Q. Page 3-10, lines 3-5: Please describe Newfoundland Power's preventive maintenance program.

A. Appendix A provides a copy of Newfoundland Power's "Transmission Inspection and Maintenance Practices" for transmission lines. The document describes the inspection frequencies as well as repair prioritization and response timelines.

Appendix B provides a copy of Newfoundland Power's "Distribution Inspection and Maintenance Practices" for distribution lines.

Electronic copies of documents describing Newfoundland Power's distribution substation equipment maintenance system, equipment standards, test procedures, equipment reference material and inspection forms, which collectively constitute the Company's preventative maintenance program, can be found in the response to Request for Information PUB-NP-025, Attachments A-G on Newfoundland Power's stranded website at the link ftp.nfpower.nf.ca .

A comprehensive assessment of Newfoundland Power's preventative maintenance programs can be found in *The Liberty Consulting Group's Report on Island Interconnected System to Interconnection with Muskrat Falls addressing Newfoundland Power, December 17, 2014* (the "Liberty Consulting Report").[1]

Amongst the conclusions in the Liberty Consulting Report, were the following:

> *"Newfoundland Power's reliability has improved significantly since 1999 and has recently remained stable overall. Its transmission and distribution systems operate effectively in ensuring adequate service reliability. Effective maintenance and capital programs, that appropriately recognize the age of its assets, have contributed materially to improved reliability…*
>
> *The program, organization, and staffing of Newfoundland Power's asset management functions are sound. The Company uses an effective combination of periodic inspection and maintenance programs and capital rebuild and modernization projects. Vegetation management practices also conform to good utility practices."*[2]

[1] *The Liberty Consulting Group's Report on Island Interconnected System to Interconnection with Muskrat Falls addressing Newfoundland Power, December 17, 2014* was commissioned by the Board in its *Investigation and Hearing into the Supply Issues and Power Outages on the Island Interconnected System.*

[2] See *The Liberty Consulting Group's Report on Island Interconnected System to Interconnection with Muskrat Falls addressing Newfoundland Power, December 17, 2014*, page ES-2.

Newfoundland Power's
Distribution Inspection Maintenance Practices

NEWFOUNDLAND POWER
A FORTIS COMPANY

TRANSMISSION INSPECTION AND MAINTENANCE PRACTICES

Approved By: Mike Comerford, P. Eng.
Approved Date: March 4, 2013

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TRANSMISSION INSPECTION AND MAINTENANCE PRACTICES

Policy Statement

Regularly scheduled inspections and correction of identified deficiencies will be undertaken on all transmission lines to provide for safe and reliable operation. Regional Managers are responsible to ensure that transmission line inspection and maintenance activities are completed in accordance with this policy. Responsibility for maintaining and revising this policy rests with the Superintendent, responsible for Transmission.

All preventative and corrective maintenance activities shall be recorded in the Company's computerized Transmission Asset Management System (TAMS).

Public and Employee Safety

Newfoundland Power owns and operates in excess of 2,000 km of transmission lines that transverse both rural and urban environments. Transmission line corridors may be used as trailways for snowmobilers, ATV operators, skiers, hikers and others and are also regularly used by employees to carry out inspection and maintenance activities. As well, in urban areas, lines often travel along streets and through residential neighbourhoods. Because transmission line corridors are used by the public and employees, lines and right-of-ways must be inspected and maintained in a safe manner.

Regular inspections of transmission lines and timely correction of identified deficiencies will minimize risk to the public and employees. Transmission line inspectors have the responsibility to inspect lines thoroughly with a keen focus on identifying potential public and employee hazards. Regional Managers, Area and Regional Superintendents of Operations, Line Operations Supervisors, and the Transmission/Distribution Maintenance Supervisor, have the shared responsibility to ensure that inspections are completed and any identified deficiencies and hazards are corrected in accordance with this policy.

Inspector Qualifications

As a minimum, an inspector must have the following qualifications to complete the Detailed Ground Inspections on Newfoundland Power's transmission lines:

i) Minimum 3 years of experience in the electrical utility industry in the operations or engineering area.

ii) Familiarity with the operation, maintenance and construction of transmission lines.

iii) Familiarity with the use and operation of off-road vehicles such as ATV's and snowmobiles.

iv) Basic understanding of the electrical and mechanical nature of transmission lines.

v) Successful completion of Newfoundland Power line inspection workshop "Line Inspection Fundamentals".

The above qualifications can be obtained by a combination of on-the-job training, formal education and training as provided by recognized educational institutions, and internal Company training and workshops.

In order to maintain status as a Newfoundland Power line inspector, the inspector must successfully complete in-house line inspector training every three years.

Typically, all inspections will be carried out by the Planner assigned to the respective area.

Transmission Asset Management System (TAMS)

All transmission line preventive maintenance and inspections as well as deficiency identification and corrective maintenance activities shall be recorded in the Company's computerized maintenance management system known as Transmission Asset Management System (TAMS). The inspections and deficiencies are to be recorded in the field, by inspectors on handheld devices. Data from these devices shall be downloaded regularly into the computer system.

The Transmission department is responsible for administering TAMS and information services for training users. Planners, Supervisors, Line Supervisors, Superintendents, and others within the Transmission group may have access to this system.

Inspection Type and Frequency

All Transmission Lines are required to have a minimum of one (1) Detailed Ground Inspection per year. More frequent inspections may be required on some lines depending on their operating performance and as determined by the Area or Regional Superintendent of Operations.

Generally, Climbing Inspections shall only be performed on transmission structures/lines to:

a) More thoroughly assess concerns with specific components (i.e. insulators, hardware, crossarms) as identified by ground inspections

b) Ensure a newly constructed line meets construction standards (acceptance inspection).

Regularly scheduled Helicopter Patrols are not required under this policy. Special circumstances and operational problems can arise that will warrant a helicopter patrol (i.e. frequent line trips, storm damage, etc). A patrol performed under these conditions shall not substitute for a ground inspection.

Detailed Ground Inspections

During detailed ground inspections of transmission lines, inspectors will inspect all poles, towers, conductors, insulators, crossarms, crossbraces, anchors, guys, deadends, jumpers, sleeves and other hardware, as well as the right-of-way, and identify deficiencies that require correction.

To provide for a thorough inspection of poles, anchors, and guys at the groundline, at least one (1) of every four (4) ground inspections shall be carried out with no snow cover present.

Personnel performing inspections shall use binoculars, plumb bob, hammer, core sampler, screw driver, crescent wrench, digital camera, height measurement meter and all other equipment deemed necessary to assist in the evaluation of transmission line components.

In some cases it will be necessary for inspectors to utilize off-road capable vehicles such as ATVs, snowmobiles, or Argos. When such vehicles are required, additional considerations will be necessary. If the vehicle used is equipped with an enclosed cab, it is required that the vehicle be equipped with an escape hatch operable from both inside and outside the vehicle. Should water bodies need to be crossed, floater survival suits are required equipment as well.

Any line or site specific hazards or details should be identified by the inspectors on a go-forward basis and noted in handheld device. This information should be consulted before beginning any line inspections to confirm any extra requirements that inspectors should be aware of prior to commencing work, and to communicate any site considerations to contractors who may be working on the lines. Any additional details should be identified by the inspectors on a go-forward basis and noted in handheld device.

When working on “Remote” transmission lines, extra safety equipment and precautions are necessary. Inspectors should have in their possession the following items:

- Appropriately stocked survival kit
- GPS device including most recent mapping software
- Personal flotation devices (PFDs) if use of off road vehicles in water is required
- Redundant transportation such as a second ATV, snowmobile, or Argo; to be used in the case of incapacitation of primary mode of transportation
- At least one satellite phone for use in areas with poor cellular coverage

Inspectors are also required to complete and document tailboard discussions on a daily basis, and more often as needed to address changing conditions and newly identified hazards. Ground conditions and communications limitations should be considered as part of the discussion.

Appropriate operations manual procedures must be followed. Relevant procedures include the following:

- OPR112.08 – "Off Road Vehicles"
- OPR112.16 – "Driving Off Road Vehicles"
- OPR101.16 – "Working Alone or in Isolated Locations"
- OPR101.17 – "Traveling and Working in Remote Areas"
- OPR300.01 – "Risk Management/Job Planning"
- OPR300.03 – "Working Alone"
- OPR112.07 – "Travelling Over Wetlands and/or Bogs"
- OPR106.46 – "Power Line De-Energization and Hold-Off Protection"
- OPR106.47 – "Transmission Line Structures with Damaged Insulators"
- OPR106.48 – "Transmission Line Structures with Damaged Equipment or Hardware other than Damaged Insulators"

Results of detailed ground inspections and identified deficiencies shall be recorded in the field on handheld devices. GPS co-ordinates are to be taken in the field for all structures, approved access trails and hazards.

Transmission Line Component Inspection Guidelines

Transmission line ground inspections require evaluation of the following components. For each component there are guidelines to follow during inspections. These guidelines do not cover all possible deficiencies that may exist on each component, and reasonable judgement must be used by the Planner in identifying and prioritizing deficiencies.

a) Wood Poles

Ensure all 'nameplate'/structure list information such as structure number, type, etc. is recorded and correct. Collect GPS co-ordinate of pole if required.

Inspect and test wood pole(s) to determine condition at and above the groundline as per the following section - Detailed Wood Pole Inspections.

Ensure pole is properly backfilled and not undermined.

Check poles for any vibrations and indications that conductors are vibrating excessively.

Where applicable, inspect condition of crib timbers. Ensure crib is properly rock filled.

Check structure for plumbness or any degree of misalignment.

Check for structure number tags.

Check rock mounts for damage or deterioration.

b) Crossarms and crossbraces

Inspect the wood crossarms/crossbraces for the following:

- Rotting
- Damage due to burning
- Splitting or Cracking
- Any deformation due to twisting or bending

c) Crib

Inspect and test the crib for the following:

- Proper rock filling
- Rotting/damaged timbers
- Missing timbers

d) Steel Pole Structures

Inspect pole for mechanical damage and corrosion.

Check for plumbness.

Check for number tags. Ensure pole is properly backfilled and not undermined.

Check that steel pole climbing pegs are not installed to at least the 4m height location.

Check structure grounding across section joints.

e) Steel Towers

Inspect tower for damaged or missing members.

Check member connections for loose or missing nuts and bolts.

Check members for buckling.

Inspect tower for corrosion

.

Check tower for plumbness and any degree of misalignment.

Check for structure number tags.

Inspect backfill conditions around tower footings and legs. Check footing for deterioration. Check vegetation around footing.

Check anchor bolts for cracks, rusting or missing nuts.

Check tower for missing or damaged Danger Signs. Ensure that signs are clearly visible.

Check condition of anti-climbing barriers. Anti-climbing barriers and warning signs should be installed on all steel towers.

f) Guys

Inspect guys and preformed grips for wear, breaks, slackness, and corrosion.

Ensure guy guards are secure and are installed on every guy wire. Install additional guy guards where deep snow or drifts are encountered or expected to cover existing guy guards.

Ensure guys are grounded where required.

Ensure guy insulators are properly installed

g) Anchors

Inspect anchor rod and backfill conditions.

Check for anchor rod damage or deterioration.

Ensure anchor is not undermined or pulling.

Ensure preformed grip is completely visible and anchor eye is above ground level.

Check for any abandoned anchor rods that are protruding above ground and may pose a hazard.

h) Insulators

Inspect for broken, cracked, chipped, misaligned, or flashed insulators. Check non-deadend

insulators for uplift.

If suspension insulators are ≥50% damaged the inspector shall stay clear of the structure in question and take pictures from a distance. These deficiencies should be called in to the Transmission/Distribution Maintenance Supervisor immediately, prioritized as Emergency and brought to the attention of the Area Operations Superintendent. The determination may be made at this time to place the line in Hold-Off immediately as per OPR116.02.

i) Hardware

Check hardware for missing nuts, bolts, cotter pins, and loose, worn, bent or corroded hardware.

j) Conductors & Accessories

Inspect conductor sag. All three conductors should appear to have the same sag. Check for excessive sag that could result in phases slapping together.

Inspect conductors for proper clearances from buildings, roads, ground, other power/communication lines. Use height measurement device to determine conductor height above ground where clearance may not be adequate.

Inspect conductor for broken or frayed strands, bird-caging, burn marks, foreign objects.

Inspect deadend assemblies and splices for any abnormal condition.

Inspect vibration dampers and anti-galloping devices for wear and positioning.

Where required, inspect for damaged or missing conductor warning markers.

k) Ground Wires

Inspect condition of overhead ground wire for corrosion and broken strands.

Inspect structure ground wire. Ensure it is rigidly supported and has not been cut, and that ground wire guard is in place.

Check for tightness and corrosion.

l) Group Operated Disconnect Switches

Check locks and locking mechanism are intact and secure. Check switch for signs of tampering. Gang-operated switches in areas readily accessible to the public are required to be double-locked.

Inspect switch handle, pipe, etc. for damage and proper alignment.

Inspect all ground connections for tightness, corrosion and damage.

Ensure switches are properly labeled.

Check switch blades are in fully open or closed position as per its normal configuration.

Inspect insulators for damage.

Ensure ground mat has not been disturbed.

Check for missing or damaged danger signs. Ensure that signs are clearly visible.

Where switch yards exist, check for damage or deterioration of the fence. Also check to ensure gate is closed and locked, that that fence is adequately grounded and danger signs are in good condition. Check vegetation inside yard.

m) In Line Switches

Ensure blades are in fully open or closed position and locked open for normally open switches.

Check insulators for deterioration or damage.

Check whips for damage and proper alignment.

n) Right of Way

To assign a priority to the vegetation deficiency, the inspector must take into consideration the details of the vegetation growth, as well as the following

- Public and employee safety
- The criticality of the line (radial or loop, number and type of customers, load, etc.)
- The physical location of the line (populated or remote area, near existing roadways or cross-country, etc.)
- The anticipated growth rate (depending on the type of vegetation)

Check condition of vegetation growth along right-of-way.

When recording a brush clearing vegetation deficiency, be sure to record information on the type of brush to be cleared (deciduous or coniferous), the density of brush to be cleared (Light, Medium, Heavy), the average height of the brush, and the start and end points of the section on line requiring brush clearing.

Check for danger trees that may contact the conductor or trees close to the line that can be easily climbed.

Check for tree stumps or cut off pole stumps that could pose a hazard for snowmobiles and ATV's.

Check for encroachments by foreign structures, unauthorized excavation or fill areas, etc.

Any clotheslines or other customer owned attachments on transmission line structures should be removed by the Planner during the inspection.

Detailed Wood Pole Inspections and Testing

The following inspection and testing procedures shall be used to determine the integrity of transmission line wood poles.

Visual Inspection

Inspect the condition of the pole from the groundline to the top on all quadrants. The pole shall be examined for the following defects: pole top rot, ground line rot, external decay, rotting, deterioration, splits, checks, cracks, breaks, burns or other fire damage, woodpecker damage, signs of insect infestation, and plumbness

During each transmission line inspection, all wood poles in service shall require a detailed Visual Inspection.

Sounding Test

Using a flat faced hammer, sound the pole surface at regular intervals on all quadrants from the groundline to 2 m above grade. Care should be taken to detect any difference in sound. When the sound does differ, (i.e. hollow sound) it may indicate internal decay and further testing may be required. This test can be used to evaluate any portion of the pole above groundline.

Sounding Tests shall be randomly done on poles in service 35 years or less.

Poles in service more than 35 years require a Sounding Test during each inspection.

Core Sampling Test

This test is performed using an approved core sampling device. By drilling through the centerline of the pole a core sample can be extracted for evaluation. The location of bore holes shall be determined by the sounding test. All bore holes should be plugged with a tight fitting, treated wooden plug. Also, to avoid transfer of decay, the core sampler must be cleaned with an approved fungicide.

If the visual inspection and/or the sounding test indicate a problem, a Core Sampling Test can be performed to aid in the evaluation of the pole.

Deficiency Prioritization and Correction

Where practical, inspectors shall correct deficiencies on site during a transmission line inspection. The inspector shall carry the required materials to complete the repair.

- Replace or reattach a missing guy guard.
- Tighten a loose pre-form connection or slack guy.
- Replace or reattach a missing ground cover.
- Add staples to an unsecured ground wire or ground cover.
- Replace or reattach a sign, equipment/structure label, or lock.

The Planner shall assign a Maintenance Priority for each major deficiency identified during an inspection which will quantify the seriousness of the deficiency and establish when corrective action is required. All non-Emergency deficiencies are to be priority ranked as TD1, TD2, TD3 or TD4 and entered into TAMS via a hand held device.

The correction of deficiencies shall be completed in the time frame outlined below:

CLASSIFICATION OF PRIORITY	RESPONSE
Emergency Immediate security of the line is at risk or serious safety hazard exists.	Immediate
TD1 Deficiencies that are a serious hazard or would result in an interruption if not corrected within 7 days.	Within 7 days
TD2 Deficiencies that are a less serious hazard or would result in an interruption if not corrected within 1 month.	Within 1 month
TD3 Deficiencies that are a minor hazard or would result in an interruption if not corrected within 6 months.	Within 6 months
TD4 Deficiencies that are not a safety hazard which should be corrected as part of the capital plan for the following year	In the following capital year

The shared responsibility for scheduling maintenance rests with the Planner and Line Supervisor.

If the Planner notes a deficiency that is considered to be an Emergency, he shall immediately notify the area Superintendent.

If a deficiency is noted to be a TD1 or TD2 priority, they will not be included on monthly maintenance schedules. It is the Planner's responsibility to ensure the appropriate personnel, whether Line Supervisors for line work or Maintenance Supervisor for contract maintenance, is aware of the work and of the high priority nature of the work.

A TD1 priority will permit time for formulating a plan of action to correct the deficiency. Planning should begin immediately to ensure corrective action is taken as quickly as possible after the identification of the deficiency.

Regional Superintendents / Supervisors will complete, in the time frames outlined above, corrective maintenance work to prevent failure from occurring. A list of maintenance overdue for 6 months will be sent to the respective Regional Manager for action.

While it is not possible to cover all conditions that a Planner may encounter, the general guidelines found in Appendix A can be used to assist in the classification of defects. In practice, the Planner will assign priority based on his knowledge and experience.

APPENDIX A

GENERAL GUIDELINES FOR CLASSIFICATION OF PRIORITY

ITEM	EMERGENCY	TD1	TD2	TD3	TD4
Poles	Broken/severe undermining	Serious cracks or deterioration/unauthorized attachment		Serious checks or splits/woodpecker holes/decay	
Crossarms	Broken	Serious cracks or deterioration		Significant rot	
Crossbrace				Significant deterioration or broken cross brace	Less significant cracks or deterioration
Cribs					Significant damage or deterioration of the crib timber or loss of rock
Leaning Structures	Line clearance in question or high risk of falling over	Leaning over 2m			Leaning between 0.5m – 1m
Steel Towers		Significant damage/deterioration to support structure or members. Missing or significant deterioration or damage to signs or anti-climbing barrier		Serious deterioration to support structure or members. Minor deterioration or damage to signs or anti-climbing barriers	Less serious damage or deterioration to support structure or members
Guys / Guy Guards Preform Grips	Broken or disconnected on angle or deadend structure	Buried or severely corroded on angle or deadend structure. Missing guy guard (TD1 or TD2 depending on location, time of year)		Broken, buried, disconnected or severely corroded on other structures Missing ground attachment.	Slack guys.
Anchors / Rod	Rod cut off or undermined on angle/deadend struc.	Rod severely corroded or pulling out on angle/deadend structure		Rod cut off on other structure types	Anchor pulling out on other structure types or buried on any structure
Suspension Insulator	50% or more defective in string or cracked/broken rod in composite insulator		Less than 50% defective in string or damage/rod exposed in composite insulator		
Pintype / Linepost Insulators	50% or more of the skirts are chipped, cracked or otherwise damaged, or insulator is floating	< 50% of the skirts are chipped, cracked or otherwise damaged		Minor defects – chipped, misaligned	
Hardware		Missing or Damaged/Worn: High risk of causing interruption	Missing or Damaged/Worn: Moderate risk of causing interruption		Missing or Damaged/Worn: Low risk of causing interruption
Conductor Damage	Sag causing public safety	More than ¼ strands broken		Less than ¼ strands	Bird caging.

	hazard			broken	1 or 2 strands broken
ITEM	**EMERGENCY**	**TD1**	**TD2**	**TD3**	**TD4**
Vibration Dampers					Failed or broken
Overhead Groundwire	Broken and/or severe clearance problem with conductor		Frayed or broken strands		Slack with minor clearance problem
Structure Grounding	Unsupported grounding in danger of contacting conductor	Section missing or cut			Section unsupported-no clearance problem
Group Operated Disconnect Switch	Lock/locking mechanism removed/damaged. Missing or significant deterioration or damage to signs. Missing or significant deterioration to ground connections or ground mats. Blades that are not fully opened or closed. Significant damage to insulators		Moderate damage or deterioration to insulators/handle or other hardware.	Minor damage or deterioration to signs	Less serious damage or deterioration to infrastructure
In Line Switches	Blades not fully engaged or not fully open. Significant damage to insulators			Moderate damage or deterioration of insulators, blades or hardware	Less serious damage or deterioration to a part of the switch
Corrosion (any component)		Severe cases			
Encroachments	Active operations with clearance concerns (public safety hazard) and/or high risk of causing interruption (Emergency or TD1)		Non-active operations with clearance problem		Other encroachments on r-o-w
Danger Trees		Substantially leaning and high risk of falling and hitting line: TD1 or TD2 depending on situation		Dead or leaning and low risk of falling	Live trees within easement that may contact line when felled
High Trees/Brush	Burnt trees close to line and trees that would pose hazard to person climbing tree. Energized trees.			Trees close to line with no evidence of burning and pose no immediate hazard if climbed.	

Newfoundland Power's
Transmission Inspection and Maintenance Practices

NEWFOUNDLAND POWER
A FORTIS COMPANY

DISTRIBUTION INSPECTION AND MAINTENANCE PRACTICES

Approved By: Byron Chubbs, P. Eng.
Approved Date: March 4, 2013

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DISTRIBUTION INSPECTION AND MAINTENANCE PRACTICES

Policy Statement

Scheduled inspection and maintenance procedures shall be undertaken on all distribution lines. The inspection and repair process is intended to ensure safe and reliable operation. Regional Managers are ultimately responsible to ensure that distribution line inspection and maintenance activities are completed in accordance with this policy in their respective regions.

Public & Employee Safety

The Company owns and operates in excess of 9,000 km of distribution line in both rural and urban environments. Distribution line corridors may be used as trail-ways for snowmobile operators, ATV operators, skiers, hikers and others and are also regularly used by employees to carry out maintenance activities. Distribution lines and distribution rights-of-ways must be inspected and maintained in a manner that assures the safety of the public.

Regular inspections of distribution lines and timely repair of identified deficiencies will minimize risk to the public and employees. Those conducting distribution line inspections have the responsibility to inspect lines thoroughly with a keen focus on identifying potential public and employee safety hazards. Regional Managers, Superintendents of Operations and Maintenance Supervisors have the shared responsibility to ensure that inspections are completed and any identified deficiencies and hazards are corrected in accordance with this policy.

Inspection Type and Frequency

All overhead primary distribution lines are required to have a minimum of one detailed ground inspection every seven years. However, Superintendents of Area Operations have the discretion to have more frequent inspections done if time and manpower allow.

Distribution Vegetation Management requires that distribution lines are inspected, on average, every three and a half years for brush clearing and tree trimming. These inspections will be completed as part of the distribution line inspection every seven years, and as a drive-by inspection once in between.

Pad mount transformers are to be inspected annually. These inspections should be completed at the same time as the detailed ground inspection or vegetation inspection if they are required during the same year.

Inspector Qualifications

To inspect Newfoundland Power distribution lines, an inspector must have the following minimum qualifications:

- Minimum 3 years of experience in the electrical utility industry in the operations or engineering area.
- Familiarity with the operation, maintenance and construction of utility lines.
- Familiarity with the use and operation of ATV's and snowmobiles.
- Basic understanding of the electrical and mechanical nature of utility lines.

Distribution Asset Management System

All distribution line preventative maintenance and inspections as well as deficiency identification and corrective maintenance activities shall be recorded in the Company's computerized asset management system known as Avantis.

The Information Systems and Regional Operations groups are responsible for administering Avantis and for training users. Maintenance Supervisors, Schedulers, Planners, Line Supervisors, Superintendents, and others within the Regional Operations group may have access to this system.

In addition to the software package, there are a number of business processes that detail the responsibilities and handoffs for each step in the asset management system. They can be found on Webster under the Regional Operations department in the Asset Management folder.

Distribution Line Inspections (7 Year Cycle)

Guidelines for detailed ground inspections of distribution lines and the associated record-keeping procedures are as follows:

- Personnel performing inspections shall use the necessary equipment to assist in the evaluation of distribution line components. For example, a hand held computer, binoculars, plumb bob, hammer, core sampler, screwdriver, crescent wrench, and digital camera may be needed.
- Inspection personnel shall assign a Maintenance Priority for each deficiency identified. This priority shall establish when corrective action is required (more information on assigning priority is given in Appendix A - Deficiency Reference Tables).
- Reasonable judgment is required in determining if something should be recorded as a deficiency. Each structure must be analyzed from the perspectives of Public Safety,

Employee Safety, Reliability and Environment to determine if action is warranted. For example;

- It is not the intent to bring all existing plant up to the current construction standards. Simply because a structure is not built to the latest construction standard does not mean it is deficient.

- It is not the intent to record every minor deficiency. For example, if the inspector determines that a minor chip in a pole does not undermine the strength of the pole and poses no danger to public or employee safety, reliability or environment, then it should not be entered into the maintenance system as a deficiency.

Distribution Vegetation Management Inspections (7 Year Cycle)

A distribution line shall have a vegetation inspection completed twice every seven years. This inspection shall be completed as part of the distribution line ground inspection every seven years, and as a drive by inspection once in between. The inspection should be documented on Hand Held Devices.

A vegetation deficiency can be one of two types. (1) A brush clearing deficiency which requires the entire width of the right of way to be cleared. A single brush clearing deficiency may cover an area several kilometers long. (2) A tree trimming deficiency in which a single tree or several trees at the same location are contacting or are in danger of contacting the line and will need to be trimmed. Each tree or small group of trees at the same location is considered a single deficiency.

To assign a priority to the vegetation deficiency, the inspector must take into consideration the details of the vegetation growth, as well as the following:

- Public and employee safety

- The physical location of the line (populated or remote area, near existing roadways or cross-country, etc.)

- The anticipated growth rate (depending on the type of vegetation)

Padmount Transformer Inspections (Annual)

Padmount transformers shall be inspected at least once per year and maintenance to the transformer completed in a timely manner. The inspection should be documented on Hand Held Devices.

This is a visual inspection only.

Appropriate Personal Protective Equipment is to be worn at all times.

Distribution Line Component Inspection Guidelines

Distribution line inspections require evaluation of the following components. For each component there are guidelines to follow during inspections. These guidelines do not cover all possible deficiencies that may exist on each component, and reasonable judgement must be used by the Planner in identifying and prioritizing deficiencies.

Structures

Wood Poles:

During each distribution line inspection, all wood poles require a detailed visual inspection. Depending on the results of the visual inspection a sounding test may be performed. If the visual inspection and/or the sounding test indicate a problem, a core-sampling test may be performed to aid in the evaluation of the pole.

- Inspect and determine condition of pole at ground line and above for rotting, deterioration, splitting, cracks, breaks, burns, woodpecker holes, insect infestation and plumbness.
- Ensure pole is properly backfilled and not undermined.
- Where applicable, inspect condition of crib timber. Ensure crib is properly rock filled.
- Check structure for plumbness or any degree of misalignment.
- Check for structure number tags.
- Ensure that pole grounds are installed on all poles with transformers on them. Ensure that it is rigidly supported, it has not been cut and a ground guard is present and secured

Steel Towers:

- Inspect tower for damaged or missing members. Check member connections for loose or missing nuts and bolts. Check members for buckling.
- Inspect tower for corrosion. Check tower for plumb and any degree of misalignment. Check for structure number tags.
- Inspect backfill conditions around tower footings and legs. Check footing for deterioration. Inspect foundation for surface cracks or splitting. Check that reinforcing is not exposed. Inspect anchor bolts for cracks, rusting or missing anchor nuts.
- Check tower for missing or damaged Danger Signs. Ensure that signs are clearly visible. Check condition of anti-climbing barriers. Anti-climbing barriers and warning signs should be installed on all steel towers. It is a significant public safety issue for barriers or signs to be missing and the deficiency should be classified as a TD1.

Hardware

Cross Arms and Braces:

- Inspect crossarms for rot, splits, cracks and twisting that may cause the conductor to fall to the ground. Also, inspect for burn marks.
- Check that cross arms or braces aren't loose, broken or hanging.

Platforms:

- Check that platform brace isn't loose, broken or hanging.
- Check that platform deck isn't failing or sagging.

Anchors and Guys:

- Inspect guys and pre-formed grips for wear, breaks, slackness and corrosion.
- Ensure guy guards are secure and installed on every guy wire. A missing guy guard is a significant public safety issue and should be classified as high priority.
- Inspect anchor rod and backfill conditions. Check for anchor rod damage. Ensure anchor is not undermined or pulling. Ensure that anchor eye is above ground level.
- Check that all guys are either insulated or effectively grounded to neutral/ground wire.
- Any anchor rods with no guy attached should be identified as a high priority work order if the guy is required or cut off by the planner on-site if the guy is not required.

Insulators

Polymer Type:

- Inspect for broken, split, misaligned, flashed or defective insulators
- Check non dead-end insulators for uplift
- Check that stand off brackets aren't twisted, delaminated or broken

Porcelain Type:

- Inspect for broken, cracked, chipped, misaligned, flashed or defective insulators.
- Check non dead-end insulators for uplift.
- Check that stand off brackets aren't twisted, delaminated or broken
- 2-piece and 8080 insulators should be identified for removal. If they are damaged they should be given a high priority.

Conductor

Primary and Neutral Conductors:

- Check for excessive sag that could result in phases slapping together. Also check for too much tension that could result in vibration induced problems such as broken ties, insulators, or conductor breaks.
- Inspect conductors for safe clearances from buildings, roads, ground, and other power/communication lines.
- Inspect conductor for broken or frayed strands, burn marks, foreign objects.
- Inspect splices for abnormal condition.
- Inspect dead-end assemblies for any abnormal condition.
- Where required, inspect for damaged or missing conductor warning markers.
- Check that tie wires or clamps are not loose or broken.
- Automatic splices, or quick sleeves, should be identified for removal.

Stirrups/Leads/Primary Connections:

- Check hardware for any visible deficiency that may result in conductor falling to the ground.
- Check for broken or corroded conductor near connections.
- Check leads for excessive length.
- Visually inspect conductor around hot line clamps for corrosion and broken strands.

Underground Cables/Conduit/Guards:

- Inspect cable and pothead for damage.
- Check for bad connections.
- Ensure guards are present and secured and grounded as required.

Primary Devices

Pole Mounted Transformers:

- Inspect transformers for rust and leaks. Transformers that are leaking or are rusted to the point that a leak appears imminent must be replaced immediately.
- Ensure that all transformers have PCB identification tags installed (Yellow, Green or White). Particularly, transformers in Protected Public Water Supply Areas contain a green or white PCB identification tag. If no tag is installed then the transformer oil

must be tested. Ensure to note transformer number, civic address, and addresses of customers fed off of transformers to be PCB tested.

- Check for cracked or broken bushings.
- Check for proper tank ground. Each tank is to have a minimum of two independent paths to ground.
- Check that secondary leads aren't rubbing against bottom rim of tank.
- Check for blown fuses.
- Check that animal/bird guards are properly installed and aren't broken or hanging off.
- 25 kVA and 50 kVA unpainted stainless steel ABB transformers without reinforcing brackets shall be identified to have reinforcing brackets installed.
- Transformers with pole mounting brackets showing signs of bending or splitting shall be replaced immediately.

Metering Tanks:

- Inspect tanks for rust and leaks.
- Check for cracked or broken bushings.
- Check for proper tank ground.
- Check that secondary leads aren't rubbing against bottom rim of tank.

Lightning Arrestors:

- Check that Lightning Arrestors (LA) are installed. LA's should be installed on distribution transformers if there is any other reason to climb or otherwise work the pole above ground level. In addition LA's should be installed on all underground dip poles, and on all equipment such as down line reclosers, regulators, and sectionalizers.
- Inspect for broken, cracked, chipped, misaligned, flashed or defective insulators.
- Checked that lightning arrestor has not failed.

Capacitors:

- Inspect tanks for rust and leaks.
- Check for cracked or broken bushings.
- Check for proper tank ground.
- Check for blown fuses.

Switches

Cutouts:

- Ensure disconnects are correctly labeled.
- Check that Current Limiting Fuses (CLF) are installed as required. This includes;
    - All cutouts where fault levels are greater than 10,000 Amps.
    - On cutouts protecting distribution transformers where fault levels are greater than 5,000 Amps and less than 10,000 Amps.
    - On cutouts protecting distribution transformers that are located in proximity to areas where the public is known to gather (e.g. near bus stops, near play ground equipment, etc.) where fault levels are greater than 3,000 Amps but less than 5,000 Amps.
- All porcelain cutouts, except on individual transformers, shall be identified for replacement.

In-Line Switches:

- Ensure disconnects are correctly labeled.
- Ensure blades are in fully open or closed position.
- Check insulators for deterioration or damage.

Gang Operated Switches:

- Ensure disconnects are correctly labeled.
- Check switch for signs of tampering. Check locks and locking mechanism are intact and secure. Gang-operated switches in areas readily accessible to the public are required to be double-locked. Inspect switch handle, pipe, etc. for damage and proper alignment. Inspect all ground connections for tightness, corrosion and damage.
- Check that the switch blades are in the fully open or the fully closed position as per its normal configuration.
- Inspect Insulators for damage.
- Ensure ground mat has not been disturbed. Check for missing or damaged danger signs. Ensure that signs are clearly visible.

Vegetation and Right of Way

To assign a priority to the vegetation deficiency, the inspector must take into consideration the details of the vegetation growth, as well as the following

- Public and employee safety.

- The physical location of the line (populated or remote area, near existing roadways or cross-country, etc.).

- The anticipated growth rate (depending on the type of vegetation).

Brush Clearing:

- Check condition of vegetation growth along right-of-way.

- When recording a brush clearing vegetation deficiency, be sure to record information on the type of brush to be cleared (deciduous or coniferous), the density of brush to be cleared (Light, Medium, Heavy), the average height of the brush, and the start and end points of the section on line requiring brush clearing.

- Check for danger trees that may contact the conductor or trees close to the line that can be easily climbed. Remember that a persons weight on a weak branch could cause it to deflect enough to contact the line.

Tree Trimming:

Public Safety and Reliability are important factors in determining the priority of the danger tree deficiency. When recording a danger tree deficiency, it is important to make the following considerations:

- Whether the tree is in close proximity to the energized high-voltage conductors such that it may make contact. Consider that a branch may swing or bend into the line due to the weight of a climber, wind or buildup of snow or ice.

- Whether the tree is easily accessed from the ground and climbable.

- Whether individuals who are possibly interested in climbing the tree frequently visit the site that the tree occupies.

Encroachments:

- Check for encroachments by foreign structures, unauthorized excavation or fill areas, etc. These should be identified as a deficiency if the Planner judges them to be a public safety hazard.

Distribution Padmount Transformer Inspection Guidelines

Distribution padmount transformer inspections require evaluation of the following components. For each component there are guidelines to follow during inspections. These guidelines do not cover all possible deficiencies that may exist on each component.

Exterior

- Ensure the company number is present and consistent with the Avantis hierarchy

- Check for deficiencies in the door and locking mechanism.

- If there is no danger sticker present, install one.
- Check for signs of oil leaks and severe rusting. Less severe rusting that will not lead to failure within the next year should not be noted as a deficiency.
- Check for proper placement of the padmount transformer on the pad.
- Ensure a snow marker is installed on the unit where required.
- Check for a PCB label. If the label is missing but the PCB content can be found from the nameplate or a test sticker on the interior, apply the appropriate label.
- Check for problems with the foundation, fences or posts and remove any debris from inside. Note any vegetation control required.

Hardware

- Replace any missing bolts and broken locks.
- Check for test caps on the load break elbows.
- Ensure fault indicator is present and reset.

Nameplate

- Verify inclusion and completeness of nameplate information in the handheld.

Bushings

- Ensure the primary and secondary bushings are not damaged.

Connections

- Check condition of all primary and secondary connections. Make note of any visible damage or bonding requirements.

Lightning Arrestors

- Check for lightning arrestors on the primary dip pole.

Typically any transformer removed from service that is greater than 30 years old, requiring painting or testing, should be handed over directly to the waste disposal contractor for scrapping. Units less than 30 years old should be shipped to the Electrical Maintenance Centre for refurbishment if in good condition, and if

- Leaking
- PCB status uncertain
- Involved in an insurance claim

It should also be noted on the work orders that padmounts being scrapped directly from the field should have their nameplates removed and the company number of the padmount written on the back of the nameplate. Nameplates should then be shipped to the EMC.

Also, any units being shipped to the EMC should be tagged with removal details including who removed the padmount from service, where it was previously installed, removal date and reasons why the unit was removed from service.

Additional Planning Details

When recording a deficiency, it is important to collect as much information as possible to assist in planning a repair.

Outage Requirements

- No Outage
- Single Transformer Outage
- Feeder Tap Outage
- Full Feeder Outage
- Multiple Feeder Outage
- Joint Use

Site Considerations

- Environmental
- Near School or Hospital
- High Traffic Area
- Within 15m of PPWSA
- Truck Accessible
- Number and Type of Customers Affected

On Site Repairs

All deficiencies shall be recorded in the Distribution Asset Management System with the exception of minor repairs that can be completed on site. These minor repairs may be completed by the inspector during a distribution line inspection, or by a line crew completing planned repairs.

The following repairs may be completed on site during a distribution line inspection. The inspector shall carry the required materials to complete the repair.

- Replace or reattach a missing guy guard.
- Tighten a loose pre-form connection.
- Replace or reattach a missing ground cover.
- Add staples to an unsecured ground wire or ground cover.
- Replace or reattach a sign or equipment label.

The following repairs may be completed on site during a padmount transformer inspection. The inspector shall carry the required materials to complete the repair.

- Replace missing or broken bolts and locks.
- Install or reset fault indicators as required.
- Install danger stickers.
- Install PCB label if PCB information is available but label is missing.

A line crew that identifies a deficiency while completing a separate job shall report the deficiency to their supervisor. This deficiency will be entered into the Distribution Asset Management System and planned repairs will be completed. However, it is acceptable that minor repairs be completed on site if they can be completed safely and in a short time. A rule of thumb to use is if the repair is simple and can be completed in less than 20-30 minutes, it shall be completed on site and not recorded as a deficiency.

Maintenance Classifications

All defects identified through the inspection process are given one of the following classifications based on the nature of the abnormal condition. Unless otherwise stated or directed, the response times shall be as follows:

PRIORITY	RESPONSE TIME
Emergency	Immediate
TD1	1 Week
TD2	1 Month
TD3	6 Months
TD4	Next Budget Cycle
TD5	Next Budget Cycle

The shared responsibility for scheduling maintenance rests with the Planner and Line Supervisor.

If the Planner notes a deficiency that is considered to be an Emergency, he shall immediately notify the area Superintendent.

If a deficiency is noted to be a TD1 or TD2 priority, they will not be included on monthly maintenance schedules. It is the Planner's responsibility to ensure the appropriate personnel, whether Line Supervisors for line work or Maintenance Supervisor for contract maintenance, is aware of the work and of the high priority nature of the work.

A TD1 priority will permit time for formulating a plan of action to correct the deficiency. Planning should begin immediately to ensure corrective action is taken as quickly as possible after the identification of the deficiency.

Regional Superintendents / Supervisors will complete, in the time frames outlined above, corrective maintenance work to prevent failure from occurring. A list of maintenance overdue for 6 months will be sent to the respective Regional Manager for action.

While it is not possible to cover all conditions that a Planner may encounter, the general guidelines found in Appendix A can be used to assist in the classification of defects. In practice, the Planner will assign priority based on his knowledge and experience.

Appendix A- Deficiency Reference Tables

Wood Poles

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4	TD5
Damaged	Broken	Serious Horizontal Cracks				
Pole Rot		Rotted to Imminent Failure			Rotted - Failed Core Test	
Woodpecker Holes					Severe Woodpecker Holes	
Unauthorized Attachments						Unauthorized Attachments
Off Vertical	Severe Lean - Failure Imminent				Lean >10°	
Pole Crib	Major Frame Damage - No Longer Supporting Pole				Frame Damaged - Rocks Becoming Loose	
Pole Ground	Grounds Cut or Broken Near Ground Level Repaired by Planner During Inspection				Grounds Cut or Broken Above Ground Level	Ground Cover Missing Staples Missing Ground Rod Exposed No Pole Ground Installed
Backfilling	Large Hole – Public Safety Hazard		Pole Not Supported			

Cross Arms and Braces

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Cross Arm Damaged	Broken - Floating Phase Severely Crooked - Failure Imminent	Broken	Cracked		Severe Rot
Brace Bent, Missing or Hanging				Missing or Hanging	

Platforms

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Brace Damaged			Brace Loose Severely Bent		
Deck Damaged	Imminent Failure		Deck Sagging Broken Beam		

Anchors and Guys

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4	TD5
Guard Missing	Replaced by Planner During Inspection					
Preform Rusting			C or E Structure		All Others	
Loose Guy					Loose Guy	
Preform Unravelling			C or E Structure		All Others	
Broken Guy	C or E Structure or Public Safety		All Others			
Broken Rod or Fitting	C or E Structure or Public Safety		All Others			
Backfilling	Large Hole – Public Safety Hazard		Pole Not Supported		Pole Support Uncompromised	
Anchor Buried					Rotting preform	Stable
Ungrounded / Uninsulated	Pole has damaged insulators or damaged porcelain cutout		Rock anchor, undamaged 2-piece or 8080 insulators or porcelain cutout	All other ungrounded or uninsulated guys		

Polymer Type Insulators

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Split/Broken	Broken	Polymer Split/Rod Exposed			Splits, Skirts Missing
Floating	Floating				
Stand-Off Bracket	Broken				

Porcelain Type Insulators

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Cracked/Broken	Broken	Insulator Severely Cracked			Chips or Cracks, Skirts Missing
Floating	Floating				
Stand-Off Bracket	Broken				
2 Piece / 8080 Insulators		Damaged			All Other Locations

Primary Conductor

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Sag	Public Safety Hazard		Could Cause Slapping		
Clearances to Buildings/Signs	Exceeds CSA Standards				Above Dwelling Within CSA Standards
Broken Strands	>1/4 Strands Broken		<1/4 Strands Broken Pencilling		1 - 2 Strands Broken Temporary Repairs
Floating	Floating				
Tie Wires or Clamps	Broken		Loose or Unravelling		
Missing Line Guards					On Aluminum or Stranded Copper
Warning Markers	Hanging			Missing	Becoming Loose
Quick Sleeves					All Locations

Neutral

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Sag	Public Safety Hazard		Could Cause Slapping		
Clearances to Buildings/Signs	Exceeds CSA Standards				Above Dwelling Within CSA Standards
Broken Strands	>1/4 Strands Broken		<1/4 Strands Broken Pencilling		1 - 2 Strands Broken Temporary Repairs
Floating	Floating				
Warning Markers	Hanging			Missing	Loose
Quick Sleeves					All Locations

Stirrups/Leads/Primary Connections

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Stirrups Missing					
Lead Length Excessive					Could Cause Slapping
Broken Strands		>1/4 Strands Broken on Main Trunk	<1/4 Strands Broken on Main Trunk	>1/4 Strands Broken – Not Main Trunk	<1/4 Strands Broken – Not Main Trunk Temporary Repairs
Pencilling on Solid Leads		Pencilling			

Underground Cables/Conduit/Guards

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4	TD5
Guard Loose			Guard Hanging Off			Guard Loose
Guard Missing		High Traffic Pedestrian Area		Low Traffic Area		
Cable Damaged	Cable Severely Damaged/Broken			Jacket Damaged		
Pothead Damaged				Excessive Pitch Leaking		Minor Pitch Leaking
Cracked/Broken Bushing	Broken	Insulator Severely Cracked				Minor or Moderate Chips or Cracks, Skirts Missing

Pole Mounted Transformers

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Tank Ground	Ungrounded	Only 1 Ground			
PCB Label					Missing
Cracked/Broken Bushing		Bushing Completely Broken			Chips or Cracks, Skirts Missing
Leaking/Weeping	Leaking or Weeping				
Rusting	Rust Causing Leaking or Weeping				Severe Rust
Blown Fuse	Blown Fuse				
Mounting Bracket	Bracket split				

Metering Tanks

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Tank Ground	Ungrounded				
PCB Label Applied					Missing
Cracked/Broken Bushing		Bushing Completely Broken			Chips or Cracks, Skirts Missing
Leaking/Weeping	Leaking or Weeping				
Rusting	Rust Causing Leaking or Weeping				Severe Rust

Lightning Arrestors

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Floating	Floating				
Grounded Incorrectly/Ungrounded					Grounded Incorrectly/Ungrounded
Insulator Damage	Broken	Severe Splits or Cracks			Splits or Cracks, Skirts Missing
Failed	Failed. No Power to Customer			Failed. Power Still On.	
Missing					Area prone to lightning strikes

Capacitor Banks

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Tank Ground	Ungrounded				
Leaking/Weeping	Leaking or Weeping				
Blown Fuse	Blown Fuse				
Insulator Damage	Broken	Severe Splits or Cracks			Splits or Cracks, Skirts Missing
Rusting	Rust Causing Leaking or Weeping				Severe Rust

Padmount Transformers

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Snow Marker			Missing		
Rusting	Rust causing leaking or weeping		Severe rust; leak imminent in less than 1 year – replacement required		Surface rust – painting required
PCB Label					Missing
Defective door	Broken off unit		Broken hinge		
Defective lock/missing bolts	Replace on site				
Xfmr moved off pad			Moved		
Incorrect Co. Number			Missing/Incorrect Co. Number		
Vegetation				Vegetation management required	
Primary/Secondary bushings		Broken			
Test cap on load break elbows			Missing		
Ground Strap					Broken/Missing
Connections/Terminations	Completely broken		Damaged		

Cutouts

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Switch Damaged	Switch Damaged				
Insulator Damage	Broken	Severe Splits or Cracks			Splits or Cracks, Skirts Missing
Porcelain					At Tie Points, Main Trunk, Large Taps, Major Customers
Label Missing			Label Missing		
Current Limiting Fuse Required					CLF Required

In-Line Switches

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Insulator Damage	Broken	Severe Splits or Cracks			Splits or Cracks, Skirts Missing
Label Missing			Label Missing		

Gang Operated Switches

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4
Grounding	Switch Ungrounded No Ground Mat				
Insulator Damage	Broken	Severe Splits or Cracks			Splits or Cracks, Skirts Missing
Label Missing			Label Missing		

Vegetation and Right-of-Way

DEFICIENCY	EMERGENCY	TD1	TD2	TD3	TD4	TD5
Tree Trimming	Touching Conductor or Showing Signs of Burning			Within 2ft of Primary Conductor		
Brush Clearing	Touching Conductor or Showing Signs of Burning			Within 2ft of Primary Conductor	Above Neutral but Greater than 2ft from Primary Conductor	
Encroachments						Encroachments