UTILITY BEST MANAGEMENT PRACTICES
TREE RISK ASSESSMENT AND ABATEMENT FOR FIRE-PRONE STATES AND PROVINCES IN THE WESTERN REGION OF NORTH AMERICA

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FORWARD

Hazard trees represent a significant liability to the general public, cities, counties, utilities, and State and Federal agencies. If left unmanaged, hazard trees can cause injury to people and property, interruptions to electric service, and threats to the nation's critical infrastructure. In fire-prone states, hazard trees can also fall onto power lines and become the source of damaging wildland fires.

To address the issue the Utility Arborist Association (UAA), through the Tree Research & Education Endowment Fund, has developed the following industry accepted best management practices (BMPs) for assessing tree risk during power line inspections. These BMPs were developed specifically to address hazard tree issues in western region fire-prone states and include the standardization of patrol protocols and inspection practices.

In the future the UAA would like to modify and expand upon these BMPs and have them adopted regionally in North America by utilities. Similar guidelines for tree risk assessment and abatement could also be developed for international use and possibly for broader application outside the utility industry.

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INTRODUCTION

Cities, utilities and agencies can be responsible for managing large populations of trees. Often, one of the primary management tasks is to identify, assess and abate hazard trees in order to protect a "target". Techniques for assessing the potential for failure of an individual tree have received considerable attention and the methodologies are widely recognized and implemented. Rather than add another voice to already well-developed practices, the intent of this BMP is to standardize inspection practices for identifying those individual trees within the larger population which should be examined more closely to determine the need for abatement.

These BMPs recognize that implementation of a tree risk assessment and abatement plan will generally vary based on the customary practices of the individual utility, existing inspection schedule, and the laws and regulations that may be applicable in their service area. Additionally, the plan should incorporate knowledge of vegetation types, tree failure patterns and the presence of high-fire risk areas.

Application of these BMPs is intended to be on forested lands and/or heavily wooded areas where it is difficult to thoroughly assess each tree from within the utility easement or right-of-way.

These BMPs were developed recognizing that there are significant challenges when dealing with large numbers of trees. Resources for any entity are always finite, and given a large population of trees and many targets, it is not reasonable to expect close monitoring of all individual trees or abatement of all trees with any defect. Also, as is often the case, the ability of utilities to perform abatement may be restricted due to property owner intervention. Given these constraints, the goal of a utility or other entity is to "manage" rather than "eliminate" the risk.

Please note that many of the terms used in this document are defined in the Glossary of Terms.

BMP DEVELOPMENT PROCESS

At the direction of the UAA, a Hazard Tree Identification Protocol working group was assembled. The group included representation from various stakeholder groups. The working group convened two workshops and communicated regularly during the development of these BMPs. Sub-committees were established to address various

issues that were identified during the workshops and in subsequent communications. A review committee was also established to evaluate and provide input on these BMPs.

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1. PATROLS, INSPECTIONS, AND METHODS USED TO ASSESS TREE RISK

Typically, each utility develops a maintenance plan that includes methods for patrolling and inspecting its electric facilities. This can include patrolling from the ground, on foot or in a vehicle, or by using aircraft, whether fixed wing or helicopter, or by the use of Light Detection and Ranging (LIDAR), in combination with other methods, to determine tree health. These methods can vary significantly between utilities as can the methods for assessing tree risk. This BMP suggests the following:

1.1 PATROL AND INSPECTION METHODS

Patrol and inspection methods used to assess tree risk are utility and site specific. Each utility should have a plan in place that describes the methods used based on site specific requirements.

For the purpose of this BMP, the geographic area assessed during a patrol includes all areas that contain trees tall enough to strike an Overhead High-voltage Conductor. This area would be considered the “strike zone”.

The following sections of this BMP define how patrols and inspections should be carried out to identify tree risk.

1.2 LINE PATROL

A Line Patrol is a periodic, ground-based visual assessment of trees, which can be observed from within or closely adjacent to an easement or right-of-way, in order to identify tree defects that could cause a tree, or parts of a tree, to fall directly into an Overhead High-voltage Conductor.

1.2.1 Each utility should define and establish specific guidelines, including frequency and methodology, for performing a Line Patrol.

1.2.2 A Line Patrol is intended to support Line Clearing Operations which are defined as: Tree pruning and removal, performed on a regular basis that supports electric service reliability, public safety, and compliance with laws and regulations related to utility vegetation management.

1.2.3 A Detailed Tree Inspection may occur when evidence warranting the detailed inspection is observed during a Line Patrol.

1.2.4 This BMP recognizes that a Line Patrol does not necessarily entail a detailed inspection of each tree within the strike zone.

1.3 DETAILED LINE PATROL

A Detailed Line Patrol is a periodic, ground-based visual assessment of trees within the strike zone, in order to identify tree defects that could cause a tree, or parts of a tree, to fall directly into an Overhead High-voltage Conductor.

1.3.1 Each utility should define and establish specific guidelines, including frequency and methodology, for performing a Detailed Line Patrol.

1.3.2 A Detailed Tree Inspection may occur when evidence warranting the detailed inspection is observed during a Detailed Line Patrol.

1.3.3 This BMP recognizes that a Detailed Line Patrol does not necessarily entail a detailed inspection of each tree within the strike zone

1.4 DETAILED TREE INSPECTION

Close proximity, 360 degree visual inspection of an individual tree from the ground.

1.4.1 The inspector determines the presence, significance, and severity of a tree defect if one exists.

1.4.2 The inspector considers the severity of the defect when prescribing abatement action.

2. FREQUENCY OF PATROLS

Patrol frequency varies among utilities based on individual needs, applicable laws and regulation, species, vegetation type, line voltage, and the presence of high fire risk areas.

Overhead High-voltage Conductors are electric lines that are energized at more than 750 Volts. Voltages for distribution and transmission lines typically range from 2.4kV to 765kV.

Overhead Low-voltage Conductors are electric lines that are energized at 750 Volts or less. For the purpose of this BMP, an Overhead Low-voltage Conductor refers to a line that is strung pole to pole and that is not associated with Overhead High-voltage Conductors (no Overhead High-voltage Conductors in the same span).

The following provides a recommended framework for developing patrol frequencies for Overhead High-voltage and Low-voltage Conductors.

2.1 OVERHEAD HIGH-VOLTAGE CONDUCTORS

A multi-component approach should be employed when determining the frequency of patrols for Overhead High-voltage Conductors. Each utility should determine their Line Patrol frequency and establish a separate Detailed Line Patrol schedule. For example, a Line Patrol could occur on an annual basis and a Detailed Line Patrol could occur every 3-5 years or as determined by the Line Patrol.

2.1.1 This practice should be viewed as a single approach involving two separate components

2.2 OVERHEAD LOW-VOLTAGE CONDUCTORS

Each utility should define a patrol and abatement strategy for Overhead Low-voltage Conductors (pole to pole, not pole to weatherhead), dependent on fire risk and regulatory requirements.

2.2.1 Overhead Low-voltage Conductors that are strung pole to pole are also known as Secondary Conductors.

3. ASSESSING TREE RISK

3.1 TREE DEFECTS

The ability to assess tree risk and tree failure potential is a baseline requirement for any utility vegetation management program. Inspectors must have the ability to identify the likelihood of a tree's failure and be able to determine the appropriate abatement action.

Appendix 'A' contains a list of some tree-specific defects that may trigger a Detailed Tree Inspection or appropriate abatement action.

Although all of the tree-specific defects listed in Appendix 'A' are considered potential triggers for a Detailed Tree Inspection, these defects may not be considered as causing a risk to the Overhead High-voltage Conductors after a Detailed Tree Inspection has been conducted.

3.2 SITES THAT REQUIRE ADDITIONAL CONSIDERATION

It may also be necessary to look at some sites in more detail due to environmental conditions, past management practices, or other human activity.

Appendix 'B' contains a list of site-specific conditions that should be considered while conducting a patrol.

3.3 TREE RISK ASSESSMENT PROCEDURE

3.3.1 The inspector determines the presence, severity, and significance of a tree defect if one exists.

3.3.2 The inspector considers the severity of the defect when prescribing an abatement action and prioritizes the work accordingly.

3.3.3 Some utilities may require that an inspector's recommendation be reviewed by a supervisor or appropriate utility personnel.

3.3.4 The tree care contractor or utility personnel, when in the field, may make a follow-up determination of the recommended abatement action.

3.3.5 It should be recognized that some recommendations for abatement treatments may be limited by legal constraints or by the property owner.

4. ASSESSMENT AND ABATEMENT PLAN

Trees that have been determined to be an unacceptable risk to high-voltage conductors during an assessment generally require some form of abatement action,

whether pruning or removal. A plan for assessment and abatement should be developed based on the varying conditions that can be encountered in the field.

4.1 Each utility should have a plan and procedure in place for the assessment and abatement of hazard trees. The assessment and abatement plan should address regulatory requirements, patrol schedule, severity of tree conditions, resource availability, environmental impacts, property owner and land manager concerns.

4.2 The plan should specify the party or parties responsible for prescribing and executing the abatement.

5. WORKER QUALIFICATIONS

Workers that perform tree risk assessment patrols and inspections should receive adequate training, as defined by the utility, to satisfactorily perform the tasks needed to identify hazard trees and recommend abatement procedures. At a minimum all workers performing tree risk assessments should be able to recognize all tree-specific defects listed in Appendix 'A' and the site conditions listed in Appendix 'B', and understand what those conditions imply regarding abatement.

5.1 Each utility should require that all personnel performing tree risk assessment patrols and inspections receive training specific to tree risk assessment. It should be required that all tree risk assessment training be recorded and updated by the individual's employer.

5.2 Each utility should define minimum qualifications necessary to perform tree risk assessment patrols and inspections. Minimum qualification requirements should take into consideration the individual's knowledge of utility assets, arboriculture-related education and experience, industry certifications and in-house training.

5.2.1 A list of recommended training resources is included as Appendix 'C'.

6. DOCUMENTATION

Documentation and data collection related to vegetation management can vary significantly among utilities. The process used to document hazard trees may include tagging, collecting GPS information, or the use of other means to document and track hazard trees such as in an inventory system.

6.1 Each utility should have documentation procedures and data collection requirements for vegetation management. The utility's existing requirements should be incorporated into their tree risk assessment and abatement plan.

GLOSSARY OF TERMS

Detailed Line Patrol:
Periodic, ground-based visual assessment of trees within the strike zone, in order to identify tree defects that could cause a tree, or parts of a tree, to fall directly into an Overhead High-voltage Conductor.

Detailed Tree Inspection:
Close proximity, 360 degree visual inspection of an individual tree from the ground.

Line:
Conductors, structures and related equipment located in an easement or right-of-way for the purpose of transmitting electricity.

Line Clearing Operations:
Tree pruning and removal, performed on a regular basis that supports compliance with laws and regulations related to utility vegetation management.

Line Patrol:
Periodic, ground-based visual assessment of trees, which can be observed from within or closely adjacent to an easement or right-of-way, in order to identify tree defects that could cause a tree, or parts of a tree, to fall directly into an Overhead High-voltage Conductor.

Overhead High-voltage Conductor:
Electric lines energized at more than 750 Volts. Voltages for distribution and transmission lines typically range from 2.4kV to 765kV.

Overhead Low-voltage Conductor:
Electric lines energized at 750 Volts or less. For the purpose of this BMP, an Overhead Low-voltage Conductor refers to a line that is strung pole to pole and that is not associated with Overhead High-voltage Conductors (no Overhead High-voltage Conductors in the same span).

Secondary Conductor:
An open wire or bundled low-voltage line that is typically strung from pole to pole.

Strike Zone:
The area within, and adjacent to the easement or right-of-way from which a tree can directly strike an Overhead High-voltage Conductor.

APPENDIX 'A'

TREE-SPECIFIC DEFECTS OR POTENTIAL TRIGGERS FOR THE DETAILED INSPECTION OF TREES WITHIN THE STRIKE ZONE (Note: This list is not intended to be all inclusive or address the severity of a defect.)

Basal wound
Bleeding and/or resinosus
Bulges and/or swellings
Cankers, including bleeding & gall rust
Cavities
Codominant or multiple stems from base or higher on trunk
Conks indicating heart rot, root rot, sap rot or canker rot
Cracks including shear
Dead branches and/or top
Dieback of twigs and/or branches
Embedded wires or cables
Excessive lean or bow
Fire damage
Foliage – off-color, flagging or loss
Hazard beam
History of limb failure(s) on tree
Included bark
Insect activity such as frass from termites, bark beetles or carpenter ants
Large branches overhanging power line
Lightning damage
Live crown ratio below 30%
Mistletoe – dwarf or broad-leaf
Nesting holes – birds, mammals, insects
Past poor pruning practices
Roots injured, exposed, undermined or uplifted
Seam
Species failure patterns
Unnatural or structurally unsound canopy weight distribution
Weak, unsound branch attachments

APPENDIX 'B'

SITE-SPECIFIC CONDITIONS OR POTENTIAL TRIGGERS FOR SITES THAT CONTAIN TREES WITHIN THE STRIKE ZONE

Areas known to be affected by introduced tree pathogens
Areas of recent clearing/new edge
Change in drainage
Change in grade
Construction – including trenching, paving or road construction
Cultural disturbance to landscape - natural or unnatural
Diseased center – dead tree in middle and dying trees around it
High stand density with single species composition
History of failure(s) at site
History of repeated outages on circuit
Fire damage
Raptor nests above lines
Recent thinning or logging
Soils prone to slides
Specific conditions like high winds
Storm damage
Wet sites

APPENDIX 'C'

TRAINING RESOURCES

Reference	Author (s)	Source	Publisher
A Field Guide to Insects & Diseases of California Oaks	Tedmund J. Swiecki & Elizabeth A. Bernhardt	United States Department of Agriculture - Forest Service - General Technical Report PSW-GTR-197	United States Department of Agriculture - Forest Service
A Handbook of Hazard Tree Evaluation for Utility Arborist	James R. Clark & Nelda Matheny	International Society of Arboriculture (ISA)	International Society of Arboriculture (ISA)
A New Tree Biology	Dr. Alex L. Shigo	Shigo & Trees, Associates	Shigo & Trees, Associates
A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas	James R. Clark & Nelda Matheny	International Society of Arboriculture (ISA)	International Society of Arboriculture (ISA)
ANSI A300 – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning)	Various contributors	American National Standards Institute	American National Standards Institute
ANSI Z133 – Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements	Various contributors	American National Standards Institute	American National Standards Institute
California Tree Failure Report Program	Laurence R. Costello, Bruce Hagen & Katherine S,.Jones	University of California	University of California
Diseases & Insect Pests of Northern & Central Rock Mountain Conifers	Susan Hagle, Kenneth Gibson & Scott Tunnock	United States Department of Agriculture-Forest Service Publication # R1-03-08	United States Department of Agriculture - Forest Service
Diseases of Pacific Coast Conifers	Robert F. Scharpf	United States Department of Agriculture - Forest Service - Handbook 521	United States Department of Agriculture - Forest Service
Evaluating Tree Defects, 2nd Edition	Ed Hayes	Safetrees	Safetrees
Field Guide for Danger Tree Identification & Response	Richard Toupin & Michael Barger	United States Department of Agriculture-Forest Service Publication # R6-NR-FP-PR-03-05	United States Department of Agriculture - Forest Service

APPENDIX 'C'

Hazard Trees - Recognizing them before you climb	Manfred Mielke, Plant Pathologist, NA FHP	United States Department of Agriculture - Forest Service	United States Department of Agriculture - Forest Service
International Tree Failure Database	NA	http://svinetfc2.fs.fed.us/natfdb/	NA
Manual of Pacific Coast Trees	McMinn & Maino	University of California Press Berkeley.	University of California Press Berkeley.
Modern Arboriculture	Dr. Alex L. Shigo	Shigo & Trees, Associates	Shigo & Trees, Associates
Pests of the Native California Conifers	UCPress, 2003, Wood et al	University of California	University of California
Power Line Fire Prevention Field Guide	Dan Nichols, Robert Loggins & R.C. "Bob" Fraitag	California Department of Forestry & Fire Protection	California Department of Forestry & Fire Protection
Pruning Trees Near Electric Utility Lines	Dr. Alex L. Shigo	Shigo & Trees, Associates	Shigo & Trees, Associates
Recognizing Tree Hazards - A Photographic Guide for Homeowners	Laurence R. Costello, Bruce Hagen & Katherine S,.Jones	University Of California Agriculture & Natural Resources Communication Services - Publications - Publication # 21584	University Of California Agriculture & Natural Resources
Roadside Vegetation Management: Protocol for Prioritizing Surveys & Recognizing, Rating, Documenting & Treating Hazard Trees along Forested Roadways in Northeastern Oregon	Craig L. Schmitt	United States Department of Agriculture - Forest Service Technical Report BMPMSC-04-01	United States Department of Agriculture - Forest Service
Ten Common Wood Decay Fungi on California Trees	Gary W. Hickman & Ed Perry	University of California - Cooperative Extension	Western Chapter-International Society of Arboriculture (ISA)
Tree Hazards-Recognition & Reduction in Recreational Sites	David w. Johnson	United States Department of Agriculture - Forest Service Technical Report R2-1	United States Department of Agriculture - Forest Service
Urban Tree Risk Management	Jana Albers, Jill Pokorny & Dr, Gary Johnson	United States Department of Agriculture-Forest Service Publication # NA-TP-03-03	United States Department of Agriculture - Forest Service