of 10.5 down to 9.0) (note that more product would be needed in such an unlikely severe condition but still gives over a month of run time capacity assuming we've started with a full tank).*

- CO2 product from Air Liquide is delivered from their depot in Medicine Hat, AB and they can turn around delivery shipments within one week when requested.

As noted above, the system design was based on historical average flow rates. Actual injection volumes will be adjusted as necessary. The new unit provides Vale with a level of confidence that sufficient product will be available on-site to accommodate temporary pH control should the need arise.

The latest round of testing was completed using the new Air Liquide system, and test data is provided herein. Please see attached photos of the new system. Note as well that all this infrastructure is completely mobile and can be removed at any time should the need arise.

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