2020 Capital Budget Application Technical Conference – Wood Pole Line Management

Presentation to the Board of Commissioners of Public Utilities

November 20, 2019

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Outline

- Newfoundland and Labrador Hydro ("Hydro") System Overview
- History
- Wood Pole Line Management ("WPLM") Program
  - Inspection and Treatment
  - Data Collection and Storage
  - Engineering Analysis and Refurbishment Recommendations
- 2020 Proposed Work
- Survival Curves for Asset Management
- Industry Practices

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Hydro System Overview – Wood Pole Transmission

- 42 wood transmission lines
  - 20 looped, 22 radial
- Voltages
  - 69 kV
  - 138 kV
  - 230 kV
- Approx. 2,500 km
- Approx. 26,000 poles

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History

- In the late 1990s and early 2000s, Hydro identified that wooden transmission poles within its system were losing their preservative treatment and were experiencing decay as a result.
- This presented the need for a long-term asset management and life extension program for Hydro's wooden transmission lines.

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History (continued)

- The WPLM Program was first initiated in 2003 as a pilot study and was presented to the Board and approved as part of Hydro's 2005 Capital Budget Application.
- *"This approach is a more strategic method of managing wood poles and conductors and associated equipment and is persuaded that the new WPLM Program, based on RCM principles, will lead to an extension of the life of the assets, as well as a more reliable method of determining the residual life of each asset.* ***One of the obvious benefits of RCM will be to defer the replacement of these assets thereby resulting in a direct benefit to the ratepayers.****"*

  - Board Order No. P.U. 53(2004).

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History (continued)

- Nearly 41,000 poles inspected and treated between 2003 and 2019.
- 1009 poles replaced in this period – approximately 2.5% pole replacement rate.

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WPLM Program

- The WPLM Program consists of three main components.
  - Inspection and treatment of poles
  - Engineering analysis of inspection results
  - Refurbishment

WPLM Inspection and Treatment

- Inspection and treatment to begin at 20 years of age to extend the life of the line.
- Inspections based on a 10-year cycle; however, there is flexibility to allow shorter or longer intervals (results in approximately 2600 poles per year).
- Factors affecting line-specific inspection intervals include condition of asset, future system plans, demand growth or shrinkage, etc.

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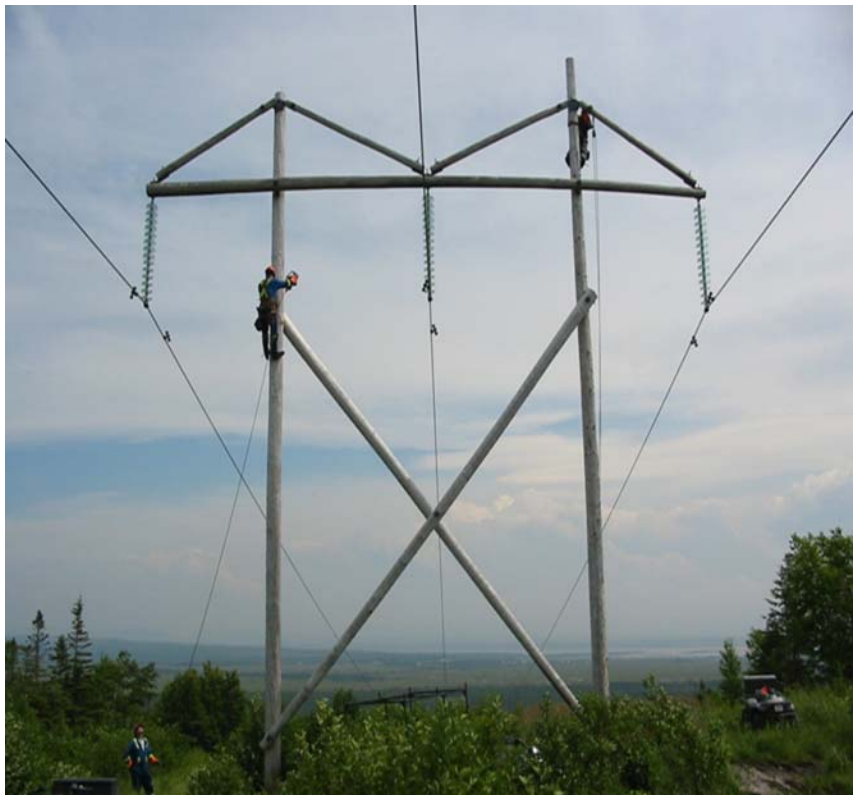
WPLM - Inspection and Treatment Process



- Groundline checked for decay.
- Full climbing inspection is completed at each structure
- Entire pole is inspected and sounded, with boring completed when decay suspected.
- Pole is treated at critical locations.
- Other components are inspected (i.e. crossarm, crossbraces, insulators etc.)
- Inspections performed by internal line crews.

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WPLM - Inspection and Treatment Process

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WPLM - Inspection and Treatment Process

- Poles and structure components are assigned a condition rating between 1 and 5.
- Poles recommended for replacement are re-evaluated to confirm condition assessment and approve replacement.

Condition	Rating	Post-Inspection and Treatment Action
Severe/Hazardous to Climb	5	Refurbishment required as soon as practicable.
Poor	4	Engineering analysis and subsequent refurbishment if deemed necessary.
Moderate	3	Early signs of minor deterioration. Follow-up inspection in 5 years.
No issues	2	None.
New (<10 Years)	1	Climbing inspection and treatment not required.

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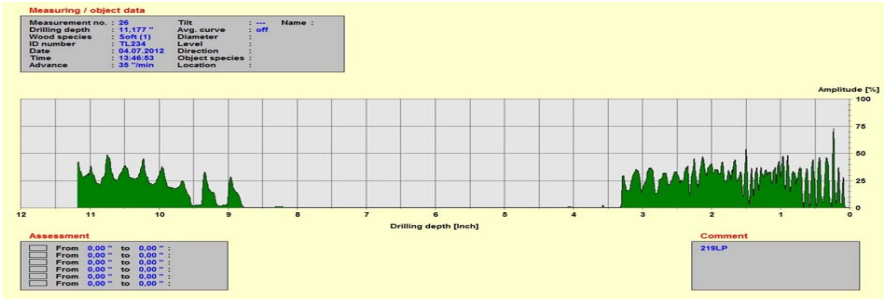
WPLM - Inspection and Treatment Process

- Resistograph ™
  - Used to measure the cross-sectional profile at any point on the pole.
  - Primarily a re-evaluation tool for rejected poles as required.
  - Accurate indication of internal pole condition.



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WPLM - Inspection and Treatment Process

- Boron Rod Treatment is applied in poles at:
  - Crossarm attachments
  - Crossbrace attachments
  - Kneebrace attachments
  - Guy attachments
  - Ground line

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WPLM - Data Collection and Storage

- Panasonic ToughPad
  - Operates using Windows 10 and custom Graphical Information System (“GIS”) software.
  - Designed for field use.
  - Data synced directly to a GIS database, making data readily available and sortable after inspections completed.

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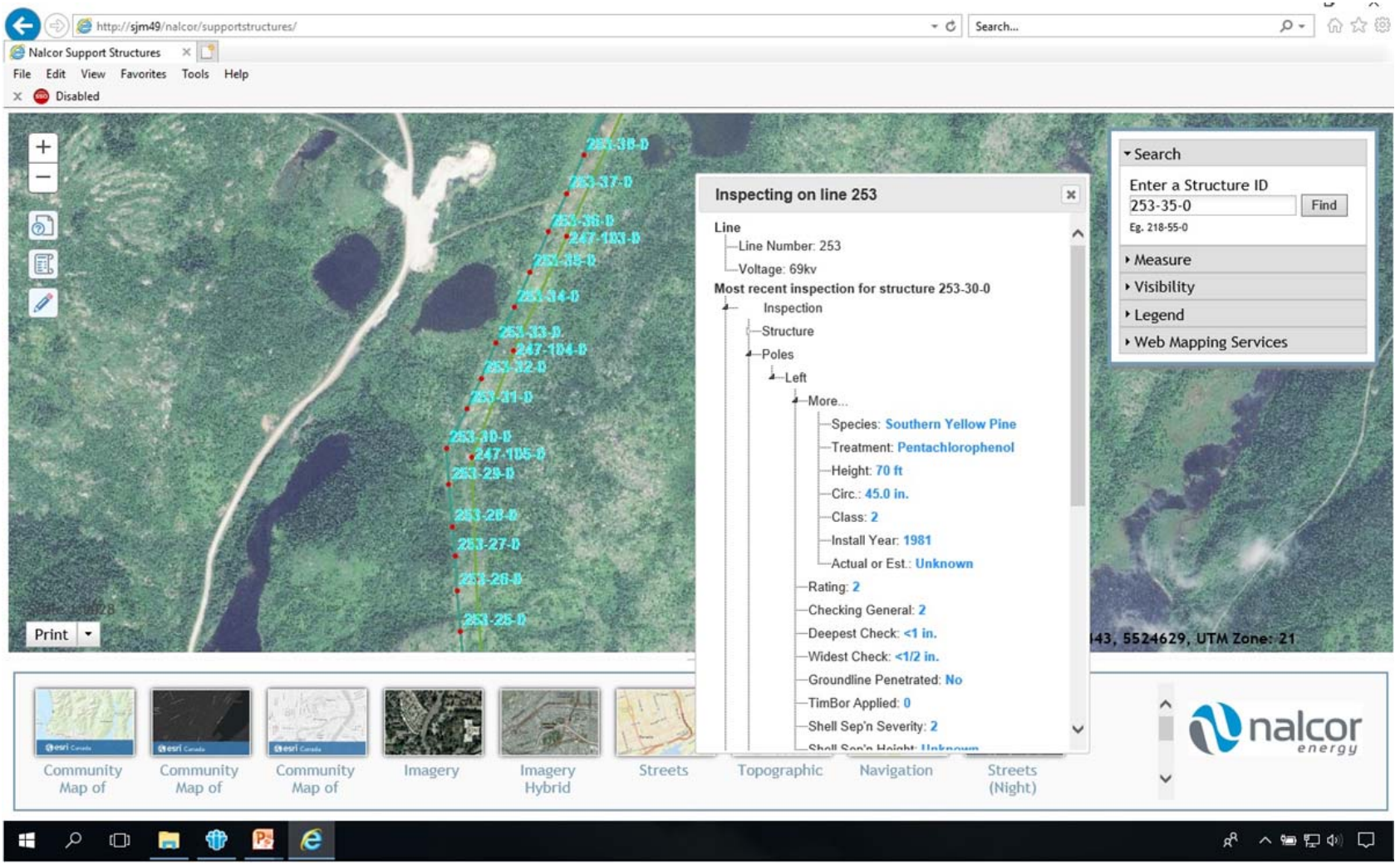
WPLM - Data Collection and Storage



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WPLM - Refurbishment Recommendations

- Field inspections are reviewed by engineering.
- Refurbishment is based on both assessed condition and engineering analysis.
- Factors considered include:
  - Extent and location of deterioration
  - Structure strength / capacity
  - Pole strength reduction based on past destructive testing.
  - Structural loading based on environmental conditions and geography of the line.

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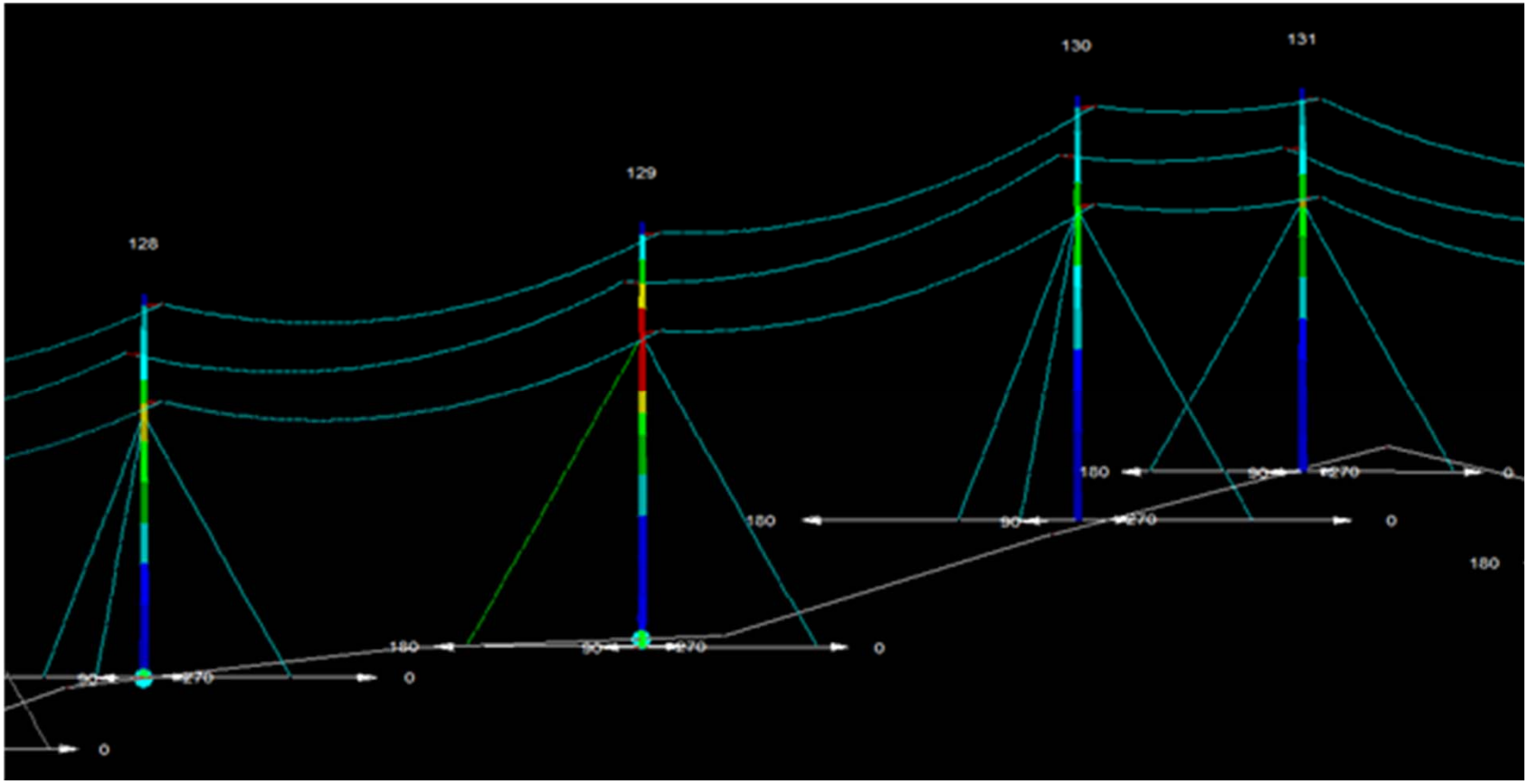
WPLM - Refurbishment Recommendations



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2020 Proposed Work
Inspections and Treatment

Region*	Line No.	Year Built	Age of Line	Target Number of Poles to Inspect
Eastern	TL219	1990	30	324
Central	TL220	1970	50	173
	TL251	1981	39	119
	TL233	1973	47	400
	TL254	1988	32	216
	TL238	1976	44	2
Western	TL209	1971	49	183
Northern	TL226	1970	50	269
	TL227	1970	50	48
	TL257	1988	32	469
TOTAL				2,203

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2020 Proposed Work Refurbishment*

Component	Region					TOTAL
	Eastern	Central	Western	Northern	Labrador	
Poles	-	15	21	1	-	37
Crossarms	1	22	2	2	-	27
Crossbracing	-	14	-	-	-	14
Kneebracing	-	8	-	-	-	8
Foundations	1	1	1	-	-	3
Miscellaneous (Insulators, hardware, etc.)	36	14	5	2	-	57

*Refurbishment list is preliminary and engineering analysis is ongoing.

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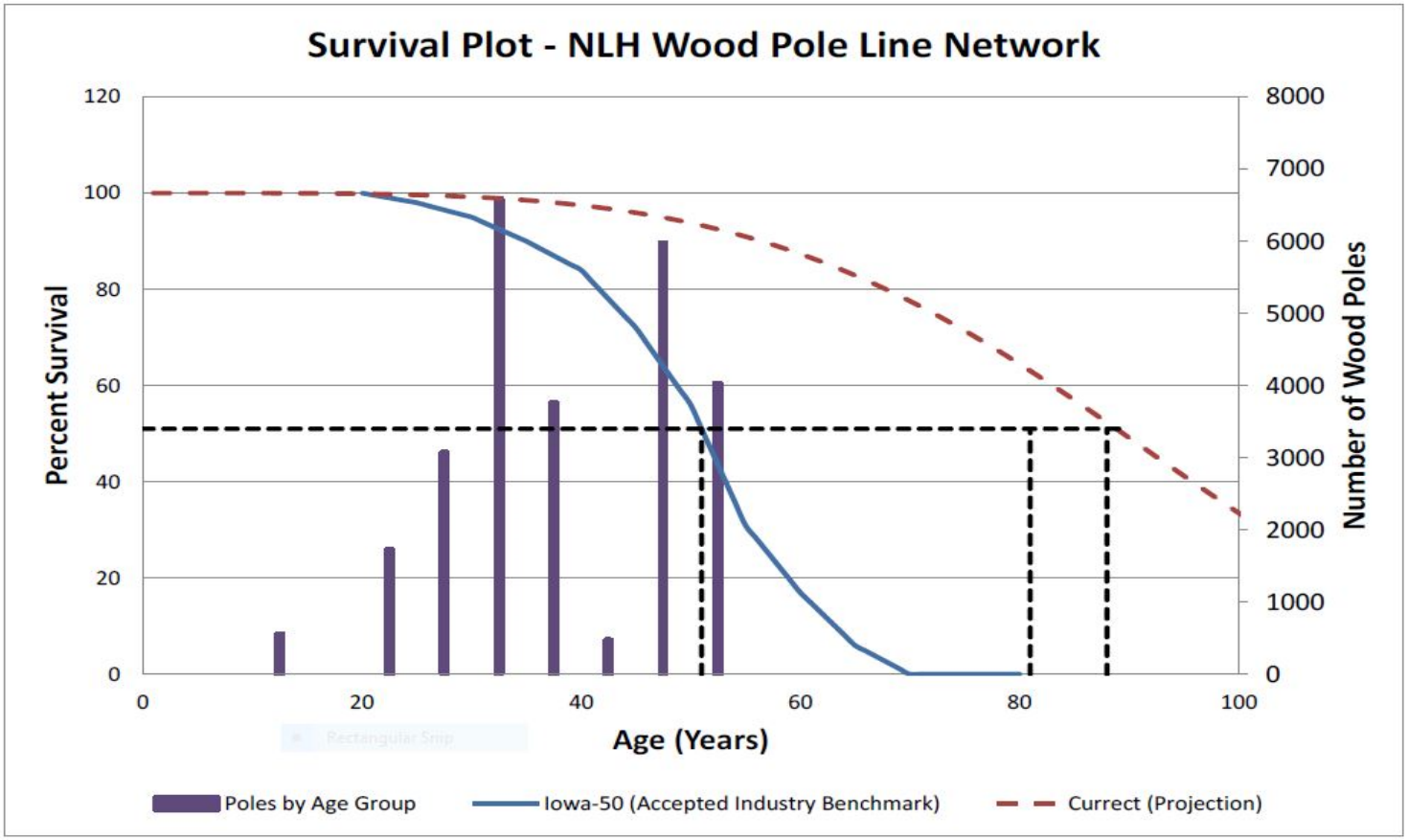
Survival Curves for Asset Management

- Pole replacement data is analyzed statistically to calibrate survival curves.



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Survival Curves for Asset Management

- Survival curves are used to predict future replacement rates and develop budget proposals and long term plans for each line.

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Industry Practices

- At the inception of the WPLM Program the following utilities followed similar programs, including BC Hydro, NB Power, Hydro One, and Manitoba Hydro.
- In 2019 Hydro asked other utilities to complete a survey on their wood pole management practices through the CEATI consortium.

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Industry Practices (continued)

- Survey Results
  - 17 utilities that had wood pole transmission lines in their systems responded, with 15 advising that they utilized a “test and treat” program.
  - Of the Canadian respondents, BC Hydro, FortisBC, Sask Power, NB Power, NS Power have reported a similar program to Hydro’s WPLM in terms of;
    - Inspection and treatment philosophy
    - Inspection cycles
    - Condition based refurbishment of lines

Industry Practice – Pole Replacement Rate

- Utilities were asked what percentage of poles is removed annually from their pole asset inventory, on average.
    - 31% of respondents said less than 1%
    - 61% of respondents said between 1-3%
    - 8% of respondents said greater than 3%
- Hydro's average annual replacement rate is 2.5%.

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