VEGETATION MANAGEMENT GUIDELINES FOR ENHANCED ELECTRICAL RELIABILITY

Liberty Utilities Central actively manages vegetation on over 7200 miles of Transmission and Distribution in 4 states. Utilizing the Integrated Vegetation Management philosophy, Liberty Utilities performs Conventional, Mechanical and Chemical practices that promote Biological Control on and along its Right of Ways.

Title: Vegetation Management Guidelines for Enhanced Electrical Reliability		Author: J. Grossman	
Distribution Vegetation Management Policy		**Revision: E**	**11/1/2018**
Revision	**Date**	**Changes**	**Approved By**
A	8/9/2008	Formalized existing documentation	McGarrah, Palmer
B	3/1/2009	Review in conjunction with our new tree trimming contracts. See letter dated Jan 30, 2009.	McGarrah, Palmer
C	3/15/2012	Annual Review – no changes.	Wallace, Penning
D	3/22/2013	Annual Review – The addition of TGR specifications. See 2.2.4 and Appendix 8.	Wallace, Penning
E	11/1/2020	Changes in standards that reflect our systems current status. Update Utility Name	Haralson, Wilson

Approval Signatures and date:

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12/03/20

Tim Wilson, Vice President Operations - Electric

Applicable Standards: 20 CSR 4240-23.010

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INTRODUCTION

The Objective of the Vegetation Management Guidelines for Enhanced Reliability is to establish the policies and procedures for Liberty Utilities (LU) to manage vegetation along its Right of Way (ROW). The main goal of the guideline will demonstrate how vegetation is managed to improve reliability, minimize risk for the public and reduce encroaching vegetation. This shall apply to all LU electric lines rated at 200kV and below

1 SAFETY

1.1 SAFETY REQUIREMENTS

All contractors performing work on or near LU facilities or rights-of-way shall:

- Follow approved safety guidelines and procedures.
- Comply with all applicable governmental safety and health regulations and the safety and health provisions of their contract.
- Comply with all municipal, County, State and Federal Laws, Rules and Regulations

All contractors must also, at all times, be aware of the nature and characteristics of LU electric facilities before work begins. Contractors shall understand that electric facilities must remain energized during the performance of work unless special arrangements are made with an authorized LU representative.

The following procedures pertain to contractors performing vegetation management work for LU:

The contractor shall obtain from LU full information as to the voltage of its circuits before starting the work.

The contractor shall at all times conduct work in a manner to safeguard the public from injury and property from damage.

The contractor must use all necessary protection for its employees and the public and guard against interference with normal operation of the circuits. If, in the judgment of the contractor's general foreman/supervisor, it is a risk to perform their work with the circuits energized, the contractor must contact an authorized LU representative(s). If appropriate, LU will provide the necessary protective materials or de-energize circuits to ensure the safe pruning or removal of the tree(s).

Should the contractor knock down or come into contact with LU conductors (power lines), the contractor must notify LU immediately and take the necessary protective measures. All contractor-caused electric service interruptions are subject to repair at the contractor's expense. This would include any damage to customers' property, including any electrical damage.

In the event a contractor becomes aware of any dangerous, broken, loose or faulty LU line/facilities in the normal course of its line clearance performance, the contractor shall promptly advise LU as to the exact pole location(s) and nature of the condition found.

2 GENERAL GUIDELINES

2.1 INTEGRATED VEGETATION MANAGEMENT

LU utilizes conventional crews, herbicide, mechanical clearing equipment, Tree Growth Regulators (TGR) and work planners to maintain its ROW. The ultimate goal will be biological control through species competition (floor) and directional pruning (side). Species competition along the floor will reduce the likely hood of tall growing woody vegetation from becoming established on the ROW while directional pruning will reduce encroachments into the wires by training the tree to grow away from the power lines. LU desires to provide ROWs that provide high quality habitat for wildlife as well as an aesthetic value where possible. This approach will use management practices that promote a 60/40 (grasses, forbs/low growing woody shrubs) split on the ROW.

2.2 MAINTENANCE CYCLE

LU shall maintain a cycle for vegetation management based on the number of customers per mile. Circuits' with customer density >35 customers per mile shall be considered Residential and be placed on a 3-year cycle. Circuits with <35 customers per mile shall be considered Rural and be placed on a 6-year cycle. Exceptions may be made for circuits with commercial load or critical facilities such as hospital, police, fire departments, etc. A Mid-Cycle Inspection will be performed on the rural circuits to ensure the circuit will remain reliable until the next maintenance cycle. TGR and Herbicide work will be performed pre-maintenance so that they may be audited during the maintenance cycle.

To improve efficiency, all circuits from a substation will be placed on the same schedule. This allows Substations with Rural and Residential circuits to be worked on the same cycle.

Circuit Type	Maintenance cycle (yrs.)	Mid-Cycle Inspection (yrs.)
Residential	3	N/A
Rural	6	3

Table 1. Maintenance and Inspection Cycle based on circuit type.

2.3 SCHEDULING AND CIRCUIT PRIORITIZATION

General scheduling of the Circuits/Substations for Vegetation management will be based on tree units. The variability of tree density per mile across the system leads to variability in staffing and a stable work force is essential to providing reliable, quality work.

Circuits may be adjusted during the year based on the following factors:

- Reliability – The circuits due to be pruned for any given year are weighted based on customer minutes interrupted by tree-related causes. Circuits that have the highest number of customer minutes interrupted by tree outages may rank higher. SAIFI and SAIDI
- Last Trim Date – Circuits are scheduled based on the last pruned date. The oldest are weighted over the earliest.

- Customers Affected – Circuits are ranked by customer count. Circuits with high numbers of customers or circuits with critical customers are ranked higher.

- Current Vegetation Conditions – The current vegetation conditions on a circuit will be used to prioritize it. Customer requests for tree pruning are also taken into consideration when determining the current vegetation conditions of a circuit.
- Other – Other factors that are considered when scheduling are circuit load, customer complaints, workload, efficiency and political issues.

3 WORK PLANNING

LU contracts a work planning service to assign resources based on the scope and type of work. Pre-Planned work makes the Contract Crews more efficient by locating access points, dealing with customer inquiries prior to the work commencement and by locating the actual work to be performed. LU or its agents will conduct a pre-work inspection to determine the amount and types of work needed to make the circuit reliable for the maintenance cycle. After the Work is completed, an audit will be performed to ensure the circuit is reliable for the next cycle and clearing specifications have been met. LU utilizes GPS based Electronic Workflow Management software that tracks Planning, Work Completion and Auditing.

3.1 NOTIFICATION

3.1.1 PRIVATE PROPERTY

LU or its agents will make a diligent attempt to notify property owners or occupants by personal contact, door hanger or mailer. Notification shall occur seven (7) days before any work is performed and no more than ninety (90) days after notification. A record of the date, content and address shall be maintained until the subsequent Maintenance Cycle has passed. If the work required is deemed an emergency due to an eminent outage, public safety issue etc., the 7-day window will be waived and the work shall be completed to ensure safe and reliable service. A Door Hanger with contact information will be left for the property owner or occupant, informing them of the situation.

3.1.2 COUNTY AND MUNICIPAL

LU shall provide each county and municipality at minimum two (2) months' notice of any scheduled Vegetation Management maintenance activities to a primary contact mutually agreed upon.

3.2 VEGETATION INQUIRIES

LU will respond to requests related to tree/right-of-way maintenance within 5 business days. After reviewing the situation, a priority level will be assigned and the request will be scheduled. The property owner will be informed of the results of the request. LU will decide if the work requested will benefit the overall safety and reliability of the electric system, its customers and the general public.

3.2.1 CUSTOMER REQUESTED PRUNING

When a customer requests LU to prune a tree away from pole-to-pole lines, LU will send out a representative to make a determination of any risk. If it is determined that pruning/removal is necessary for safety or reliability, LU will schedule a crew to prune/remove the tree(s) in question.

If the tree is not a significant risk, LU will inform the customer that the tree will be re-evaluated when that circuit is scheduled for maintenance.

Service drops are the customer's responsibility. Crews will not be re-directed unless there is an immediate threat to LU facilities. However, they will be picked up on regularly scheduled maintenance.

3.2.2 CUSTOMER REQUESTED ASSISTANCE

When a customer desires to prune/remove a tree close to LU lines for reasons other than line clearance, LU will send out a representative to make a determination of any potential risk that exists. LU will do one of the following after customer notification:

- Temporarily drop the conductor while the customer or customer's agent performs the work.
- Prune or remove the portion of the tree to meet the 10' minimum Overhead Powerline Safety Act. On Customer Requested Assistance work, limbs and branch cleanup will be the responsibility of the property owner.
- Inform the customer that the work is outside the scope of LU's responsibility and no work will be done by LU at this time.

In all cases, the decision on which course of action to take will be determined by an LU or an LU representative after consultation with the customer.

4 CONVENTIONAL CLEARING

Trees are pruned to provide adequate clearance from LU facilities at the time of trimming for the cycle length. ANSI-A300 and ANSI Z133.1 procedures and techniques will be followed.

The following guidelines (Table 2.) are minimum tree clearances that may apply at the time of pruning to protect the wires under normal operating conditions. Special clearances may be needed at times because of field conditions. Tree species are categorized into fast and slow growing (Table 3).

Clearance From Trees	Rate Of Growth	Secondary Cable (120-480V)	Open Wire Secondary (120-480V)	Primary Voltage Single Phase	Primary Voltage Three Phase
Side	Slow	3	6	10	10
	Fast			15	15
Over	Slow	3	6	15	Remove all Overhang
	Fast			15	
Under	Slow	3	8	10	10
	Fast			15	15

Table 2. Recommended Line Clearances (in feet).

Common Name	Scientific Name	Growth Rate
Aillanthus	*Ailianthus Altissima*	F
Ash, White	*Fraxinus americana L.*	F
Ash, Green	*Fraxinus pennsylvanica*	F
Basswood	*Tilia american L.*	F
Birch	*Betula nigra*	F
Black Walnut	*Juglans Nigra*	F
Boxelder	*Acer negundo*	F
Bradford Pear	*Pyrus calleryiana*	F
Buckeye	*Aesculus*	S
Catalpa	*Catalpa bignonioides*	F
Cherry	*Prunus scrotina*	F
Cottonwood	*Populus deltoides*	F
Dogwood	*Cornus florida*	S
Eastern Redcedar	*Juniperus virginiana*	S
Elm	*Ulmus sp.*	F
Ginkgo	*Ginkgo biloba*	F
Hackberry	*Celtis occidentalis*	F
Hickory	*Caryatexana sp.*	S
Honey locust	*Gleditsia triacanthos*	F
Hybrid Maples	*Acer sp.*	F
Kentucky Coffee Tree	*Gymnocladus dioica*	F
Locust	*Robinia sp.*	F
Mimosa	*Mimosa pudica*	F
Mulberry	*Morus sp.*	F
Osage Orange	*Maclura poynifera*	F
Pin Oak	*Quercus palustris*	F
Pine	*Pinus sp.*	S
Poplar	*Populus alba*	F
Post Oak	*Quercus stellata*	S
Red Bud	*Cercis canadensis*	S
Red Oak	*Quercus rubra*	S
Sassafrass	*Sassafrass albidum*	F
Silver Maple	*Acer saccharinum*	F
Sugar maple	*Acer saccharum*	S
Sweetgum	*Liquidambar styraciflua*	F
Sycamore	*Platanus occidentalis*	F
White Oaks	*Quercus alba*	S

Table 3. Major tree species and growth rates.

4.1 CONSIDERATIONS FOR PRUNING

Factors to consider before pruning include:

- The growth rate of the tree species and proximity to the line
- Tree/branch Failure potential
- TGR effectiveness
- The voltage of the conductor
- Sag and sway
- The Quality of the site (i.e. riparian zones, chert glades, etc.)

4.2 TREE REMOVAL

Trees less than 6 inches at Diameter at Breast Height (DBH) will be considered brush and removed from the ROW.

4.3 REMOVAL CONSIDERATIONS IN MANICURED AREAS

In areas that are being actively maintained, such as yards, LU or its agents shall acquire permission to remove trees from the property owner or occupant by signature. Verbal permission may be used in the event the property owner or occupant is unable to sign a removal card.

Candidates for removal:

- Trees growing in the ROW
- Fast growing trees adjacent to the ROW
- Trees growing around poles, guy wires and other equipment
- Regrowth from old stumps
- High risk trees – dead/ dying trees, root failure, canker, Insect infestation, internal decay, etc.
- Trees that cannot be pruned to ANSI A300 standards

4.4 REMOVAL CONSIDERATIONS IN NON-MANICURED AREAS

Volunteer trees in areas that lack any beneficial value shall be removed at the discretion of LU or its representatives. A diligent attempt will be made to inform the property owner or occupant of the removal prior to work commencement.

Candidates for removal:

- All considerations in section 4.3
- Unmarketable fencerow trees that currently lack ability to be beneficial shade for livestock.
- Edge trees of no market value that yield no additional benefit due to adjacent or otherwise available shade to livestock.
- Trees located in areas not manicured, accessible and inaccessible alleys, City and County Right of Ways, or not associated with a residence.

4.5 LIMB AND BRANCH DISPOSAL

4.5.1 MAINTENANCE

LU contract crews performing scheduled maintenance will dispose of limbs that are small enough to be fed through a chipper unless different arrangements have been made with the property owner or occupant. Wood too large to be chipped shall be cut and stacked at the site unless the homeowner requests the wood be removed before or at the time of the pruning (*See Section 3.2.2 for exception*).

4.5.2 OUTAGES

Outages caused by grow-ins will be cleaned up by LU contract crews. The property owner is responsible for outages caused by acts of God including but not limited to wind, rot, whole tree failure, ice, etc.

4.5.3 MAJOR EVENTS

LU's primary focus during Major Events is restoration. Due to the regional impact, brush and limbs cut during major events will be left onsite.

4.6 STUMPS

Stump will be cut as close to the ground as safely possible. All stumps shall be treated with an approved herbicide unless a property owner has requested that the stump not be treated or if the herbicide label warns against treatment of stumps in particular situations. LU and its contract crews will not grind out stumps, unless prior arrangements have been agreed upon.

5 HERBICIDES

Herbicides are an essential component of vegetation management and an integral tool for promoting biological control on the ROW.

All herbicides shall be applied in strict compliance with all federal, state and local laws and regulations. This includes, but is not limited to: application, transportation, handling and container disposal.

All herbicide and treatment methods used by the contractor shall have prior approval by LU.

It is the contractor's responsibility to provide all crew members applying herbicides with the appropriate protective gear, current label and Material Safety Data Sheet (MSDS) for the product being applied.

The contractor is responsible for the proper disposal or recycling of all herbicide containers.

Any spills shall be reported by the contractor's general foreman/supervisor as soon as the situation is controlled and it is safe to do so. The type of product and amount of spillage along with the contamination efforts that were made shall be documented in an email to the Manager of Vegetation Control. Then the general foreman shall notify the proper state or federal agencies if necessary. All damage from such leaks or spills are the responsibility of the contractor.

5.1 APPLICATION

- All herbicide treatment shall be performed in a responsible manner that will reflect the best interests of the property owner and LU. If a property owner should object to any of the herbicide treatments, the operation shall immediately be discontinued on that property until any differences are resolved. Legitimate refusals include but are not limited to: organic farming and chemical sensitivity of customer; in these instances, a recommendation for the customer to keep the area free of brush would eliminate the need for herbicide on their property.

- The Contractor shall guarantee one hundred percent (100%) coverage and a minimum ninety five percent (95%) control per span on stumps and vegetation applied, as determined during the growing season following the treatment. Spans not meeting these specifications shall be re-treated by the Contractor at the Contractor's expense to achieve the proper mortality.

- In herbicide application work, the Contractor shall have the right to skip any portion of a line when, in the opinion of the Contractor, damage to crops, orchards, or ornamental plantings may result. Any skips shall be reported to the appropriate LU representative.

5.2 APPLICATION METHODS

LU uses multiple methods for controlling vegetation on and along its ROW. These include but are not limited to:

- **Foliar**: Applied during the growing season to the foliage of undesirable vegetation
- **Basal**: Dormant season application applied to the base of undesirable vegetation

- **Dormant Stem**: Applied to the stems of undesirable vegetation during the dormant season
- **Granular**: Applied any time of year with soil residual activity to prevent regrowth
- **Mechanical Application**: Foliar application during the growing season
- **Bare ground**: Applied to Substations and areas surrounding substations regulators, distribution 3-phase re-closers, transmission and distribution switches before vegetation emerges.
- **Cut Stubble Application:** Brush hogging followed by broadcast selective herbicide.
- **Stump Treatment:** Stumps from removed Trees shall be treated to prevent regrowth.

6 TREE GROWTH REGULATOR

LU and its agents will apply TGR on a 3-year cycle to applicable trees. TGR is a cost effective alternative to pruning and will be the primary tool for preventing vegetative growth into energized conductors. Application methods are a Basal Drench or Probe. The main stem of the tree should be half the distance of maximum crown expansion from the conductor to be considered for application. Inches in Table 3 represent Diameter at Breast Height (DBH). Table 3 will serve as a guideline for TGR application. Field conditions may include or exclude trees from the guideline.

TGR / Trim type	Category 1	Category 2	Category 3	Category 4
Bucket ST	All	<24"	<24"	<12"
Bucket VT	All	<24"	<24"	<18"
Manual ST	All	All	<24"	<24"
Manual VT	All	All	<24"	<24"

Category 1	Sweetgum, Redbud, Bald Cypress
Category 2	Basswood, Hard Maple, Elm, Boxelder, Ailanthus
Category 3	Catalpa, Oaks, Mimosa, Hickory, Locust, Sassafras, Silver Maple,
Category 4	Birch, Gingko, Hackberry, Sycamore, Poplar, Osage Orange, Mulberry, Tulip Tree, Willow, Cottonwood

Table 4. TGR guidelines for application

7 MECHANICAL CLEARING

In areas that would be labor intensive for conventional crews to clear, mechanical clearing offers a cost effective alternative. LU utilizes serval types of machinery to clear vegetation along the ROW including, but not limited to boom trimmers, drum head mowers, dozers and flail head mowers. Mechanical clearing allows access to facilities and has shown a positive impact on SAIDI numbers

8 SUBSTATION VEGETATION MANAGEMENT

8.1 VEGETATION ENCROACHMENTS

During the maintenance cycle, the perimeter of the substation will be inspected for vegetation encroachments and the appropriate resource assigned to mitigate any vegetation issues.

8.2 SUBSTATION SPRAYING

Bare ground Herbicides will be applied between February 1st and April 30th to the graveled portions of the substation to prevent vegetation from establishing inside the Substation (see Section 5 for Application guidelines). Contractor shall guarantee one hundred percent (100%) coverage with a ninety five percent (95%) control based on square footage per Substation. Any work that does not meet these criteria shall be re-treated by the contractor at the contractor's expense. Audits will be performed during the growing season that the herbicide was applied.

9 PUBLIC EDUCATION

LU will host/participate yearly in multiple public outreach events including proper pruning, Right Tree Right Place, proper planting demonstrations and energy efficient tree planting. LU also has brochures on tree care, tree health and maintenance available through its website. By partnering with the Arbor Day Foundation's Energy Savings Tree Program LU has increased awareness of Right tree, Right Place and provides customers with information on where to plant trees for the most energy efficiency.

10 RESEARCH AND DEVELOPMENT

LU is committed to pursuing technology and improved methods of vegetation management that enhance reliability while reducing costs associated with vegetation management.

10.1 WIRES OVER WILDLIFE (WOW)

In this program, property owners are encouraged to maintain their portion of the ROW for vegetation that promotes wildlife while eliminating potential conflicts with the power lines. Forming a partnership with property owners will ultimately reduce LU's need for vegetation management.

10.2 SIDE TRIMMING WITH HERBICIDE

LU has pioneered an innovative delivery system that applies herbicide to the vertical wire zone to control side encroachment. Early evaluation shows a reduced cost per foot and potential increased cycle length.

10.3 AUGMENTED REALITY

Leveraging GIS to improve planning accuracy and information transfer reduces costs and improves efficiencies. Augmented Reality has multiple applications in the industry but specifically it allows the tree to become an asset that can be managed based on historical information.

10.4 TREE GROWTH REGULATOR

The benefit of tree growth regulator has already been proven, however their application and integration into a maintenance schedule is specific to each Utility. LU is developing a best management practice involving pruning and treating with TGR.

10.5 AUTO-MOWERS

LU is piloting test areas for Autonomous Electric Mowers. These mowers will reduce maintenance costs while providing a safer and better-quality product.

10.6 POWER TO THE POLLINATORS

LU also provides opportunities for individuals and communities to promote pollinator habitat on the ROW and for community improvement.

10.7 RE-GROWTH STUDY

LU tree crews are capturing the re-growth on trees previously trimmed to determine if the clearance distances are adequate. The data capture is timestamped and georeferenced for multiple species across the system. This study will also help assess the effectiveness of TGR usage in the Vegetation Management program and how it affects the clearance specifications.

AFFIDAVIT

State of Missouri)
) ss
County of Jasper)

I, Tim Wilson, state that I am the Vice President of Electric Operations – Liberty, under penalty of perjury, I declare that the above document is true and correct to the best of my knowledge and belief.

Tim Wilson