CARLSON COMMERCIAL & INDUSTRIAL SERVICES LTD.
1035 MISSION STREET, WINNIPEG, MANITOBA, CANADA. R2J 0A4
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12 December 2016

City of Winnipeg
Winnipeg Drinking Water Treatment Plant
c/o 552 Plinguet Street
Winnipeg, Mb. R2J 0G1

Attention; Mr. David Minor, P. Eng.
Water Treatment Operations Engineer
Water Services Division, Water and Waste Department

Re: Tank # TK-J540A (SW) Contents: Sodium Hypochlorite 10.8%. Field Inspection Report.

Dear Mr. Minor;

Here is our report as requested.

Background:
Sodium Hypochlorite, used in drinking water systems to purify water, is a material that displays a high oxidation potential. Under most storage conditions this material is quite stable, but when activated, sodium hypochlorite (NaCIO) generates hypochlorous acid and hypochlorite ions which afford oxidation. These acids and ions are exceptionally aggressive to many metals and organic materials including resins used in composites. Tank TK-J540A (the tank) is a 120,000 liter composite vessel that stores a 10.8% solution of NaCIO. On November 24, 2016 Carlson Commercial and Industrial Services was commissioned to assess the condition of the exterior and interior corrosion barrier surfaces. The following are the results of this inspection.

General Site Observations:
The tank was first put in service in December 2009, and is situated in the Hypochlorite Building that is located at the City of Winnipeg Drinking Water Treatment Plant on Highway 207 in the R.M. of Springfield. The building is enclosed from the elements and heated. All areas inside and outside of the tank were accessible during inspection.

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Exterior Surface Observation:

- Fitting exteriors are in good condition.
- No cracks or leaks were observed.
- Tank surface appears sound.
- No signs of corrosion on exterior surfaces.
- Body joints and nozzle joints appear to be in good condition.
- No sign of cracking on hold down lugs.

Refer to Appendix A: Pictures.

Internal Surface Observation:

- Corrosion barrier on the tank wall and floor show extensive oxidization from contact with the NaCIO mixture.
- All nozzles and internal piping have the same oxidization.
- Tramp flake material was deposited downstream trapped by filters and processing equipment. This is most certainly a result of the release of resin from unprepared interior surfaces adjacent to the lines of repairs required to re-bond the top of the tank in April 2004.

Refer to Appendix B: Pictures.

Recommendations:

The corrosion barrier, which is to be considered sacrificial due to the introduction of NaCIO, has reached the end of its service life and must be replaced. This can be done by carefully abrasive blasting the tank surface to remove the affected barrier to substrate; applying two (2) layers of 1.5 oz. boron-free glass; two (2) layers of synthetic veil, using a high quality epoxy vinyl ester resin (Reichhold Dion 9102) for bonding. After the liner has cured, a resin rich flood coat complete with an air dry additive, must be applied to the liner surface. All piping should be wrapped in the same method.
Nozzles that show excessive wear should also be replaced.
Additionally, extra attention must be taken on any remedial work to ensure a positive bond around the line adjacent to the repair work performed in April 2004.
It is also highly recommended that due to the nature of the work and working conditions that the following are observed:

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- All persons supervising the work shall have a valid ACMA CCT-C certificate. (Certified Composite Technician – Corrosion).
- All tradespersons entering the tank must have valid and updated confined space, respirator and fall arrest training.
- All companies working on site must have a COR registered safety program and a confined space rescue plan.
- The use of a non-silicon based abrasive (eg. Garnet) for blasting.

Summary:
The primary purpose of the corrosion barrier is to protect the structural layers from the substances contained, primarily using the resin. With exposure to the NaCIO, the oxidized resin on the surface is softened and can be abraded off with little effort. Because these changes occur, monitoring and inspection of the corrosion barrier is required to understand its condition and trigger corrective action when required. The conventional inspection and monitoring approach for corrosion barriers requires access to the surface so that the surface can be assessed based on its appearance, surface hardness and the depth of attack. Conventional repairs to extend the life of corrosion barriers consist of partial removal of the damaged corrosion barrier and replacement with a new corrosion barrier on the accessible surfaces. Following this conventional practice can increase the lifetime of the corrosion barrier and service of the tank.

Yours truly,

Murray Hornung, CCT-C
Manager Fiberglass Manufacturing