| 1 | Q. | Refurbishment of Tank 2. |
|---|----|---|
| 2 | | With reference to Schedule 2, page 5, lines 5-6 and line 9, please provide copies of the 2018 and |
| 3 | | 2020 remaining life assessment reports from the tank inspection contractor. |
| 4 | | |
| 5 | | |
| 6 | A. | The 2018 and 2020 life extension reports are provided as IC-NLH-010, Attachment 1 and |
| 7 | | IC-NLH-010, Attachment 2, respectively. |



Branch Office 149 McNamara Drive, Paradise, NL A1L 0A7 Canada Tel.: (709) 745-1818 Fax: (709) 745-5401

Newfoundland and Labrador Hydro Holyrood, NL

Fuel Oil Tank No.2

Inspection Interval Extension Report

October, 2018





To practice Professional Engineering in Newfoundland and Labrador Permit No. as issued by PEG-NL <u>Y0342</u> which is valid for the year <u>2018</u>



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Appendix A – Photographs

Appendix B - NDE Results



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1.0 Executive Summary

TISI Canada Inc. (TEAM) was engaged by Newfoundland and Labrador Hydro (NL Hydro) to determine if the out-of-service inspection interval for fuel oil storage Tank No.2 could be extended. The purpose of requesting this extension is to extend the inspection interval to coincide with NL Hydro's evaluation of the service life and future plans for the tank farm in which this tank is located. Based on data collected during previous inspections in addition to recently collected data, TEAM prepared a list of recommended items to be completed. These items have since been completed to TEAM's satisfaction. It is TEAM's recommendation that the next out-of-service inspection should be completed by December, 2021.

2.0 Introduction

During the last API 653 in-service inspection completed by TEAM, in July 2017, it was determined that the next API 653 out-of-service inspection is scheduled for December 2018. Since the tank farm is scheduled to be decommissioned in 2021, NL Hydro engaged TEAM to investigate if the out-of-service inspection date can be extended.

3.0 Tank Details

| Client | NL Hydro | Location | Thermal Generation Plant, Holyrood, NL |
|---------------|-----------------|------------------|--|
| Tank I.D. | Tank No. 2 | Tank Type | Vertical, Uninsulated |
| Product | Bunker C Oil | Roof Type | Fixed |
| Tank Diameter | 180'0" | Tank Height | 48'0" |
| Year Built | 1970 | Specific Gravity | 1.00 |
| Capacity | 217,000 Barrels | Manufacturer | McNamara Industries Ltd. |

4.0 Tank History

This oil storage tank is an above ground uninsulated vertical tank with a fixed cone roof. As per the previous inspection report, the construction date is 1970. The tank features six (6) carbon steel butt welded courses. The overall dimensions are 180'0" diameter and 48'0" height.

5.0 Summary of Concerns

The main issues that were identified during previous inspections include:

- 1. Cracking and spalling of concrete ring beam (2017)
- 2. Corrosion and possible delamination of chine area (2017)
- 3. Corrosion concerns with floor (2008)

Since the tank was scheduled for an out-of-service inspection in December 2018, the inspection completed in 2017 was limited to an in-service (external) inspection.



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In order to determine if the next out-of-service inspection can be scheduled beyond the original December 2018 date, a detailed investigation into the three areas noted above was required.

6.0 Methodology

The methodology used to determine if extending the out-of-service inspection interval was a possibility is as follows:

- 1. TEAM would conduct a preliminary inspection to determine if any additional issues have developed since the last out-of-service inspection was conducted in 2017. This also included determining the extent of preparatory work required.
- 2. TEAM would recommend the type and extent of preparatory work prior to completing the required inspections.
- 3. TEAM would complete a 100% magnetic particle inspection (MPI) in the critical external corner weld to ensure it has not been compromised by the deterioration of the concrete ring beam
- 4. TEAM would complete an ultrasonic thickness survey (UT) of the chine area
- 5. TEAM would complete an assessment of the floor plate thickness from previous report data

7.0 Findings

The results of the inspection are as follows:

- Derrick French, P. Eng. and Keith Gowan, CET, Authorized API Inspector, completed the preliminary assessment on June 15th. No additional issues were identified during the preliminary assessment.
- TEAM prepared a list of preparatory work which was submitted to NL Hydro on June 13th, prior to the preliminary assessment. No further actions were added as a result of the preliminary assessment.
- 3. The MPI inspection commenced the week of June 16th. No rejectable indications were found during the time of inspection. The MPI report can be found in Appendix B.
- 4. The UT inspection commenced concurrently with the MPI inspection. The data indicated that there are no issues with the chine area with the exception of one (1) hole as shown on the reports in Appendix B. The area around the hole showed no signs of corrosion or stress.
- 5. Based on the floor assessment completed in 2008, any/all floor plates with corrosion loss greater than 40% were patched at that time. Without several sets of data, we can only assume a linear corrosion rate at this time. The areas that had experienced corrosion loss up to 40% would have experienced an estimated corrosion rate and remaining life of:

Original floor thickness = 0.250"

40% of original thickness = 0.10"

Corrosion Rate = 0.10'' / (2008 - 1970) = 0.10'' / 38 year = 0.00263'' / year



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According to API 653 Table 4.4, The minimum bottom plate thickness required at the next inspection is 0.100" when there is no means for detection and containment of a bottom leak.

Thickness remaining in 2008 (at 40% loss rate) = 0.250'' - 0.100'' = 0.150''

Allowable corrosion to meet requirements of Table 4.4 = 0.150" - 0.10" = 0.05"

Remaining life to minimum corrosion thickness = 0.05"/.00263"/year = 19 years

Remaining life for areas with up to 40% corrosion in 2008 = 2008 + 19 = 2027

It is also relevant to note that while a linear corrosion rate is assumed due to a lack of historical data, the corrosion rate has likely decelerated in recent years. This is due to improvements that have been made to the tank farm where Tank No. 2 is located. For the majority of the tanks service life, the bottom and several feet of the first shell course were submerged in water. In 2009 the tank farm was upgraded with a new drainage system which resulted in reconfiguring the tank compound. The geography was modified to promote drainage to the new drain locations. In summary, it is our opinion that the calculations above represent a worst-case scenario for the remaining floor life. Based on experience and industry standards, we expect the corrosion rate to be reduced now that the tank floor is no longer submerged in water.

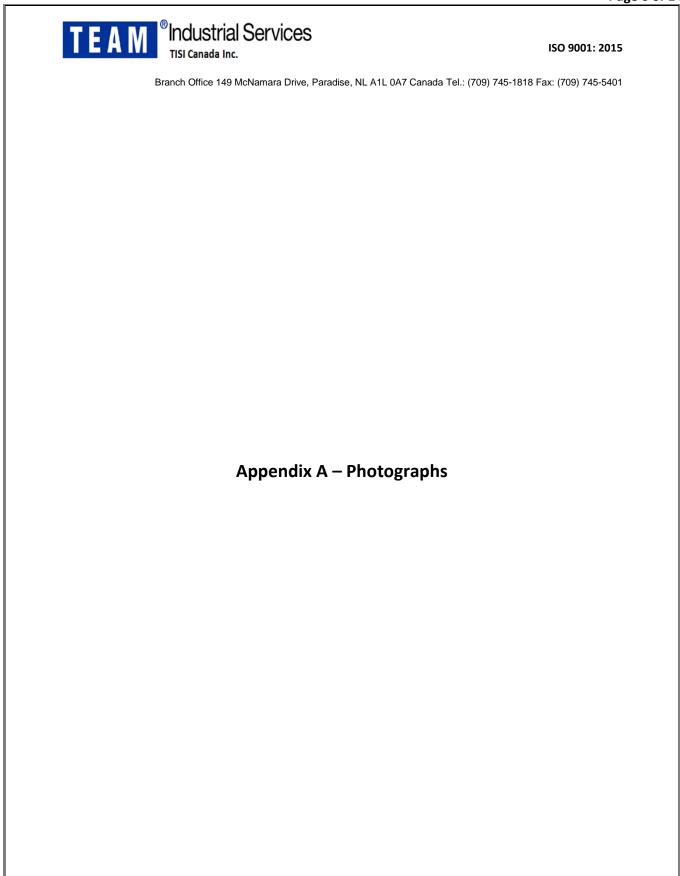
8.0 Recommendations

The following items were recommended to be completed:

- 1. Repair cracked and spalling areas of concrete ring beam
- 2. Seal chine and ring wall interface following repair of ring beam
- 3. Reapply coatings to the tank chine area
- 4. Install tank nameplate in accordance with API 650
- 5. Complete all recommendations from the 2016 inspection report

9.0 Conclusion

All items on the list of recommendations have been completed at this time with the exception of installing the nameplate. TEAM recommends the next out-of-service inspection to be scheduled for December, 2021. Please refer to Appendix A for photographs of the completed repairs.



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Figure 1: View of concrete ring beam repairs.



Figure 2: View of concrete ring beam repairs.



Figure 3: View of concrete ring beam repairs.



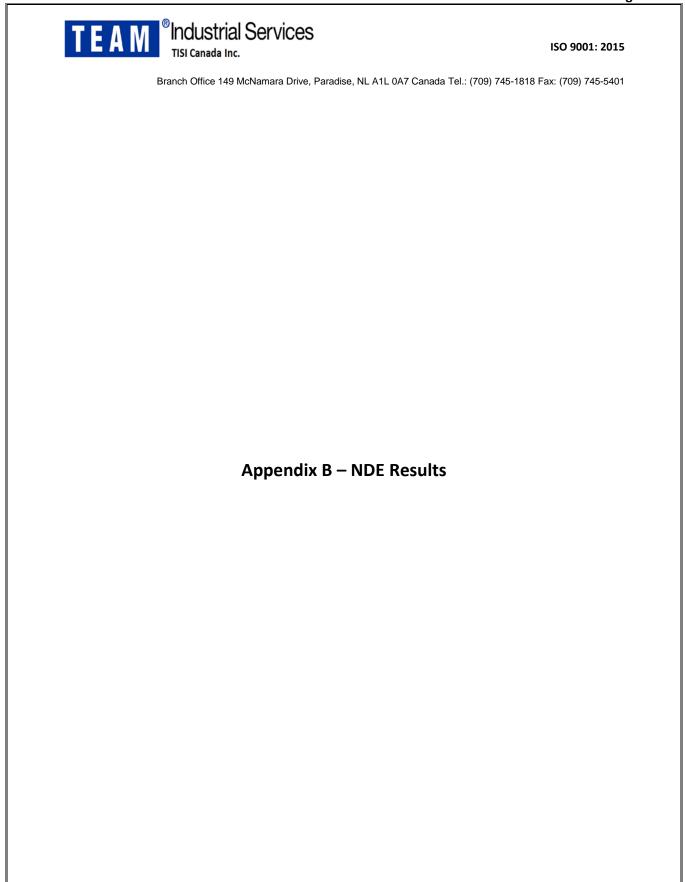
Figure 4: View of sealant applied to tank chine and ring beam interface.



Figure 5: View of concrete repair and sealant applied to tank chine and ring beam interface.



Figure 6: View of concrete repair and sealant applied to tank chine and ring beam interface.



IC-NLH-010, Attachment 1

Supplemental Capital Projects – Holyrood Thermal Generating Station

Page 9 of 14

TEAM BIndustrial Services TISI Canada Inc.

MAGNETIC PARTICLE EXAMINATION REPORT - Portable

| Note 10 10 10 10 10 10 10 1 | | | | | | | | Ī | | | | | |
|---|-----------------------------|-------------------|--------------------------|---------------|---------------------------|-------------|------------------|------------------------------|--------------------|-------------------|-------------------------------|---------------------|---------------|
| Encloyed No. Encl | Client Name | NL Hydro | | | | | | P.O. No. | Verbal | | Team Job No. | 5208-3696 | |
| Doctor D | Work Location | | , NL | | | | | Client Job No. | Verbal | | Report No. | MT-002 SR | |
| CSA MYSS Clause 12 N. Hydro Tonk 22 N. Hydro | Code / Specification / CE. | | Clause 12 | | | | | Technique No. | ASTM E709 | | Date of Exam | June 22nd 2018 | 018 |
| Ni | Acceptance / CED | CSA W59 | Clause 12 | | | | | Procedure | CSA MT-1 Rev 5 | | | | |
| Nit Hydro Tank # 2 | Part Description | | | | | | | | | | | | |
| | | NL Hydro Tank #2 | | | Material | S | | Qty Inspec | ted | 1 | Qty Accepted | | 1 |
| Vessel C Tank C See C C See C C See Se | | N/A | | | Material Thickness | N/A | | Heat No. | | N/A | Qty Rejected | ~ | N/A |
| | Type of Fabrication | | | | | | | | | | | | |
| Product Product Product Prod Spacing Product Prod Spacing Prod Spacing Prod Spacing Prod Spacing Prod Spacing Product Prod Spacing Product Prod Spacing Prod | □ Piping | □ Vessel | ✓ Tank | > | |] Casting | ∏ Forginξ | | | _ | ✓ Surface | 3 Acceptable for Ir | spection |
| Parket Volta Style 25637 Cultibration Date: Style 25637 Cultibration Date: Parket Volta Parket Volta Style 155404 Style | Inspection Parameter | S | | | | | | | | | | | |
| | Magnetic Equipment | | ıke | s/N: | 22667 | | alibration Date: | Sept 8th 2018 | ☑ AC | | ✓ Continuous | ☐ Residual | |
| Product: 735 Product: 736 Prod | Daily Yoke Verification | | Weight S/N: | 15385 | Yoke Leg Spacing | | ď | rod Spacing Amps: | N/A | Permanen | t Magnet Spacing: | N/A | |
| Products WOP2 Types Ty | Testing Medium | Product: | 7HF | | | | | ✓ Colour Contrast | | Batch No.: | 17H03K | Expiry Date: | 08-01-22 |
| Part Tengersture: Non-Planetscent Month Light Equipment used: Non-Planetscent Month Equipment Month Equipmen | Testing Medium | Product: | WCP2 | | | | ☐ Dry Powder | ✓ Colour Contrast | | Batch No.: | 17L10K | Expiry Date: | 11-01-22 |
| Loads: No. Number of Centeds: N/A Load: Cal. Date: Light Neter S/N: 1364247 Cal. Date: Northite Light Equipment used: Accriminal XP-2000 The time of Inspection: Cal. Date: Light Neter S/N: Light Neter S/N: Cal. Date: Date: <td< td=""><td>Bath Concentration</td><td></td><td></td><td>Non-Fluore</td><td>scent</td><td>ml / 10</td><td>0ml</td><td>✓ Aerosol</td><td></td><td>Part Temperat</td><td></td><td></td><td>ပ</td></td<> | Bath Concentration | | | Non-Fluore | scent | ml / 10 | 0ml | ✓ Aerosol | | Part Temperat | | | ပ |
| Cal. Date: Due Date: Light Nates 5/N; 136-427 Cal. Date: Mari Sh. 2018 | | O | emagnetization |), | > | | | Number of Oe | | | | | |
| stock: Cal. Date: Due Date: White Light Equipment stock: Accumax NP-2000 Cal. Date: Due Date: Light Neter SN: 1964247 Cal. Date: Mar. Sth 2018 Intertine of Imspection: July Load: Due Date: Light Neter SN: 1964247 Cal. Date: Mar. Sth 2018 by to be > 1000 µW /cm² : It is assumination surfaces Min. White Light Intersity to be > 100 pc : It is assumination surfaces It is assumination surfaces Bit in Darkened Area < 2 to at inspection surfaces Min. White Light Intensity to be > 100 pc : It is assumination surfaces It is assumination surfaces Well going around full circum/ference of Tank Fin on Tank It is 2. Assume Control of Min. White Light Intensity to be > 100 pc : It is assumination surfaces It is assumination surfaces Sid Rayone Reg. No. 17346 Client Final Acceptance Signature Signature Sid Rayone Expiry Date No. 153 2021 Level 2 Level 3 | Lighting Equipment | | | | | | | | | | | | |
| Cal. Date: Due Date: Light Neter's Sir. 1967 47 Cal. Date: No. 2a. 10 | Black Light Equipment us | ed: | | | | | White Lig. | ht Equipment used: | Accumax XP-2000 | | | | |
| the time of inspection: Number of inspection: July / cm² July | Black Light Meter S/N: | | Cal. Date: | | Due Date: | | Light Met | er S/N: | 1964247 | Cal. Date: | Mar 5th 2018 | Due Date: | Sept 5th 2018 |
| anality at the time of Inspection: the intensity at the time of Inspection: the intensity to be > 1000 µW / cm² : □ at examination surface White Light in Darkened Area < 2 fc at imposition surface White Light in Darkened Area < 2 fc at imposition surface White Light in Darkened Area < 2 fc at imposition surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light in Darkened Area < 2 fc at imposition surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light intensity to be > 1000 µW / cm² : □ at examination surface White Light intensity to be > 1000 µW / cm² : □ at examination surface Signature CGSB: □ Level 3 SW TTC-1A: □ Level 2 □ Level 3 CSA Supervisors Review Signature T-Port R1 T-Port R1 White Light intensity to the intensity of | Black Light Sensor S/N: | | Cal. Date: | | Due Date: | | Light Sens | or S/N: | | Cal. Date: | | Due Date: | |
| NVA And certification Authorized by to be > 1000 ft : □ at examination surface No. white Light in the native to be > 1000 ft : □ at examination surface I at examination surface NVA In the Light in Dark energy of Area < 21 cat inspection surface | Black Light Intensity at th | e time of inspect | ou: | μW / cm | 2 | | White Lig. | ht Intensity at the time o | f inspection: | 10 | | | |
| White Light in Darkened Area < 2 to at inspection surface) Signer N/A And Certification Signature Signature Signature Signature Signature Signature Coss. I Level 2 Level 2 Level 3 Strincial inspector Signature Coss. I Level 2 Level 2 Level 3 Strincial inspector Signature T-Port RI. T-Port RI. | Min. Black Light intensity | to be > 1000 μW | | camination su | ırface | | Min. Whit | te Light Intensity to be > . | > | amination surface | | | |
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| 0% MT on weld going ground full circumference of Tank Fin on Tank #2 N/A nd Certification Certification Signature Signature Sid Raysone Reg. No. 17346 Client Final Acceptance Signature CGSs. Z. Level 2 Level 2 Level 3 SNT-TC-1A: Signature Signature T- Port R1 139 McNamara Drive I Paradse, NL. I All LOA? I TEL (709) 745-1818 I FAX (709) 745-5401 Signature | Inspection Scope | | | | | | | | | | | | |
| nd Certification Sid Raysome Reg. No. 17346 Client Final Acceptance Signature Signature Signature Signature CGSB: Level 2 Level 3 SNT-TC-1A: Level 2 Level 3 CSA Supervisors Review Signature Signatur | Perform 100% MT on w | veld going around | full circumference of | Tank Fin on 1 | ank #2 | | | | | | | | |
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| nd Certification Sid Ragsome Reg. No. 17346 Client Final Acceptance Signature Sid Ragsome Reg. No. 15th 2021 Authorized Inspector CGSB: ☐ Level 2 ☐ Level 3 SINT-TC-1A: ☐ Level 3 CSA Supervisors Review Signature T - Port R 1 149 MCNamara Drive I Paradise, NL. I A1L 0A7 I TEL (709) 745-1818 I FAX (709) 745-5401 | | | | | | | | | | | | | |
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Supplemental Capital Projects – Holyrood Thermal Generating Station

TEAM BINGUStrial Services TISI Canada Inc.

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| EPORT - F | |
| NATION REPORT | |
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| | |

| Client Name NL Hydro Work Location Holyrood, NL Code / Specification / CED CSA W59 Clause 12 Acceptance / CED CSA W59 Clause 12 Inspection Results At the time of inspection of weld , there were no recordable indications. Acceptable to code. At the time of inspection of weld , there were no recordable indications. Acceptable to code. For additional notes. As shown in the picture below, 1 hole was noted in the Tank Fin. | Void #3 | o No. | 709 1-1 Rev 5 | Report No. Date of Exam | 5208-3696 MT-002 SR June 22nd 2018 |
|--|--|-------|------------------|-------------------------|------------------------------------|
| Mork Location Code / Specification / CED CSA W59 Clause 12 Acceptance / CED CSA W59 Clause 12 CSA W59 Clause 12 At the time of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. Acceptance of inspection of weld , there were no recordable indications. | Void #3 | | F709 | ate of Exam | MT-002 SR June 22nd 2018 |
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| At the time of inspection of weld , there were no recordable indications. Accep | Void #3 | | T-1 Rev 5 | | |
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| For additional notes. As shown in the picture below, 1 hole was noted in the Ta | | | | | |
| | Void #3 | | | | |
| | Void #3 | | | | |
| Additional Optional Information - Sketches, Graphs etc. | | | | | |
| ome Reg. No. | | | Signature | | |
| Expiry Date | | | Signature | | Date |
| Certification CGSB: | ☐ Level 2 ☐ Level 3 CSA Supervisors Review Signa | | Signature | | Date Date |

IC-NLH-010, Attachment 1

Supplemental Capital Projects – Holyrood Thermal Generating Station

TEAM BINDUStrial Services TISI Canada Inc.

ULTRASOUND EXAMINATION REPORT

| | UT-002 SR | June 22nd 2018 | | | N/A | N/A | | le for Inspection | | er dB Scan dB | 80% FSH | | | Carbon Steel | Carbon Steel | 4 | |
|--------|----------------|----------------------------|-----------------------|------------------|-----------------|--------------------|-----------------------|-------------------------------------|----------------------|----------------------------|---------------|------------|----------------------|-------------------|---------------------------|-------------------|------------------|
| | | | | | epted | ected | | ✓ Surface Acceptable for Inspection | | Reference dB Transfer dB | 80 % FSH 0 | | | | | Batch No.: 11382F | |
| | Report No. | Date of Exam | | | Qty Accepted | Qty Rejected | | 7 | ransducer | S/N Refere | 936358 80% | | | Material | Material | Batch | |
| | | | 10 Rev 2 | | N/A | N/A | | ☐ Other | Tre | Freq. MHz | 5 Mhz | | | 3175 | 16-1769 | Sonoglide | |
| , cipa | Verbal | ASME V Article 4 | UT.ASME.11 5200 Rev 2 | | Qty Inspected | Heat No. | | ✓ Plate | | Size | 0.5" Diameter | | | N/S | s/N | Couplant: | |
| | Client Job No. | Technique No. | Procedure | | | | | ☐ Forging | | Angle° | 0 | | | ness | 0" Thickness | N/A | |
| | | | | | CS | N/A | | ☐ Casting ☐ | | Daily | Daily | .9 | ☐ Yes ☑ No | 1" & 4" Thickness | 0.100" & 0.500" Thickness | Batch No.: | |
| | | | | | | Material Thickness | | □ Meld | | Cal. Date | Cal. Due Date | Cabl | | è | Ref. Reflector | N/A | |
| | | | | | Material | Material | - | | | S/N: 071524109 Cal. | ☐ C-Scan | ☐ Other | Damping | | | Material: | |
| | | tion | tion | | | | | sel 🗸 Tank | Ultrasonic Equipment | 37 DL Plus | scar | | No - | | Step Wedge | | |
| | Holyrood, NL | Client Information | Client Information | | | | | □ Vessel | n | rics Model: | | ☐ Microdot | □ Yes | | Step V | | |
| | | | | | Tank #2 | N/A | meters | n 🗆 Piping | | .e: Panametrics | ☑ A-Scan | □ BNC | Reject | + | Туре | Method: | e e |
| | Work Location | Code / Specification / CED | Acceptance / CED | Part Description | Part / Assy No. | DWG No. | Inspection Parameters | Type of Fabrication | | Make: | Presentation | Cable Type | Leader of the second | Calibration Block | Calibration Block | Post Clean | Inspection Scope |

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Page 2 of 2

149 McNamara Drive I Paradise, NL. I A1L 0A7 I TEL (709) 745-1818 I FAX (709) 745-5401

form# 007 UT R2

June 22nd 2018 UT-002 SR 5208-3587 Date Date Date Team Job No. Date of Exam Report No. View looking Northwest at Southeast of Tank #2 0.296 0.301 0.309 0.281 0.322 0.281 Signature Signature Signature 0.294 0.333 0.314 0.270 0.341 0.307 Readings are taken starting at North of Tank on West side of Shack (Facing Plant) around the circumference 0.304 0.299 0.326 0.291 UT.ASME.11 5200 Rev 2 ASME V Article 4 0.291 0.335 Verbal 0.286 0.241 0.288 0.364 0.311 0.331 0.330 0.282 0.329 0.307 Technique No. Client Job No. Readings are going from left to right Procedure **Ultrasonic Thickness Readings** start on West side of building attached to Tank # 2 and continue around the full 0.260 0.299 CSA Supervisors Review circumference of the Tank Client Final Acceptance Authorized Inspector 0.266 0.320 0.298 0.365 0.298 0.221 0.298 ☐ Level 3 0.315 0.360 0.306 0.284 0.321 View looking SouthWest at Northeast side of Tank #2 Nov 15th 2021 0.390 0.334 0.331 0.280 0.302 ☐ Level 2 17346 0.286 0.323 0.281 0.300 0.348 **Expiry Date** SNT-TC-1A: dditional Optional Information - Sketches, Graphs etc. Reg. No. 0.276 0.299 0.344 0.355 0.3390.335 TISI Canada Inc. ☐ Level 3 Client Information Holyrood, NL **ASME B31.1** ☐ Level 2 Sid Ransome, CGSB: Code / Specification / CED spection Results Acceptance / CED **Work Location** Certification **Technician** Signature

ULTRASOUND EXAMINATION REPORT

® Industrial Services

IC-NLH-010, Attachment 1

Supplemental Capital Projects – Holyrood Thermal Generating Station

TEAM Industrial Services

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|---|--------------|----------------|----------------------------|-----------------------|------------------|-----------------|--------------------|-----------------------|-------------------------------------|----------------------|----------------------------|---------------|--------------|-----------------------|-------------------|---------------------------|-------------|------------------|--|-------|---|----------|--|---|---|----------------------|-----------------------|
| | | | 8 | | | N/A | N/A | | spection | | Scan dB | 80% FSH | | | | | | | | | | | | П | | | |
| | 5208-3696 | UT-003 SR | June 22nd 2018 | | | 2 | N | | ✓ Surface Acceptable for Inspection | | Transfer dB | 0 | | | Carbon Steel | Carbon Steel | 11382F | | | | | | | | Date | Date | |
| | Team Job No. | Report No. | Date of Exam | | | Qty Accepted | Qty Rejected | | Surface | | Reference dB | 80 % FSH | | | Material | Material | Batch No.: | | | | | | | | | | |
| | | | | | | N/A | N/A | | | Transducer | N/S | 858986 | | | | | | | | | | | | | Signature | Signature | 2 |
| | | | e 4 | 200 Rev 2 | | Z | N | | □ Other | | Freq. MHz | 5 Mhz | | | 3175 | 16-1769 | Sonoglide | | | | | | | | | | |
| | Verbal | Verbal | ASME V Article 4 | UT.ASME.11 5200 Rev 2 | | Qty Inspected | Heat No. | | ✓ Plate | | Size | 0.5" Diameter | | | s/N | N/S | Couplant: | | | | | | | | | | |
| | PO No. | Client Job No. | Technique No. | Procedure | | | | | ☐ Forging | | Angle° | 0 | | | iss | " Thickness | N/A | | | | | | | | itance | ctor | |
| | | | | | | CS | N/A | | | | Daily | Daily | .9 ON | ransmission | 1" & 4" Thickness | 0.100" & 0.500" Thickness | Batch No.: | | pection. | | | | | | Client Final Acceptance | Authorized Inspector | |
| | | | | | | | ickness | | ld Casting | | al. Date | Cal. Due Date | Cable Length | | Re l | Ref. Reflector | N/A | | Perform Ultrasonic thickness readings on Tank Fin around the voids that were discovered during inspection. | | | | | | | | 0 |
| | | | | | | Material | Material Thickness | | □ Weld | ent | S/N: 071524109 Cal. | _ | ☐ Other | Immersion Resonance | | | Material: N | | ds that were disc | | | | | | 17346 | | IL |
| | | | , | | | | | | ✓ Tank | Ultrasonic Equipment | | : | omin SN | | | ge | 2 | | n around the voic | | | | | | Reg. No. | Expiry Date | |
| | NL Hydro | Holyrood , NL | Client Information | Client Information | | #2 | | | □ Vessel | Ultra | Mode | B-Scan | ☐ Microdot | ☐ Pulse Echo | IIW Type I | Step Wedge | N/A | | dings on Tank Fi | | | | | | | 2000 | : : : : : |
| | Z | Н | | Ū | | Tank #1 & #2 | N/A | meters | ا ا | | e: Panametrics | ☑ A-Scan | BNC | Ŀ | | Туре | Method: | به | nic thickness rea | | | | | : | ertification Sid Ransome | I John & | |
| | Client Name | Work Location | Code / Specification / CED | Acceptance / CED | Part Description | Part / Assy No. | DWG No. | Inspection Parameters | Type of Fabrication | | Make: | Presentation | Cable Type | Inspection Method | Calibration Block | Calibration Block | Post Clean | Inspection Scope | Perform Ultrasor | | | | | | Signature and Certitication Technician | | 1 |

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Page 2 of 2

June 22nd 2018 5208-3696 UT-003 SR Date Date Report No. Date of Exam Team Job No. Void #3 **ULTRASOUND EXAMINATION REPORT** Signature Signature Signature 0.286 0.279 0.313 Fank #2 Void #3 UT.ASME.11 5200 Rev 2 ASME V Article 4 0.310 0.311 0.280 Verbal Client Job No. Technique No. 0.304 0.289 0.305 Procedure Void #2 CSA Supervisors Review Client Final Acceptance **Authorized Inspector** Void #2 0.291 0.325 0.331 Tank #1 ☐ Level 3 0.288 Nov 15th 2021 0.291 0.301 17346 ☐ Level 2 Void #1 ® Industrial Services **Expiry Date** SNT-TC-1A: dditional Optional Information - Sketches, Graphs etc. 0.266 0.314 0.277 Reg. No. ☐ Level 3 Client Information Client Information Void#1 Holyrood, NL ☐ Level 2 Sid Ransome CGSB: Code / Specification / CED spection Results Acceptance / CED **Work Location** Certification **Technician** Signature

149 McNamara Drive | Paradise, NL. | A1L 0A7 | TEL (709) 745-1818 | FAX (709) 745-5401

form# 007 UT R2



18 February, 2021

Newfoundland and Labrador Hydro Holyrood, NL

Attention:- Ms. Joanne Norman

Subject: Tank No. 2 Inspection Interval

Dear Ms. Norman,

We have conducted a review of the API Recommended Practice 575. The review of API RP 575 was recommended in an email response provided by the Department of Environment, Climate Change and Municipalities dated February 12, 2021, regarding the previously requested internal inspection interval for Tank No.2.

In API RP 575 Third Edition, Section 7.2 Condition-based Inspection Scheduling and Minimum Acceptable Thickness, an equation is provided to calculate the remaining life of a tank and its components. Please refer to the equation and defined variables below.

remaining life (years) =
$$\frac{t_{actual} - t_{minimum}}{\text{corrosion rate}}$$
 = the remaining life of a tank component in years,

where

 t_{actual} is the thickness measured at the time of inspection for a given location or component used to determine the minimum acceptable thickness, in inches (mm),

 $t_{minimum}$ is the minimum acceptable thickness for a given location or component, in inches (mm),

corrosion rate =
$$\frac{t_{previous} - t_{actual}}{\text{time (years) between } t_{previous} \text{ and } t_{actual}}$$
 = in inches (mm) per year,

where

 $t_{previous}$ is the thickness at the same location as t_{actual} measured during a previous inspection, in inches (mm).

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Based on the available data from the Out-of-service inspection completed on Tank No.2 in 2008, we can complete the calculations as shown above to determine the remaining life of the tank floor.

The drawings for the original tank construction indicate that the tank floor was constructed from ASTM A 283 Grade C material. As per ASTM A 283/ASTM A 6 Standards, the maximum permitted mill tolerance in thickness over nominal thickness for plate specified as 0.25in thick for widths up to 8'0", as utilized in the construction of the tank floor of Tank No.2 is 0.03in. We can use this maximum permissible thickness to calculate the worst-case corrosion rate that could have occurred between construction and the inspection completed in 2008. The MFL scanner used during the 2008 inspection was calibrated based on the nominal plate thickness of 0.25in. All percentage of discontinuities recorded by the MFL scanner were in relation to this nominal thickness used for calibration. Based on all areas with >40% discontinuities being repaired, the minimum remaining thickness following repairs, t_{actual} is as follows.

$$t_{actual} = 0.6 * t_{nominal}$$

 $t_{actual} = 0.6 * 0.25 in$

$$t_{actual} = 0.15in$$

 $t_{minimum} = 0.10in$ (As per API 653, Table 4.4 – Bottom Plate Minimum Thickness)

$$t_{previous} = t_{nominal} + Max \ Mill \ Tolerance$$
 $t_{previous} = 0.25in + 0.03in$ $t_{previous} = 0.28in$ $corossion \ rate = rac{0.28 - 0.15}{2008 - 1970}$ $corossion \ rate = rac{0.13}{38}$

remaining life (years) =
$$\frac{0.15 - 0.10}{0.00342}$$

 $corossion\ rate = 0.00342in/year$

$$remaining\ life\ (years) = 14.6$$



If we add the remaining life to the date of inspection (November, 2008 = 2008.9) we get the following:

2008.9 + 14.6 = 2023.5

Based on this calculation following API RP 575 Section 7.2, it is our recommendation that Tank No.2 remain in service through June, 2023.

Derrick French, P.Eng., IWE

Senior Mechanical Engineer



