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May 1, 2006

***Via Electronic Filing and U.S. Mail***

Oregon Public Utility Commission  
Attention: Filing Center  
PO Box 2148  
Salem OR 97308-2148

Re: In the Matter of a Rulemaking to Amend and Adopt Permanent Rules in OAR 860,  
Divisions 024 and 028, Regarding Pole Attachment Use and Safety  
OPUC Docket No. AR 506

Attention Filing Center:

Enclosed for filing in the above-captioned docket is Portland General Electric's First Round Comments. This document is being filed by electronic mail with the Filing Center.

An extra copy of this cover letter is enclosed. Please date stamp the extra copy and return it to me in the envelope provided.

Thank you in advance for your assistance.

Sincerely,

/s/ INARA K. SCOTT  
Inara K. Scott

IKS:am

cc: AR 506 Service List

Enclosure

**BEFORE THE PUBLIC UTILITY COMMISSION**

**OF OREGON**

**AR 506**

In the Matter of a Rulemaking to Amend and Adopt Permanent Rules in OAR 860, Divisions 024 and 028, Regarding Pole Attachment Use and Safety

**FIRST ROUND COMMENTS OF  
PORTLAND GENERAL ELECTRIC  
COMPANY**

Portland General Electric Company (PGE) appreciates the opportunity to comment in AR 506. Our concerns with the proposed new and amended Division 24 rules are broadly addressed below. Please note that PGE has commented on selected issues from the Issues List.

**1. “Pattern of noncompliance” - OAR 860-024-0001(7)**

The proposed definition could be applied in a subjective or arbitrary manner because the term “frequent” is not defined. In addition, the definition does not distinguish between violations that are material and/or significant and those that are unlikely to result in any threat to life or property. PGE suggests further discussion of the type and frequency of violations that will trigger a finding of a “pattern of non-compliance” as described at OAR 860-024-0011(d).

**2. Training Requirement for Contractors - OAR 850-024-0011 (1)(b) and (c)**

Current federal, state, and local laws and regulations do not require general training in all Commission Safety Rules; rather, they allow for task specific training in relevant subject areas. PGE notes that additional training requirements for contractors could increase utility costs. In addition, the proposed rule requires utilities to provide evidence that contractors received Commission Safety Rules training, but provides no guidance as to the type of training required or the type of documentation the utility must provide. PGE suggests further discussion of the intent

behind this provision and refinement of the rule so the Commission and utilities have a clear picture of what is required of each entity (owner-operators and contractors).

### **3. Prioritization of Work - OAR 860-024-0012**

As pointed out in the Oregon Joint Utility Association's (OJUA) Inspection/Correction Committee Final Report, dated June 10, 2004 (OJUA Report), all pole owners and pole users currently install and maintain their facilities in accordance with National Electric Safety Code (NESC) rules. In accordance with NESC policies, the OJUA proposed to organize prioritization of repairs into three categories:

- 1) High hazard requiring immediate response;
- 2) Violation with potential hazard requiring correction no later than the end of the following year; and
- 3) Violations that cannot reasonably be expected to endanger life or property and can be corrected during the next major activity.

Issues that fall into Category Three would be tracked and repaired when the pole owner has a major activity, like a pole replacement, scheduled for that pole. Examples of Category Three issues would be the presence of staples and small nails in distribution poles, or 39 inches of clearance at the pole between an electrical service drop and a telephone service drop where 40 inches is required. These types of issues pose little safety risk, but are technically a violation of the code. If the proposed rule is adopted, the utility must treat all code violations that do not pose an imminent danger to life or property equivalently, and must complete repair of all such violations within two years (or possibly three, under circumstances outlined in OAR 860-024-0012(3)).

Total compliance in a dynamic distribution system environment is impossible. Our goals must reflect reasonable expectations, and must take into account the cost impact of the proposal.

Some code violations can require significant cost to repair, yet provide little additional safety protection. PGE believes this topic should be considered in greater detail, and the significant and realistic costs involved with implementing this provision should be determined.

**4. Cooperation on inspections – OAR 860-024-0011(2)**

Although it is not entirely clear, OAR 860-024-0011(2) appears to require the operator of electric facilities to schedule inspections of facilities more than a year in advance, and make any and all changes to the schedule not less than one year in advance of the start of the next year's inspection. The rule makes no provision for schedule changes that arise during the normal course of business, for reasons such as labor availability, cost impacts, or adverse weather. The inflexibility inherent in this proposed rule would necessarily increase costs and reduce efficient scheduling of crews, and could subject the operator to complaints or rule violations due to events entirely outside the operator's control. PGE suggests reconsidering this requirement or, at a minimum, adopting a transitional period so pole owners and operators can collect the information necessary to effectively coordinate their inspections. PGE supports the OJUA's proposal to establish a graphic information systems (GIS) database that would be available to all facility operators.

**5. Placement of "Duties of Electric Supply and Communication Structure Owners" in Division 28 – OAR 860-024-0014**

To the extent that OAR 860-024-0014 concerns the relationship between structure owners and occupants, the rule should more appropriately be moved to Division 28, which deals specifically with standards for that relationship. At a minimum, OAR 860-024-0014(1) and (2) should be moved to Division 28 because they do not deal with safety issues, but rather with communications between owners and occupants.

OAR 860-024-0014(3) states that “An owner must maintain its facilities in compliance with Commission Safety Rules for occupants.” PGE believes the phrase “for occupants” should be deleted. The owner’s compliance with applicable safety rules is prescribed by law and regulation and benefits the public interest; owners do not have a distinct and additional legal duty to occupants. Moreover, to the extent that this rule requires the owner to modify or remove occupant attachments, PGE believes that it inappropriately transfers the responsibility from the occupant to the owner to inspect and repair the occupant’s facilities, and leaves the utility vulnerable to being unable to recover costs associated with these repairs. PGE believes this rule may be reasonable for safety violations that pose an imminent danger to life or property, but suggests that owners should not be responsible for making modifications or repairs to occupant facilities that do not pose such a threat. PGE also suggests that additional rule language be added to clarify the precise nature of the utility’s authority to modify or remove occupant facilities in these circumstances.

OAR 860-024-0014(3)(b) appears to suggest that the owner has a duty to provide any occupant with a plan of correction for any violation of the Commission Safety Rules. As noted above, the owner has a duty to comply with applicable rules and regulations and it would be appropriate for the rule to require the owner to provide a reasonable plan of correction to the Commission, upon request by the Commission. On the other hand, it is inappropriate to put the occupant in the shoes of a regulator and give the occupant the authority to request the owner to create a plan of correction.

## **6. Vegetation Clearance Requirements – OAR 860-024-0016**

PGE has a number of concerns with the proposed vegetation clearance requirements, many of which are addressed in a report that was prepared by Environmental Consultants,

Incorporated (ECI), nationally recognized experts in vegetation management. ECI reviewed PGE's vegetation management program for the entire service territory in the fourth quarter of 2005 and considered the impact of the then-proposed rules on PGE's current vegetation management practices. ECI's Report, "Review of Proposed OPUC Vegetation Management Rules and Impact on Portland General," is attached as Exhibit A. Exhibit B is ECI's comparison of the OPUC's proposed safety rules with those rules currently in place in California. Exhibit C is a statement of ECI's qualifications, including the resumes for Philip M. Charlton, ECI President, and Paul Appelt, ECI Vice President. The findings presented by ECI provide a clear framework for developing appropriate vegetation rules that maintain safety in a manner that recognizes the real world circumstances within which utilities operate.

**(a) Interference**

The word "interfere" is included but not defined in the 2002 edition of the National Electric Safety Code (NESC). Significantly, the Edison Electric Institute Vegetation Management Task Force ("Task Force") determined that the term "interfere" was being widely misinterpreted, and decided to remove the term from Rule 218 of the revised NESC, which will be effective January 1, 2007.

PGE believes it is important to acknowledge the expertise and consideration that went into revising Rule 218, and believes the Commission Safety Code should be drafted in a manner that is consistent with the NESC. As proposed, OAR 860-024-0016(1)(a) represents an interpretation of the NESC that has been rejected as unnecessary for safety regulations. With this proposed rule, the Commission would be significantly altering current safety standards and raising them above those demanded at the national level. However, there has been no documentation of any threat to life or property this rule is necessary to prevent, or any study of

the cost that facility owners would be required to expend to meet this significant new requirement.

In comments discussing this decision, the Task Force stated, “The word ‘interfere’ is removed because it has been interpreted to mean all, even incidental, vegetation contact with electric apparatus. ‘Interfere’ has also been used by some regulatory commissions to suggest that incidental contact causes reliability issues. In these instances the regulatory commissions are using NESC -under the guise of safety- to enforce otherwise unjustifiable clearance for reliability purposes.”

The Subcommittee #4 of the NESC voted 23 to 0 to recommend to the full committee a change to the code. Where the NESC currently reads, “Trees that interfere with ungrounded supply conductors should be trimmed or removed,” the revised code will read, “Vegetation that may damage ungrounded supply conductors should be pruned or removed.”

**(b) Readily Climbable**

Section 2 of proposed rule OAR 860-024-0016 defines “Readily Climbable” as vegetation “having sufficient handholds and footholds to permit a child or an average person to climb easily without using a ladder or other temporarily-placed equipment.” Under this definition, to prevent a tree from being “readily climbable” all trees would be required to have no branches for eight feet or more above any accessible surface. We find that 85% of all trees have branches below eight feet, and therefore suggest that a definition of “readily climbable” include sufficient additional detail to except trees that are unlikely to be climbed or do not pose a safety hazard.

For example, the definition of readily climbable could consider: 1) whether there are low limbs that are accessible from the ground and sufficiently close together so that the tree is readily

climbable by a child or average person; 2) whether the tree has a main stem within arm's reach of a power line or electric supply line by someone in the tree; and 3) whether the tree is located where children play and may climb a tree (i.e., schoolyards, playgrounds, parks, yards).

**(c) Tree to Power line Clearances**

The proposed rule requires 10 feet of clearance for lines energized above 50,000 volts. Currently 57,000 and 115,000 volt lines are trimmed 10 to 15 feet from the lines on roadside construction. Limited intrusion of new growth and small limbs can be closer at the end of our three-year trimming cycle for these lines. If the rule is enacted as proposed PGE will need to trim trees back 20 feet or more from sub-transmission lines. In a number of areas main trunks of large Douglas fir are within these new clearing limits and will have to be removed.

In order to maintain a minimum of 10 feet of clearance at all times, PGE would have to move from a three-year sub transmission system trimming cycle to a two-year cycle. Under this scenario, PGE's annual costs for trimming 57kV and 115kV lines will increase by approximately \$300,000.

In lieu of the proposed rule, PGE suggests using the draft North American Electric Reliability Council (NERC) Vegetation Management Standard Part 2 Clearance Standard for transmission clearance. This standard requires a minimum end-of-cycle clearance of 1.3 feet for standard 57 kV lines and a minimum clearance of 2.5 feet for 115 kV lines.

The proposed standard in OAR 860-024-0016(5)(b), which would require a minimum of three feet of clearance on all distribution lines in rural areas, would also greatly increase PGE's tree trimming efforts.

There are many factors that affect tree growth; rates of growth are variable from species to species, site to site and growing season to growing season. To maintain a minimum of three



feet of clearance on all distribution lines in rural areas would require either the wholesale removal of nearly all trees under the lines or moving the tree trimming cycle to two years. Clearly, this change to present vegetation management practices would require significant additional costs, and should be undertaken only if significant benefits would result.

**(d) OAR 860-024-0016(8)**

We believe that extending the applicability of the tree trimming requirements to communication companies is unnecessary.

**7. Generic Waiver – OAR 860-024-0012(4)**

We support the addition of this section. It is a necessary provision for situations in which the owner does not strictly adhere to a particular safety rule, but is able to maintain an equivalent level of safety. For instance, NESC rules require that all staples be removed from distribution poles. This requirement is virtually impossible for an owner to consistently meet, particularly in heavily populated areas where residents use distribution poles to post signs and notices. In cases such as these, where strict adherence to the rule does not provide an incremental increase in safety, PGE believes it may be appropriate for the owner to seek a waiver of repair requirements.

**8. Application of Accident Reports – OAR 860-024-0050**

We support increasing the financial threshold for damage to property that qualifies as “serious injury to property” under this rule. This increase merely adjusts the amount to reflect the current cost of money.

**9. Costs Benefit – all proposed rule changes**

The AR 506 Rule summary, filed March 10, 2006 with the Archives Division of the Secretary of State, states “The purpose of this rulemaking is to ensure that Oregon’s utility lines and facilities accommodate competitive changes and are constructed, operated, and maintained

in a safe and efficient manner.” PGE agrees that Oregon’s utility lines and facilities should accommodate competitive changes and should continue to be constructed, operated and maintained in a safe and efficient manner. However, the proposed rules go beyond this.

OPUC Statement of Need and Fiscal Impact for AR 506 states, “The proposed rules will have little overall financial impact on the PUC, other state agencies, units of local governments, businesses, industry, and the public.” This statement is not accurate with respect to PGE. The proposed rules could, in fact, result in as much as a \$4.7 million per year increase in vegetation management costs, without any demonstrable benefit. See Exhibit A at 12. Moreover, as described above in greater detail, PGE would be required to make significant changes to its current practices to ensure compliance with the proposed rules.

Safety is a top priority for PGE, both safety of the public at large and PGE’s employees, and PGE is proud of its exemplary safety record. However, the proposed rules will require PGE to “raise the bar” on these already exemplary safety standards and costs will rise as a result. PGE therefore suggests that participants to this docket carefully consider whether or not each rule modification results in a gain in safety that is commensurate with the cost incurred.

## **Conclusion**

We appreciate the opportunity to comment and we look forward to further participating in this rulemaking.

DATED this 1<sup>st</sup> day of May, 2006.

Respectfully submitted,

/s/ INARA K. SCOTT

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## **CERTIFICATE OF SERVICE**

I certify that I have caused to be served the foregoing **FIRST ROUND COMMENTS OF PORTLAND GENERAL ELECTRIC** in OPUC Docket No AR 506, by electronic mail, and for the parties who have not waived paper service, by First Class US Mail, postage prepaid and properly addressed, upon each party on the attached service list, pursuant to Oregon Administrative Rule 860-013-0070.

/s/ INARA K. SCOTT\_\_\_\_\_

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# **Review of Proposed OPUC Vegetation Management Rules and Impact on Portland General**

Prepared for  
Portland General Electric  
Portland, Oregon

Prepared by  
Environmental Consultants, Inc.  
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April 24, 2006

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## INTRODUCTION

Portland General Electric (PGE) contracted with ECI to evaluate the PGE vegetation management program in terms of effectiveness and consistency with industry best practices. ECI has completed comprehensive assessments of the vegetation management programs of over 125 electric utilities.

This evaluation was conducted in response to an Oregon Public Utility Commission (OPUC) staff review of tree conditions documenting probable violations associated with safety and reliability. In conducting this assessment, ECI reviewed the clearances between trees and conductors throughout the PGE service territory and within service territories of other utilities within the Willamette Valley. ECI also examined PGE's Climbable Tree policy and practices and compared those against the practices of other utilities nationwide.

In addition to a general assessment of the program, the report also presents ECI's review and comments on the OPUC proposed rules as they relate to electric utility tree maintenance.

## ASSESSMENT

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### ***Tree-to-conductor Contact***

Tree-to-conductor contact on the PGE system is quite low compared to both industry norms and other Oregon Utilities, based on ECI's evaluation of over 7,000 trees in Oregon. In fact, very few trees (two percent across the system) encroach closely (within one foot or less) on conductors at PGE. Contact that was observed was incidental contact only and not a significant threat to safety or reliability.

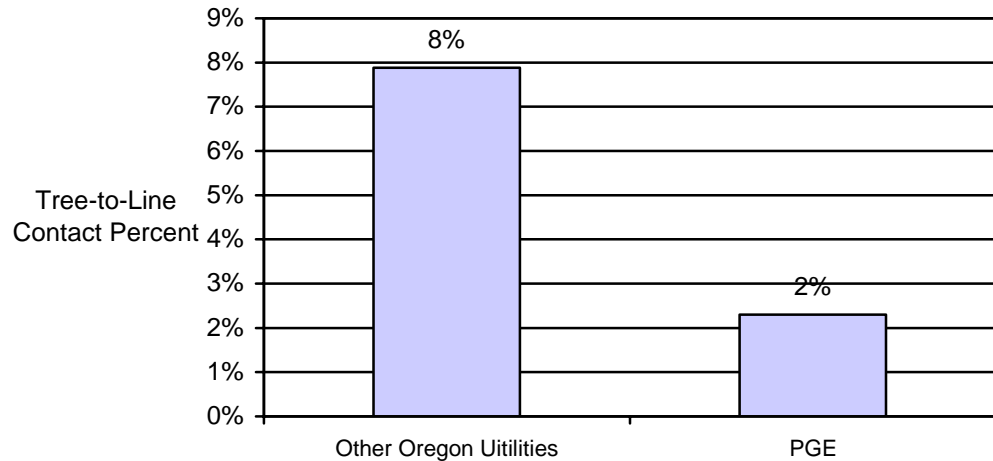
Figure 1 compares PGE's tree-to-conductor contact with that of five other Oregon utilities within the Willamette Valley, including rural electric cooperative, investor-owned and municipal utilities. As shown, average tree-to-conductor contact at PGE was found to be 75 percent lower than what was found at the other utilities. Both of these percentages of trees in contact with the conductors are also well below what ECI has observed as the industry norm.



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**Clearances at the Time of Tree Trimming**

The low number of tree-to-conductor contacts clearly indicates that the clearances achieved at the time of tree trimming are appropriate for end of cycle standards based on industry best practices.



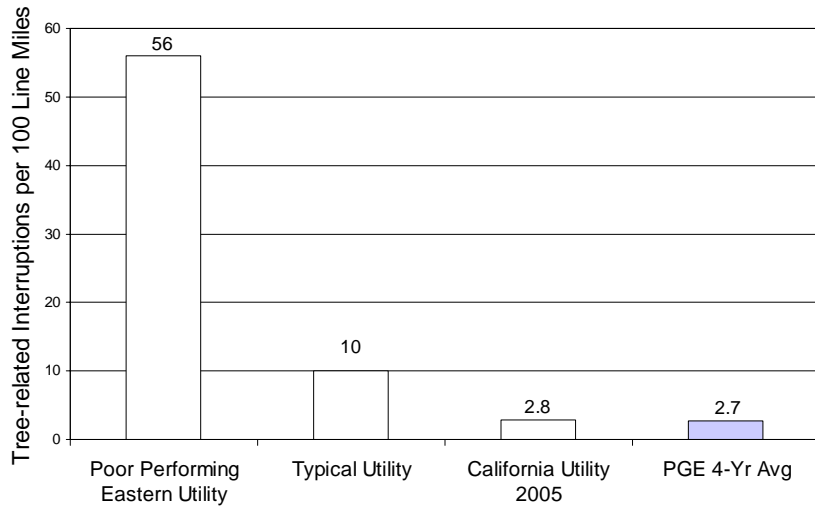
**Figure 1. Tree Contact (Less Than One Foot of Clearance) with Primary Conductors at PGE Is Well Below that Observed Across the Territories of Five Other Oregon Utilities in 2005.**

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**Tree-related Service Interruptions**

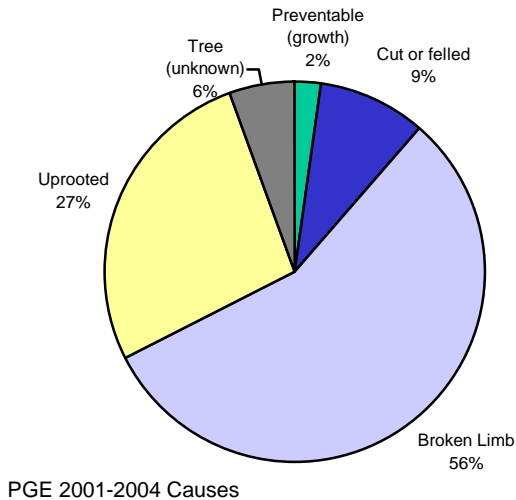
The very low level of tree-to-conductor contact would suggest that PGE should be experiencing relatively low numbers of tree-caused service interruptions and this is the case. In fact, the number of tree-caused interruptions on the PGE overhead primary system per 100 miles of line was found to be among the lowest of any utility in the United States that ECI has examined. The frequency of tree-caused service interruptions at PGE was at least 30 percent, and as much as 80 percent lower than several benchmark groups of U.S. utilities. Figure 2 compares PGE's average number of tree-related interruptions per 100 miles of line with several representative groups from throughout the country.





**Figure 2. PGE’s Performance In Terms of the Annual Number of Primary Tree-Related Interruptions per 100 Miles Is Quite Good as Compared to Representative U.S. Utilities.**

Of the tree-caused interruptions that do occur on the PGE system, few have been the result of trees growing into the conductor. The vast majority of interruptions have been attributed to unforeseen or non-preventable tree failure, including broken limbs, uprooted, cut or felled trees (Figure 3). ECI’s experience shows that most utilities experience a much higher proportion of outages due to tree growth than has PGE. This finding is consistent with the relatively low tree-to-conductor contact observed and discussed above.



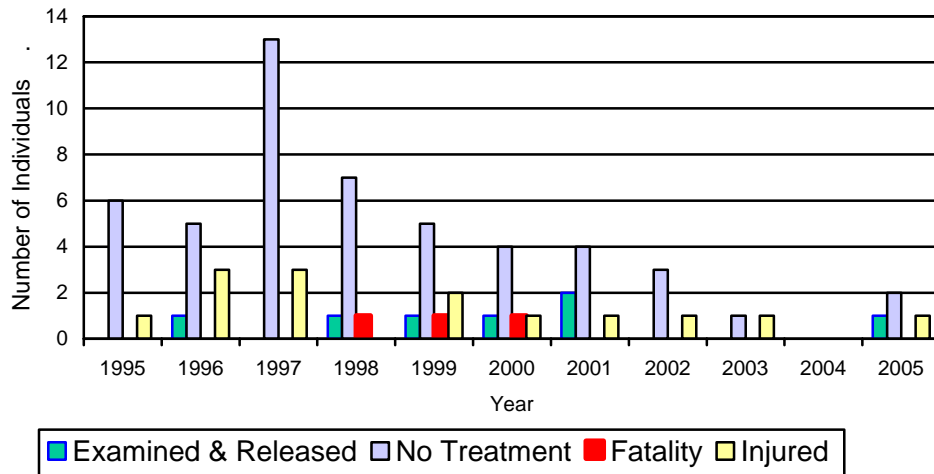
**Figure 3. Service Interruptions Caused by Tree Growth, the Primary Target of Routine Tree Maintenance, Is Quite Low at PGE as Compared to Other Electric Utilities**



## Clearances and Safety

Oregon utilities and the OPUC document all known incidents involving public contact with energized conductors in association with trees. ECI categorized each tree-related contact reported based on published descriptions as either examined and released, no treatment (treatment refused), injured (non-fatally), or fatality (Figure 4).

No incidents of children coming into contact with high voltage lines have been reported within Oregon since 1999. At PGE, no child has climbed a tree and been injured from contact with power lines in over 20 years.



**Figure 4. Total Statewide Tree-related Contacts with Power Lines by People<sup>1</sup>**

ECI's examination of OPUC incident reports indicated that a total of 74 individuals were reported to have experienced a tree-related contact with overhead conductors. Categorization of incidents by year may be slightly different than listed in OPUC reports due to differences in year of occurrence and year reported. OPUC records report that statewide, there have been an average of five public tree-related contacts with power lines reported per year over the past 20 years. Statewide, these incidents have been declining over the past five years and there were zero incidents in 2004. Many of these incidents are related to adults attempting to trim or remove trees in the vicinity of power lines. Few incidents resulted in injury that required medical examination or treatment. Over 75 percent of the persons reported declined hospital treatment or were examined and released without any reported injury.

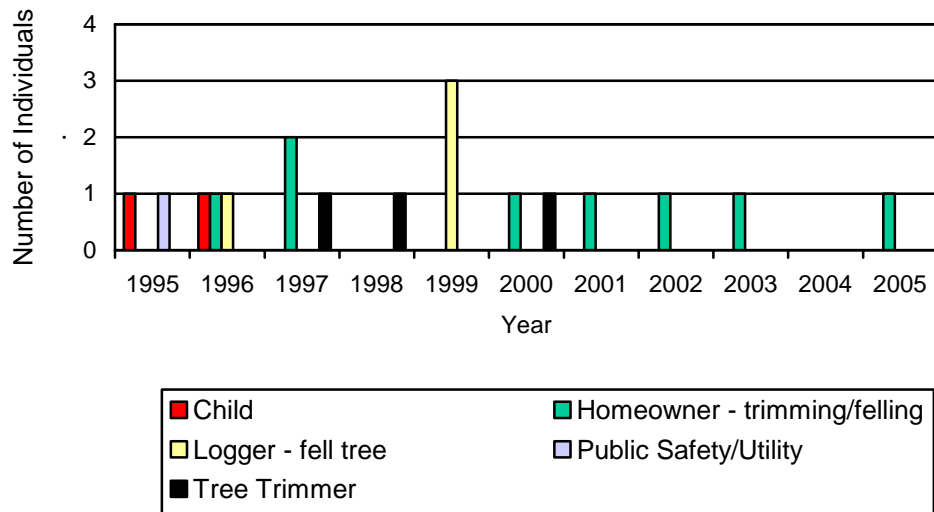
On the basis of the descriptions of tree-related power line incidents, the injury to a child in 1996 involved an evergreen tree that was growing

<sup>1</sup> The 2004 fatality did not involve contact by the individual on a high voltage line – see description in Appendix.



within reach of primary lines. Based on ECI's observation of tree-related electrical injuries among children, climbing readily climbable evergreen trees that have main trunks within a few feet of a conductor is a common scenario, when tree-related electrical contact injuries to children have occurred.

ECI categorized the individuals that were described in the reports of tree-related contacts as children, homeowners, tree trimmers (working for a company or self employed, loggers, or public safety/utility employees (including cable television, utility linemen, and firemen). Contact incident descriptions regarding individuals who were either injured or killed (examined and released and treatment refused excluded) are summarized in Figure 5.



**Figure 5. Total Statewide Tree-related Injuries and/or Fatalities**

It is important to note that review of the incidents in Figure 5 above shows that the proposed OPUC rule changes would have minimal if any affect on the number of injuries or fatalities experienced throughout Oregon. Based on ECI's observation of industry practice, utilities address such risk through public education, warning signs and responsiveness to customer requests for assistance in partial clearing of trees away from power lines to facilitate safe tree maintenance by the customer or their arborist. Utility companies cannot prevent people from ignoring warnings and obvious hazards or becoming involved in inherently unsafe acts. OSHA regulations and American National Standards Institute (ANSI) standards address electrical contact hazard by requiring non-certified line clearance tree workers to stay at least 10 feet away from any energized conductors. However, even these national standards and federal regulations do not



prevent individuals from ignoring obvious hazards, even after having received electrical hazard training.

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**Fire Risk**

Of course tree-to-conductor contact raises the question of fire risk. Fire risk is a significant concern in many locations in the west. However, the fire regime in the PGE service territory is such that forest and brush fire risk is much less than in other parts of the west, in part due to the high average rainfall and in part due to the significant agricultural land use in the Portland area. ECI did not observe trees in close proximity to primary conductors that represented a forest fire risk.

PGE records report no fires caused by tree contact with power lines since 1989 when one tree-caused fire occurred. This is significant in that during the same period other western utilities have experienced numerous fires associated with trees growing into power lines.

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**Climbable Trees –  
Industry Practice**

Climbable trees have been a focus of the OPUC staff in their efforts to help assure that conditions that lead to injuries are minimized. Climbable trees are not typically defined or even addressed in tree maintenance standards or specifications by electric utilities in the United States. In fact, benchmarking studies conducted by ECI have indicated that 90 percent of utility respondents have no program to address “climbable trees”. Some utilities do have certain provisions in their specifications that provide for special treatment of trees that would be considered “climbable”.

Most utility specifications and standards do not address the question of climbable trees directly because of the inherent subjectivity associated with determining when a tree is climbable and when such a tree represents a public safety risk.

Three conditions would typically be considered necessary in order for a tree to be deemed climbable. These are location (is it where children are present), access (is it readily climbable), and hazard (is contact with the energized lines likely). Trees are generally considered climbable if they meet three criteria:

1. The tree is located where children play and may climb a tree (school yards, playgrounds, parks, yards),
2. Low limbs (within 8 feet of the ground), accessible from the ground, and limbs sufficiently close together so that the tree is readily climbable by a child or average person, and





3. A main stem within arms reach of the line by someone in the tree at conductor height.



## REVIEW OF OPUC PROPOSED RULES

### Comparison of Current OPUC Staff Policy and Proposed Rules

In 1997, Oregon Public Utility Commission (OPUC) staff crafted a policy concerning clearance between trees and distribution power lines. This current policy specifies clearances to be maintained between “energized high voltage distribution conductors” and any part of a tree. The proposed rules addressing vegetation clearance requirements contain significant differences from the current OPUC staff policy. The complete text of the OPUC Staff’s Proposed Safety Rules related to Vegetation Clearance Requirements are as follows:

#### **860-024-0016**

#### **Vegetation Clearance Requirements**

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Attachment C - Staff’s Proposed Safety Rules

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**(1) For purposes of this rule:**

**(a) “Interfere” or “interference” means any flow of electricity from the conductor to the vegetation through direct contact or arcing, or any abrasion to conductor, equipment, or vegetation caused by contact.**

**(b) “Readily climbable” means having sufficient handholds and footholds to permit a child or an average person to easily climb without using a ladder or other temporarily-placed equipment.**

**(c) “Vegetation” means trees, shrubs, and any other woody plants.**

**(d) “Volts” means nominal voltage levels, measured phase-to-phase.**

**(2) The requirements in this rule provide the minimum standards for conductor clearances from vegetation to provide safety for the public and utility workers, reasonable service continuity, and fire prevention. Each operator of electric supply facilities must have a vegetation management program and keep appropriate records to ensure that timely trimming is accomplished to keep the designated minimum clearances. These records must be made available to the Commission upon request.**

**(3) Each operator of electric supply facilities must trim or remove vegetation away from electric supply conductors that may cause interference under reasonably anticipated conditions.**

**(4) Each operator of electric supply facilities must trim or remove readily climbable vegetation to minimize the likelihood of direct or indirect access to a high voltage conductor by a member of the public or any unauthorized person.**



**(5) Under reasonably anticipated operational conditions, an operator of electric supply facilities must maintain the following minimum clearances of vegetation from conductors:**

**(a) Ten feet for conductors energized above 50,000 volts; or**

**(b) Five feet for conductors energized at 600 through 50,000 volts, except clearances may be reduced to three feet if the vegetation is not readily climbable.**

**(c) Infrequent intrusion of small new vegetation growth into these minimum clearance areas is acceptable provided the vegetation does not cause interference with a conductor.**

**(6) For conductors energized below 600 volts, an operator of electric supply facilities must trim vegetation to prevent it from causing strain or abrasion on electric conductors. Where trimming or removal of vegetation is not practical, the operator of electric supply facilities must install suitable material or devices to avoid insulation damage by abrasion.**

**(7) In determining the extent of trimming required to maintain the clearances required in section (5) of this rule, the operator of electric supply facilities must consider at minimum these factors for each conductor:**

**(a) Voltage;**

**(b) Location;**

**(c) Configuration;**

**(d) Sag of conductors at elevated temperatures and under wind and ice loading; and**

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**(e) Growth habit, strength, and health of vegetation growing adjacent to the conductor, with the combined movement of the vegetation, supporting structures, and conductors under adverse weather conditions.**

**(8) Each operator of communication facilities must trim or remove vegetation that poses a risk to their facilities. Risk to facilities includes, but is not limited to, deflection of cables, wires, or messengers, or those contacts which cause damage to facilities.**

**Stat. Auth.: ORS Ch. 183, 756, 757 & 758**

**Stats. Implemented: ORS 757.035 & 758.280 through 758.286**

**Hist.: NEW**



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**Differences Staff  
Policy v. Proposed  
Rules**

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**1 Definition: Interfere and  
Interference**

**OPUC Staff Policy**

OPUC staff policy does not specifically define interference, but references NESC Section 218, which states: “*Trees that may interfere with ungrounded supply conductors should be trimmed or removed.*” The 2007 revision of NESC Section 218 has been revised to read: “*Vegetation that may damage ungrounded supply conductors should be pruned or removed.*”

**Proposed Rule**

*“Interfere” or “interference” means any flow of electricity from the conductor to the vegetation through direct contact or arcing, or any abrasion to conductor, equipment, or vegetation caused by contact.”*

**Impact**

Incidental contact between trees and distribution primary or secondary conductors does not constitute “interference” as used within the NESC section 218 on tree trimming. In fact the NESC has long helped define interference through their section 218 A2, which describes an alternative to trimming that achieves the avoidance of interference, that is, avoiding “conductor damage by abrasion and grounding of the circuit through the tree”. Interference is, therefore, avoided when damage by abrasion or grounding of the circuit through the tree is avoided. Grounding of a circuit is not the same as current leakage, since minor amounts of current leak through even the best insulators. Rather, grounding of a circuit results from a high-current fault and would normally cause operation of protective devices. Incidental contact between tree branch tips does not result in high-current faults or “grounding” through a tree. Therefore, incidental contact between trees and distribution primary or secondary conductors does not constitute “interference” as used within the NESC section on tree trimming.

Ongoing contact with conductors, depending on voltage and conductor type, can result in abrasion or mechanical damage to conductors. Mechanically damaged conductors have been known to fail, resulting in economic loss, system failure and unsafe conditions upon failure. Therefore caution to avoid this condition is appropriately included in the NESC.

The propose rule goes far beyond this accepted standard in several ways.

1. It creates a new, unique understanding of interference that includes any flow of electricity from conductors to vegetation, however small, and regardless of impact on safety or reliability.



2. It assumes and ties “flow of electricity” to “contact” with vegetation, or “arcing” to vegetation.
3. In addition to abrasion to a conductor it adds abrasion to equipment through which any flow of electricity might occur. This could mean abrasion to a pole, guy, or any other part of the system with which vegetation could come in contact and through which some current leakage could occur.
4. Abrasion to the vegetation would even be included in interference.

The practical application of this proposed unique definition of interference is to preclude any contact between trees and energized conductors, irrespective of the impact even incidental, short duration or minimal contact might have on system performance or safety. No basis for creating this additional requirement has been presented. No historic problem is present that this new requirement would seek to solve. No benefit has been postulated to accrue from this new requirement. However, there will be additional costs incurred by Oregon utilities and their customers if a new requirement is imposed to eliminate any contact between trees and energized conductors.

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**1 Definition: Readily Climbable**

**OPUC Staff Policy**

*“...having sufficient handholds and footholds to permit an average person to climb easily without using a ladder or other special equipment.”*

**Proposed Rule**

Readily climbable *“...means having sufficient handholds and footholds to permit a child or an average person to easily climb without using a ladder or other temporarily-placed equipment.”*

**Impact**

The emphasis of the climbable tree rule has been clarified to focus on ease of climbing by a child. This change helps to better define the type of tree that is the subject of the rule and makes clear that this rule is not intended to prevent professional tree trimmers or others with special skills or equipment from climbing trees and making contact with conductors.

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**4 Rule: Readily Climbable**

**OPUC Staff Policy**

*There should be a minimum 5-foot clearance between an energized high voltage distribution conductor and any part of a tree [that is readily climbable]*



### **Proposed Rule**

*Each operator of electric supply facilities must trim or remove readily climbable vegetation to minimize the likelihood of direct or indirect access to a high voltage conductor by a member of the public or any unauthorized person.*

### **Impact**

This change adds clarity by pointing to the purpose of trimming or removing readily climbable vegetation, that is, to “minimize likelihood of direct or indirect access to high voltage conductors”. This change should allow for the exercise of good judgment about what circumstances, conditions and locations may collectively contribute to minimizing likelihood of contact by a child. Many trees in residential as well as rural and uninhabited land could necessarily need to be removed without this clarification if they were climbable and could grow within five feet of conductors.

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### **5a and b Rule: Minimum Clearances**

### **OPUC Staff Policy**

*There should be a minimum 5-foot clearance between an energized high voltage distribution conductor and any part of a tree. This clearance may be reduced to three feet if the tree is not readily climbable....*

### **Proposed Rule**

*Under reasonably anticipated operational conditions, an operator of electric supply facilities must maintain the following minimum clearances of vegetation from conductors:*

- (a) Ten feet for conductors energized above 50,000 volts; or*
- (b) Five feet for conductors energized at 600 through 50,000 volts, except clearances may be reduced to three feet if the vegetation is not readily climbable.*

### **Impact**

This change expands the clearance requirements from high voltage conductors to even secondary lines of at least 600 volts. There appears to be no rationale for this change the impact may not be great since secondary voltages above 600 volts on most distribution system are fairly rare.



The change from the words “should be a minimum of 5 foot” to “must maintain...five feet” indicates a change to a level of required compliance not expected in the staff policy. This change is likely to have significant cost implications to Oregon Utilities without demonstrated benefit.

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**5c Rule: Minimum Clearances**

**OPUC Staff Policy**

*Intrusion of limited small branches and new tree growth into this minimum clearance area can be tolerated so long as it does not contribute to a safety hazard to a person climbing the tree or cause interference with the conductors.*

**Proposed Rule**

*(c) Infrequent intrusion of small new vegetation growth into these minimum clearance areas is acceptable provided the vegetation does not cause interference with a conductor.*

**Impact**

The proposed rule changes the qualifier of “limited” to “infrequent intrusion” to the allowance of small branches/small new vegetation growth into the minimum clearance areas. This may not seem significant at first glance, but careful examination of the meaning of the words reveals a much higher standard in the proposed rule than in the staff policy.

Limit means, “to confine or set bounds”<sup>2</sup>. The limit set and defined in the staff policy has been the provision that the new growth does not contribute to a safety hazard or cause interference with the conductors. The new term “infrequent”, meaning “seldom happening or occurring: rare”<sup>3</sup>, sets a new standard for intrusion such that rarely should branches intrude, but on those rare instances when intrusion occurs, interference with conductors will still not be allowed.

Coupled with the definition of interference included in the proposed rule, this change will have significant impact on utility vegetation management operations, pruning frequency, and costs.

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<sup>2</sup> *Webster’s Ninth New Collegiate Dictionary*. (Springfield, Massachusetts, USA: Merriam-Webster Inc. 1985), 693.

<sup>3</sup> *Webster’s Ninth New Collegiate Dictionary*. (Springfield, Massachusetts, USA: Merriam-Webster Inc. 1985), 621.



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**8 Rule: Minimum  
Clearances**

**OPUC Staff Policy**

*Not applicable to communication lines.*

**Proposed Rule**

*Each operator of communication facilities must trim or remove vegetation that poses a risk to their facilities. Risk to facilities includes, but is not limited to, deflection of cables, wires, or messengers, or those contacts which cause damage to facilities.*

**Impact**

Many trees throughout Oregon would require trimming or removal to avoid deflection of cables (including phone services lines to buildings), which may not be causing damage to facilities. However, many of these trees removed, presumably by communication companies, would also provide benefit to electric utilities that may have already needed to prune higher portions of the tree. When property owners observe tree trimming near utility lines, they invariably call the electric utility if they have a question or complaint. In order to answer the question, electric utility personnel will need to make a site visit to determine if the inquiry is associated with power line maintenance or communication company maintenance. For inquiries associated with communication companies this need for additional inspection and communication with property owners represents additional cost to the electric utilities.

**COST OF  
PROPOSED  
RULES**

In order to fully comply with the proposed rules, PGE would need to change its current approach to vegetation management in ways that would increase annual costs. Two potential options may be effective in achieving rule compliance. One involves a one-year reduction in cycle length from the current two years in residential areas and three years in rural areas. This strategy could result in as much as a \$4.7 per year increase in vegetation maintenance costs. This is nearly \$1 million per tree growth outage prevented.

A second approach may be to continue the current cycles, but supplement them with inspections approximately one year in advance of scheduled maintenance to identify trees likely to become non-compliant before scheduled maintenance. These trees, so identified could then be maintained in advance of the remainder of the work area. The cost of this option may be less than the overall cycle reduction strategy, but still substantially more than the cost of the current program.





## APPENDIX



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**OPUC Tree-Related  
Electric Contact  
Incident Descriptions**

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2005

**Homeowner – trimming/felling:**

No Treatment

Customer performing tree trimming caused a tree limb – by his own weight – to contact high voltage primary conductor. Customer received a shock, but denied any injury. He refused medical treatment.

**Homeowner – trimming/felling:**

Examined and Released

A customer received a shock while attempting to remove a limb from a primary electric line with a 2X4 stud. He was checked out by a doctor and was released as ok.

**Homeowner – trimming/felling:**

No Treatment

A man fell a tree into a primary electric line. While pulling the tree off the line with a tractor, he received a minor shock. He refused medical care.

**Homeowner – trimming/felling:**

Injured

A homeowner fell a tree, which went in the wrong direction and landed on a 7200-volt line. He received a shock (supposedly minor) and was hit by tree limbs. He was transported to the hospital and admitted for overnight observation.

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2004

**None**



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2003

**Homeowner – trimming/felling:**

Injured

A 69-year-old was helping his friend trim a tree. The hand pruner he was using contacted a 7.2 kV line. The man received burns to his hands and fell from the ladder breaking two or more ribs. The victim was hospitalized.

**Tree Trimmer**

No Treatment

A tree trimmer was doing residential tree work for a customer when he felled a limb into a 12kV line. He received a shock but refused any medical treatment. The utility had not been notified of the work near their line.

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2002

**Homeowner – trimming/felling:**

Injury

A customer was trimming a tree from an aluminum ladder. A branch that he cut fell onto the line and made contact with the ladder. The man was feeling shocks and jumped about 20 feet to the ground breaking a leg and bruising his shoulder.

**Logger – fell tree**

No Treatment

A contract logger felled a Myrtle tree onto a 14.4 kV line. When he attempted to cut the tree off the line, he felt a jolt through his feet. He said it was like grabbing a 110-volt line. There were no injuries.

**Other – CATV lineman**

No Treatment

A Cable TV employee, working out of a bucket, was stringing a cable messenger. The messenger came into contact with a tree that was in contact with a 7.2 kV power line. The employee felt a shock. The electric utility was not notified of this work activity prior to the incident.



**Other – CATV lineman**

No Treatment

A Cable TV employee was cutting a tree branch and felt a shock. The branch was in contact with a 20.8 kV line.

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2001

**Homeowner – trimming/felling**

No Treatment

Two customers were trimming trees on their own property and felled a tree into a 20.8 kV line. The chainsaw operator felt a shock, but the incident was not reported to the power company. Neighbors who witnessed the trimming told the company of the incident.

**Homeowner – trimming/felling**

No Treatment

A property owner climbed into a pine tree using a metal ladder. He cut a large branch that fell across a 3-phase 12kV line. He tried to remove the branch and he “could feel the electricity flowing through the branch.” Two of the fuses blew. He refused any medical treatment. The area had just recently been trimmed by the utility for clearance.

**Tree Trimmer**

Examined & Released

A utility tree trimmer (contractor) was roped into a tree when the root ball gave way, allowing the tree to fall. The tree hit the primary power line on the way down. The trimmer experienced some shocks and was taken to the hospital for observation. He was released the same day.

**Tree Trimmer**

Examined & Released

A utility tree trimmer (contractor) made contact with a 7.2 kV line while working. He received a shock but was not injured. He was checked at a hospital and released.



**Homeowner – trimming/felling**

No Treatment

An unknown male was trimming a tree when the branch he was cutting came into contact with a nearby power line. The victim received a “tingle” through the saw he was using to make the cut. A passing line crew noticed an aluminum ladder in the tree. They stopped to caution the property owner who told them about the incident.

**Homeowner – trimming/felling**

No Treatment

While a man was trimming a tree in his yard, a branch made contact with a primary conductor. He felt a tingle but refused any medical attention. [2000, included in 2001]

**Homeowner – trimming/felling**

Injured

A man was cutting down a tree on his property. The tree contacted a 115 kV transmission line and the man received a shock through a cable he was using to pull the tree away from the line. He went to the hospital and they had him stay because of high blood enzyme counts. [2000, included in 2001]

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2000

**Homeowner – trimming/felling**

Examined and Released

A customer was cutting down a large elm tree in his yard with an axe. He cut off a 30-ish foot long branch that fell across all three phases of a 12kV line. He was shocked and shaken up, but a hospital check indicated that he was not injured.

**Tree Trimmer**

No Treatment

A “Tree Service” employee was trimming a tree near a 13kV line. The employee received a shock from a branch. He was not a qualified utility trimmer.



**Homeowner – trimming/felling**

No Treatment

A customer was trimming a tree in his yard. When a branch touched the primary line, he felt a tingle.

**Homeowner – trimming/felling**

No Treatment

A customer was cutting down an 8” diameter Alder tree along his driveway. The tree leaned over into the line when it was cut off. The customer wrapped a shirt around the tree to protect himself, but still got shocked when he was pulling it away from the line.

**Tree Trimmer**

Fatality

A tree trimmer (? landscaper) cut a branch which fell into the primary conductors. He was working in the tree and the butt of the branch ended up in his lap. He was fatally shocked. Information is sketchy at this time.

**Homeowner – trimming/felling**

No Treatment

The son of a customer was felling a tree. The tree hung up in another tree, and while the young man was trying to dislodge it, a branch contacted a 7200-volt line giving him a “tingle”.

**Homeowner – trimming/felling**

Injured

A 30-year-old resident was trimming his tree when a branch fell into a 13kV conductor. The victim received minor burns to his left hand. He was treated and released from the hospital.



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1999

**Homeowner – trimming/felling**

No Treatment

On April 4, a customer's son climbed up into a tree with an aluminum ladder and fell the tree-top on a high voltage line. He received minor shock, but refused medical attention. No prior notification was given to the utility about the tree needing trimming.

**Homeowner – trimming/felling**

No Treatment

On May 5, a customer fell a tree into a 7200-volt line while working on his own property. Although he received a shock, no serious injuries were sustained and he did not seek medical help.

**Tree Trimmer**

No Treatment

A non-certified tree trimmer, who was clearing a hillside for a view, climbed a tree which was about 15 feet from a 7.2 kV power line on June 30<sup>th</sup>. He was supposed to wait for a power company crew to arrive. The tree was not strong enough to support his weight and bent toward the power line and contacted it. The worker was shocked but not injured. He refused medical attention and continued to work.

**Child**

No Treatment

A 13-year old boy climbed a tree and received a shock from a 7.2 kV line on July 11<sup>th</sup>. He was not injured but it was reported that it felt like a bee sting. Also, it was reported that he climbed up one tree, then out a branch to reach a second tree, then climbed up to the area of the conductor. This tree was reported as not one considered being readily climbable.



### **Logger – fell tree**

1 Fatality

2 Injuries

On August 23rd, a logger felled a 48-foot Douglas Fir tree. The tree was 29 feet away from a 115 kV transmission line. The tree fell into the line and was held up by the wire. One worker rushed over to cut the tree off the line. He was fatally electrocuted through his chainsaw. Two other workers tried to help and were also injured: one was hospitalized and the other had minor injuries.

### **Tree Trimmer**

No Treatment

On September 1<sup>st</sup>, a gardener was trimming a tree. He cut a branch that contacted a power line. When he grabbed the branch, he was shocked. The power company came out and cut the tree back when they were called. The gardener stayed on the job site and continued his clean-up work.

### **Other – Firefighter**

Examined & Released

Firefighters responded to a fire on September 12<sup>th</sup>. The fire was caused by a treetop that had broken out of the tree about 70 feet up in high winds. The treetop (about 6 inches in diameter) landed on the 7,200-volt powerline and was dangling down close to the ground. A firefighter somehow contacted the treetop and was shocked. He was checked over and returned to work. The serviceman on arriving at the scene immediately shut down the line, as several firefighters were working near the dangling top with hoses and chainsaws.

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1998

### **Homeowner – trimming/felling**

No Treatment

On May 5, a person was trimming a tree from an aluminum ladder. The pine tree was topped, and the top fell across 2 phases of 12.5 kV primary. The 60+-year-old man said he felt a tingle.





### **Other – CATV lineman**

No Treatment

June 11, 1998 – A CATV lineman was helping to maneuver a lasher along a cable. When he pushed a tree limb out of the way it contacted a 7.2 kV conductor and he received a shock.

### **Tree Trimmer**

Examined & Released

June 11, 1998 – A “self-proclaimed tree trimmer” was working in a tree for the property owner when he dropped a branch into the 7.2 kV conductor. The recloser operated and he received a shock. He was taken to the hospital for examination and was released. He returned to the site and continued working.

### **Homeowner – trimming/felling**

No Treatment

June 12, 1998 – A homeowner was topping a 50’ coastal pine when a limb fell into a three-phase 20.8 kV powerline. He felt a minor tingle to his left arm when he attempted to clear the treetop with a rope. He was standing on an aluminum ladder.

### **Homeowner – trimming/felling**

No Treatment

June 28, 1998 – A property owner was trimming his tree and dropped a branch into the 7.2 kV powerline. He had climbed up an aluminum ladder but went on up the tree. He felt a tingle when the branch made contact but stayed in the tree until the power company came and killed the line. H refused any medical treatment.

### **Logger – fell tree**

No Treatment

July 1, 1998 – A person was thinning cedar trees when he felled one across a high voltage line. He received a tingle when he stepped over (straddled) the fallen tree. He was not injured. The tree was 50’ from the line.



### **Homeowner – trimming/felling**

No Treatment

July 11, 1998 – (Not reported until July 27<sup>th</sup>) A customer was removing some smaller maple trees. He felled a tree into the line. The utility warned him about the danger and advised him to let the utility trimmers do the removals. About 6 hours later he again felled a tree into the line receiving a slight shock. He refused any medical attention.

### **Homeowner – trimming/felling**

No Treatment

July 29, 1998 – A member of the public received a tingle when the branch he was trimming contacted the primary conductor.

### **Tree Trimmer**

Fatality

A non—utility tree trimmer was fatally injured on September 28<sup>th</sup>. The victim was working by himself in a large tree and appears to have raised into or backed into the primary line. It was reported that the man had attended a seminar that explained required clearances and utility pre-notification requirements.

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1997

### **Tree Trimmer**

No Treatment

On March 11, 1997, an employee of a tree trimming company received a shock when a willow limb and primary line contacted the bucked truck.

### **Tree Trimmer**

No Treatment

A non-utility aerial worker received a minor shock on April 29, 1997 when a branch he was trimming contacted a 12.5 kV line.



**Homeowner – trimming/felling**

No Treatment

A property owner was attempting to straighten a 35-foot fir tree which had leaned over about 8 feet on May 4, 1997. He was pulling on the tree with a chain hoist when the tree top contacted the 12.5 kV line. He received a shock described as similar to an electric fence contact.

**Child**

No Treatment

A 14-year-old boy was trimming a tree at his parents' residence on May 5, 1997. A branch fell into the 12.5 kV primary and he received a minor shock.

**Homeowner – trimming/felling**

No Treatment

On June 21, 1997, a 37-year old male attempted to clear an alder tree that had fallen over a 12kV conductor. He had been riding by on his bicycle and stopped to help. He sustained a shock to his left hand.

**Homeowner – trimming/felling**

No Treatment

On June 22, 1997, a property owner was trimming his own trees. He dropped a limb onto a primary conductor and received a “tingle”. There was no injury and he refused medical attention.

**Tree Trimmer**

No Treatment

On June 23, 1997, an employee of a tree trimming company received a slight shock while trimming trees. There was no injury.



**Homeowner – trimming/felling**

No Treatment

On November 30, 1997, a residential customer (a 35-year old male) was trimming trees. He received a minor shock. He did not seek medical attention.

**Homeowner – trimming/felling**

Injured

On December 2, 1997, a 43-year old male was trimming a poplar tree for an apartment complex owner. In the process he dropped a tree limb into a 7.2 kV primary conductor. He was transported to Emmanuel Hospital. He had an exit wound below the knee.

**Homeowner – trimming/felling**

No Treatment

On October 10, 1997, a male was trimming a willow tree when a branch came into contact with a primary conductor. He felt a shock. He received no burns and did not seek medical attention.

**Homeowner – trimming/felling**

2 No Treatment

Two individuals dropped a tree into a high voltage primary line and received shocks when they put a chain around the butt of the fallen tree. Both refused medical attention.

**Homeowner – trimming/felling**

No Treatment

While trimming a tree, a customer felt a slight shock through his chainsaw. He stopped and called the electric utility to complete the work and check it out. No medical treatment was involved.



### **Tree Trimmer**

No Treatment

A tree service employee received a shock while tree trimming. No medical treatment involved.

### **Tree Trimmer**

Injured

A contract utility tree trimmer made contact with an OH primary high voltage line. He was taken to the hospital with unknown injuries.

### **Homeowner – trimming/felling**

Injured

A farm worker pulled a limb off primary high voltage line. Apparently in pulling of the line, the power line phases slapped together. The worker indicated he felt his hands “burnt” and his feet burning. He refused to give his name and also refused medical treatment.

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1996

### **Homeowner – trimming/felling**

No Treatment

On March 3, 1996, a male customer fell a tree through a primary conductor. The tree was smoldering so he tried to kick the tree away from the conductor. He felt a slight tingle in his left foot when it made contact with the tree. He refused to go to the hospital.

### **Tree Trimmer**

No Treatment

On March 6, 1996, a tree trimming company flagger received a slight tingle to his hand when a tree branch that was trimmed fell into a primary conductor. It contacted a stop sign that he was holding.



**Homeowner – trimming/felling**

No Treatment

On March 28, 1996, a 33-year old male was shocked by 12.5 kV line when he was removing a tree branch that he had cut. He refused medical treatment.

**Logger – fell tree**

Injured

On April 3, 1996, a 30-year old male was clearing trees for a development company. He was pulling a tree with a cable when the cable gave way and contacted an overhead 230 kV transmission line. He was standing on a construction vehicle outrigger at the time. He received burns to one foot and hand. His injuries were not serious.

**Homeowner – trimming/felling**

Injured

On June 5, 1996, a 29-year old male fell a 30-foot juniper tree across a 7.2 kV primary conductor. He made contact when trying to cut it away from the line with his chain saw. He received minor burns to his left hand but refused medical treatment.

**Homeowner – trimming/felling**

No Treatment

On June 28, 1996, a male was trimming a tree when the tip of a branch contacted a primary conductor. He felt a slight shock.

**Homeowner – trimming/felling**

No Treatment

On July 21, 1996, a 42-year old male was trimming a tree in a yard on an aluminum ladder. The tree branch contacted a 12.5 kV primary and neutral. He was shocked and jumped of the ladder. He refused medical help.



### **Child**

Injured

On September 5, 1996, a 14-year old male climbed to the top of a sequoia tree (readily climbable tree) on a dare, he reached over and grabbed the single-phase 12,000 kV [*sic*] primary conductor. He fell out of the treetop approximately 28 to 29 feet. He was taken to Emanuel Burn Center in Portland.

### **Tree Trimmer**

Examined & Released

On September 6, 1996, a 45-year old male landscape tree trimmer contacted a two phase on a 12.5 kV primary line with a tree branch. He received a shock in the tree and was rescued by the fire department. He was taken to the hospital and released the same day.

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1995

### **Child**

Injured

In July, a 9-year old girl received minor blisters to her right hand. She was climbing in a tree in a backyard when she pushed a branch into a 7.2 kV primary conductor. A PUC investigation at the site concluded that the girl took extraordinary effort to climb the tree to the high voltage level.

### **Logger – fell tree**

No Treatment

On August 22, 1995, a logger/tree trimmer was doing residential tree removal when a tree fell into a single phase 7.2 kV primary conductor. He then tried to remove the tree from the primary conductor and he experienced a shock. There was no injury. The tree was 8 feet from the primary conductor.



### **Tree Trimmer**

No Treatment

On August 21, 1995, a tree trimmer was lowering a branch that was 10 feet above the 7.2 kV primary and neutral conductors. He saw an electrical arc and felt a shock to his knee. The feeder tap line opened the fuse 2 spans away. There was no injury.

### **Homeowner – trimming/felling**

No Treatment

On September 6, 1995, a 41-year-old female was clearing brush under a 230 kV transmission line. As she was lifting a fir branch to throw it over a ledge, she felt a very minor shock. She declined medical attention.

### **Other – CATV lineman**

Injury

On June 7, 1995, a CATV construction worker in a bucket truck pushed a tree branch into a 7.2 kV primary conductor. He received a minor injury from the shock.

### **Other – CATV lineman**

No Treatment

On June 28, 1995, another CATV construction worker pushed a tree branch into a 7.2 kV primary conductor while stringing cable. A minor shock was received.

### **Homeowner – trimming/felling**

No Treatment

On November 27, 1995, a male (age unknown) fell a tree into a primary conductor. While cutting it down, he said he felt a minor shock.





## Oregon Proposed Safety Rules Compared to California

Safety rules concerning vegetation clearance requirements have been proposed by the Oregon Public Utilities Commission (OPUC) staff for adoption by the OPUC. This document compared these proposed rules with vegetation clearance rules in California, the state with similar regulations.

### Specific Minimum Clearance

#### **OPUC Proposed Rule**

*Five feet for conductors energized at 600 through 50,000 volts, except clearances may be reduced to three feet if the vegetation is not readily climbable.*

#### **California Requirement**

General Order Number 95, Rule 35 prescribed by the California Public Utilities Commission (CPUC), January 2006

*The minimum clearances established in Table 1, Case 13, [750-22,500 Volts: 18 inches] measured between line conductors and vegetation under normal conditions, shall be maintained.*

Section 4293 of the California Public Resources Code (CPRC)

*...any person that owns, controls, operates, or maintains any electrical transmission or distribution line upon any mountainous land, or in forest-covered land, brush-covered land, or grass-covered land shall, during such times and in such areas as are determined to be necessary by the director or the agency which has primary responsibility for the fire protection of such areas, maintain a clearance of the respective distances which are specified in this section in all directions between all vegetation and all conductors which are carrying electric current:*

*(a) For any line which is operating at 2,400 or more volts, but less than 72,000 volts, four feet.*

#### **Comparison**

Both the Oregon proposed rule and California requirements list a specific clearance that must be maintained between vegetation and conductors of specific voltages. However, the minimum clearance listed in Oregon's proposed rules is twice the distance of the minimum clearance required in California cities that have primary responsibility for fire protection (not subject to the CPRC section 4293 requirements): 3 feet compared to California's 18 inches.



## Reason for Minimum Clearances (Readily Climbable)

### **OPUC Proposed Rule**

*Each operator of electric supply facilities must trim or remove readily climbable vegetation to minimize the likelihood of direct or indirect access to a high voltage conductor by a member of the public or any unauthorized person.*

and

*(b) Five feet for conductors energized at 600 through 50,000 volts, except clearances may be reduced to three feet if the vegetation is not readily climbable.*

### **California Requirement**

Fire hazard, not ability to be climbed is the driving force behind tree-to-conductor clearance requirements in the state of California. The following requirements deal specifically with fire hazard requirements.

#### Section 4293 of the California Public Resources Code (CPRC)

*...during such times and in such areas as are determined to be necessary by the director or the agency which has primary responsibility for the fire protection of such areas, maintain a clearance of the respective distances which are specified in this section in all directions between all vegetation and all conductors which are carrying electric current:*

### **Comparison**

While Oregon's proposed rules vary clearance based on a tree's ability to be climbed, California varies clearance requirements based on fire prevention. No mention is made in either of California's two requirements concerning "readily climbable trees".



## Minimum Clearances - Exceptions

### **OPUC Proposed Rule**

*Infrequent intrusion of small new vegetation growth into these minimum clearance areas is acceptable provided the vegetation does not cause interference with a conductor.*

### **California Requirement**

General Order Number 95, Rule 35 prescribed by the California Public Utilities Commission (CPUC), January 2006

#### ***EXCEPTIONS:***

- 1. Rule 35 requirements do not apply to conductors, or aerial cable that complies with Rule 57.4-C, energized at less than 60,000 volts, where trimming or removal is not practicable and the conductor is separated from the tree with suitable materials or devices to avoid conductor damage by abrasion and grounding of the circuit through the tree.*
- 2. Rule 35 requirements do not apply where the utility has made a "good faith" effort to obtain permission to trim or remove vegetation but permission was refused or unobtainable. A "good faith" effort shall consist of current documentation of a minimum of an attempted personal contact and a written communication, including documentation of mailing or delivery. However, this does not preclude other action or actions from demonstrating "good faith". If permission to trim or remove vegetation is unobtainable and requirements of exception 2 are met, the utility is not compelled to comply with the requirements of exception 1.*
- 3. The Commission recognizes that unusual circumstances beyond the control of the utility may result in nonconformance with the rules. In such cases, the utility may be directed by the Commission to take prompt remedial action to come into conformance, whether or not the nonconformance gives rise to penalties or is alleged to fall within permitted exceptions or phase-in requirements.*
- 4. Mature trees whose trunks and major limbs are located more than six inches, but less than 18 inches, from primary distribution conductors are exempt from the 18-inch minimum clearance requirement under this rule. The trunks and limbs to which this exemption applies shall only be those of sufficient strength and rigidity to prevent the trunk or limb from encroaching upon the*



*six-inch minimum clearance under reasonably foreseeable local wind and weather conditions. The utility shall bear the risk of determining whether this exemption applies, and the Commission shall have final authority to determine whether the exemption applies in any specific instance, and to order that corrective action be taken in accordance with this rule, if it determines that the exemption does not apply.*

**Section 4293 of the California Public Resources Code (CPRC)**

*The director or the agency which has primary responsibility for the fire protection of such areas may permit exceptions from the requirements of this section which are based upon the specific circumstances involved.*

**Comparison**

Neither of the requirements governing utility vegetation management in the state of California specifically mentions interference, and there are no provisions for allowable intrusion, regardless of frequency.

Specific exceptions are, however, made to California's clearance requirements for other reasons. California's GO 95, Rule 35 makes a specific exception for property owners who are unwilling to grant permission. No such consideration is mentioned in Oregon's proposed rules. CPRC Section 4293 is primarily concerned with the prevention of tree caused fires and makes an exception only for areas found by the local fire prevention authorities to cause no fire hazard.

Another notable exception to California's clearance requirements has been made for major stems or limbs growing within the 18-inch minimum clearance zone. This exception is the opposite of Oregon's exception, made only for "small, new vegetation".

The majority of utilities throughout the rest of the United States base clearance between trees and conductors on service reliability. Trees are not maintained at a specific distance from the conductors, but are pruned with the goal of reducing tree-caused outage risk on primary distribution systems.





## Business Solutions for Vegetation and Asset Management

*ECI* has been providing right-of-way vegetation management consulting services for over thirty years and has a proven track record of success at over 140 electric utilities.

### *Services*

- Comprehensive business plans for:
  - ◆ Vegetation management
  - ◆ Wood pole maintenance
  - ◆ Joint facilities
  - ◆ Municipal forestry programs
- Professional contract personnel services for:
  - ◆ Line clearance work planning and customer notification
  - ◆ Customer request investigation
  - ◆ Performance auditing
  - ◆ Program supervision
  - ◆ Program management
  - ◆ Special projects
- Data collection and information management systems.
  - ◆ Work Measurement Software
  - ◆ Remote Data Collection Systems
- Total program management services
- Benchmarking
- Research
- Expert testimony
- Environmental studies



## About ECI

- ◆ **ECI is an independent, privately owned consulting corporation that specializes in electric utility vegetation management.** ECI has helped over 140 utilities develop new or improved distribution and/or transmission vegetation management programs. We have a proven record of success in helping utilities for over 30 years.
- ◆ **ECI does not provide tree crews or engage in the actual completion of vegetation maintenance work, and can thus provide impartial services.** ECI's clients can be confident that there are no conflicts of interest with ECI's projections and recommendations.
- ◆ **ECI is consistently at the forefront in the development of reliability-focused, cost-effective line clearance programs.** Clients implementing our programs and recommendations have realized dramatic improvements in reliability, significant cost savings, and overall improvements in operational effectiveness. In addition, ECI's programs enhance the public's perception of line clearance operations.
- ◆ **ECI's cutting-edge research efforts are consistently integrated with our consulting services, ensuring that the latest information is incorporated into program development.** ECI has conducted and been involved in several competitive analyses and benchmarking studies, which provide a resource base for comparative statistics. Ongoing research into how trees cause outages continues to shed light on the interactions between electrical conductors and trees. The Economic Impacts of Deferring Electric Utility Tree Maintenance study completed by ECI continues to be widely used to assess the impact of line clearance program budget reductions.
- ◆ **ECI has also conducted numerous environmental studies,** including a wetlands study, an herbicide use study, an EIS for R/W management in the Allegheny National Forest, an EIS for Tree Growth Regulator use, and buffer zone effectiveness study. ECI's ongoing Green Lane Research Demonstration Project in Pennsylvania, begun in 1987, is a long-term, continuous study that examines the impacts of various right-of-way vegetation management techniques.



- ◆ **ECI's Distribution Line Clearance Programs also meet with regulatory approval;** our projections, studies and final reports have been successfully used in rate cases in several states. An independent consultant gave unconditional support to our recommendations after conducting a PUC-ordered review of an ECI Distribution Line Clearance Program, with special emphasis on environmental impacts. ECI has not only developed recommendations for vegetation management but also actively manages line clearance work and implements industry best practices.
- ◆ **ECI has literally written the book on electric utility industry best practices.** ECI prepared the Vegetation Management Manual for the National Rural Electric Cooperative Association and has recently completed a companion manual on tree growth regulators and the Utility Specialist Certification Guide for the International Society of Arboriculture.

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*Ownership*

ECI is a privately owned consulting company without ties to any line clearance tree trimming contractor.



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*Select Clients*

**ECI's vegetation management clients include:**

Access Energy Electric Cooperative  
Alabama Power  
Allamakee-Clayton Electric Cooperative  
Alliant Utilities  
American Transmission Company  
Arizona Public Service Co.  
Arkansas Power & Light  
Atlantic Electric Co.  
B.C. Hydro  
Carolina Power & Light  
Central Illinois Light Co.  
Central Illinois Public Service  
Central Maine Power Co.  
Central Vermont Public Service Corp.  
Cleveland Electric Illuminating Co.  
Colorado Springs Dept. of Utilities  
Columbia Gas Transmission Corp  
Commonwealth Edison Co.  
Commonwealth Electric Co.  
Consolidated Edison Co.  
Connecticut Power & Light Co.  
Cumberland EMC  
Dayton Power & Light Co.  
Delmarva Power & Light Co.  
Detroit Edison Co.  
El Paso Electric Co.  
Electric Power Research Institute  
Flint Energies  
Florence Electric Department  
Florida Power & Light Co.  
Florida Power Corp.  
FirstEnergy  
Ft. Loudon EMC  
Gainesville Regional Utilities  
Gas Research Institute  
Gibson EMC  
Granite State Electric Co.  
Green Mountain Power Corp.  
Gulf Power Co.  
Gulf States Utilities Co.  
Hawaiian Electric Co., Inc.  
Hawkeye Tri-County Electric Cooperative  
Jersey Central Power & Light Co.  
Joe Wheeler EMC  
Kansas City Power & Light Co.  
Knoxville Utilities Board  
Louisiana Power & Light Co.  
Massachusetts Electric Co.  
Minnesota Power & Light Co.  
Mississippi Power  
Missouri Public Service Co.  
Mitchell EMC  
Narragansett Electric Co.  
Nashville Electric Service  
NRECA Cooperative Research Network  
New York State Electric & Gas  
Niagara Mohawk Power Corp.  
NiSource  
North Georgia EMC  
Northern States Power Co.  
NOVA Gas Transmission Ltd.  
Okefenoke EMC  
Hydro One  
Orange & Rockland Utilities, Inc.  
Pacific Gas & Electric Co.  
Pacific Power & Light Co.  
PECO Energy Co.  
Peninsula Light Co.  
Pennsylvania Power & Light Co.  
Public Service Co. of Colorado  
Public Service Co. of New Hampshire  
Public Service Co. of New Mexico  
Public Service Co. of Oklahoma  
Public Service Electric & Gas Co.  
Puget Sound Energy  
Rappahannock Electric Cooperative  
Sacramento Municipal Utility District  
Santee Cooper  
Seattle City Light  
Sequachee Valley Electric Cooperative  
Snohomish County PUD #1  
Southeastern Illinois Electric Cooperative  
Southern Illinois Power Cooperative  
Southern Iowa Electric Cooperative  
Tampa Electric Co.  
Texas Power & Light Co.  
Texas Utilities Electric Co.  
Toledo Edison Co.  
TransAlta Utilities Corp.  
Tri-county Electric Cooperative  
Union Electric  
Washington Water Power Co.  
Western Massachusetts Electric Co.  
West Penn Power Co.  
West Florida Electric Cooperative  
Wisconsin Electric Company  
Wisconsin Power & Light Co.  
Wisconsin Public Service Co.





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## Consulting Experience

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*Philip Charlton, Ph.D.,  
President*

Dr. Charlton has over 27 years of utility vegetation experience, which includes involvement in the development of over 100 comprehensive right-of-way programs, development of ECI's crew production monitoring system – TRES (Trim Report and Evaluation System), and management of numerous other industry-related environmental and research projects. The Utility Arborist Association recently recognized Dr. Charlton for his outstanding contributions to the utility vegetation management industry.

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*Paul Appelt  
Vice President,  
Consulting Services*

Paul Appelt is responsible for oversight and direction of ECI's Consulting Services Business Unit including distribution line clearance studies, wood pole and joint facilities management plans, transmission ROW studies, turnkey vegetation management operations, training services, practical research projects, litigation support and special studies. Mr. Appelt has over 29 years of vegetation management experience including 10 years as the manager of a large utility line clearance program. Mr. Appelt has recently completed assessments of vegetation management programs for both large and small utilities as well as a multi-utility process benchmarking study.

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*Mark Browning  
Director,  
Field Services*

Mark Browning has over 15 years of experience with ECI in providing vegetation management consulting services to utilities. He is currently responsible for the direction and oversight of ECI's Field Services Business unit, which includes Contract Personnel and a team of Regional Coordinators. Mark recently authored a comprehensive *Electric Utility Vegetation Management Manual* for the National Rural Electric Association's Cooperative Research Network and led an internationally acclaimed study on the *Economic Impacts of Deferring Electric Utility Tree Maintenance*.



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*Ken Finch  
Manager,  
Special Projects*

Following 28 years experience in managing T&D line clearance operations at a large New York utility, Ken Finch joined ECI and has been responsible for total management services operations at several electric cooperatives. He is also involved in the management of special projects. In recent years, Ken has been at the forefront in implementing new strategies for tree-related outage reduction. He also serves on the Executive Board of the New York State Urban and Community Forestry Advisory Council, and chairs the Utility Arborist Association Education and Training Committee.

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*Bradley Williams  
Senior Project Manager*

Mr. Williams has 34 years experience in utility operations and vegetation management, including management of a multi-state vegetation management program. He has participated in numerous benchmarking studies and currently has responsibility for one of ECI's line clearance Total Management Services operations at a Midwestern IOU.

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*Tom Williams  
Manager,  
Information Technology*

Mr. Williams has 16 years of vegetation management consulting experience and is responsible for ECI's Information Technology Services. Mr. Williams has extensive experience with right-of-way crew production monitoring, benchmarking, and utility vegetation management consulting, and is responsible for integrating state-of-the-art technology into ECI's consulting services.

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*Charles Hughes  
Manager,  
Field Services*

As Southeast Regional Coordinator for ECI, Mr. Hughes is responsible for service and customer support, sales coordination, project assistance and planning, and supervision of Contract Arborists. Mr. Hughes has 30 years of experience in utility vegetation management having worked for two electric utilities and as district manager for a national line clearance contracting firm. Mr. Hughes developed successful transmission and distribution vegetation management programs in North Carolina and Florida and developed various training programs related to utility line clearance. As a contractor, Mr. Hughes managed accounts for three major public utilities and four electric cooperatives providing tree trimming, mowing and herbicide application services.



## Additional Information About ECI



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## ECI Profile

**Our Commitment:** *Environmental Consultants, Inc. has over 30 years of consulting experience in the electric utility industry. We provide quality solutions for all aspects of vegetation management, including program development, crew productivity measurement, environmental assessment, contract foresters, training, expert testimony, and research. We are committed to providing the absolute highest quality state-of-the-art consulting services.*

Environmental Consultants, Inc. (ECI) is an independent, privately owned, environmental, scientific, and vegetation management consulting firm with the operations office located in Stoughton, Wisconsin. ECI's administrative office is located in Southampton, Pennsylvania and there are several other offices nationwide and in Australia. ECI has successfully served companies throughout the United States, Canada, Australia and the United Kingdom by furnishing consulting services tailored to meet the specific needs of the client.

ECI avails itself of a professional, technical, and support staff, including a group of specialized scientists, engineers, and field technicians, to help clients solve complex environmental and operations problems, through cost-effective management practices and state-of-the-art quality control methods.

The cornerstone of ECI's consulting effectiveness is the demonstrated ability to assemble and manage multi-disciplinary project teams. These teams are developed for each assignment and focus on the specific requirements of each client. The interplay between the many phases of a project may involve scientific, engineering, economic, and regulatory aspects. These requirements are addressed through the wide range of expertise available in ECI and outside specialists as required. The ability to organize and complete complex research is employed in meeting the objectives of each assignment.

ECI has a staff of several hundred professionals with expertise in vegetation management, forestry, biology, wildlife management, and related areas. The following corporate officers direct activities of the corporation:

Dennis E. Holewinski ..... CEO  
Philip M. Charlton, Ph.D. .... President  
Paul J. Appelt ..... Vice President, Consulting Services  
D. Mark Browning ..... Director, Field Services  
Douglas J. LeRoy ..... Treasurer



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## **Vegetation Management Solutions**

ECI can provide quality solutions for:

- Documenting vegetation workloads
- Optimizing and justifying expenditures
- Ensuring cost-effective management
- Reducing long-term costs
- Increasing reliability
- Improving customer service

Development of comprehensive utility vegetation management programs is a specialty of ECI. We have been helping utilities improve their vegetation management programs for over 30 years and have a ***proven record of success at over 140 electric utilities.***

ECI's approach is designed to help a utility document its vegetation workload, establish and justify optimum expenditure levels, and implement cost-effective work practices and operating procedures. Typical program elements reviewed in our studies are shown below.

For utilities that have implemented our programs, our projections have proven to be accurate. These utilities have also discovered that ECI's recommendations can lead to increased service reliability, reduced long-term costs, and improved customer satisfaction.

ECI has always been the consultant of choice for electric utilities preparing for a rate case. Our studies and final reports have been successfully used in rate cases in at least eight states. An independent consultant gave unconditional support to our program after conducting a PUC-ordered review of ECI's recommendations, with special emphasis on environmental impacts.



What can you expect from ECI’s Distribution Line Clearance Programs?

- **Documentation of needs and foundation for program improvement**  
 “The recommendations provided by ECI are the basis for the significant improvements we are experiencing in our vegetation management program.”  
 Source: Winston Smith, Nashville Electric Service

- **Accurate cost projections**

**Cost Comparisons**

ECI 3-Year Projection	\$24.6 M
Actual Costs Incurred	\$23.8 M
Difference	(3.5%)

Source: J.R. Binkley, Dayton Power and Light Co.  
 Paper presented at an EEI T&D meeting

- **Improved service reliability**  
 “Following completion of the first maintenance cycle, tree-caused service interruptions were reduced by over 50 percent.”  
 Source: Diane Bell, Santee Cooper  
 Presentation at Southern Chapter ISA

- **Better public relations**  
 “Implementation of the new program and continued support by senior management are helping to reduce tree-caused service interruptions, increase the effectiveness of line clearance expenditures, and improve relation with the public. The evidence indicates a reversal of the trend of ever-escalating maintenance costs and customer complaints.”  
 Source: Neil Thiessen, TransAlta Utilities Corp.  
 Electric Light & Power

- **Long-term cost savings**

**Cycle Costs and Average Manpower**

Cycle	Duration	Avg. Personnel / Year	Cycle Cost (Actual \$)
1	1/85 – 12/87	173	\$19.7M
2	1/88 – 2/91	138	\$16.9M
3	2/91 – 12/93	121	--

Source: M.D. Schuler, Kansas City Power & Light Co.



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**Vegetation  
Management Program  
Experience**

The following briefly summarizes our experience in developing comprehensive vegetation management programs for electric utilities throughout the world. ECI has...

- **Over 30 years of experience** developing comprehensive vegetation management programs.
- Developed **over 140 line clearance programs for electric utilities** throughout the United States, Canada, The British Isles, and Australasia.
- Identified program improvements that have allowed utilities to...
  - ✓ Achieve reductions in long-term workload and costs after the first cycle.
  - ✓ Hit reliability improvement goals by significantly reducing tree-caused outages.
  - ✓ Obtain recommended clearances.
  - ✓ Demonstrate the ability to stabilize annual budgets.
  - ✓ Obtain customer acceptance of pruning techniques and clearance requirements.
  - ✓ Secure approval of program improvements by regulatory and city officials.
  - ✓ Meet established time lines and schedules for implementation.
  - ✓ Complete entire workload within budget estimates.
- Provided recommendations and projections used in rate cases in eight states.
- Designed specifications, work practice guidelines, forms, and procedures for implementation of new programs.
- Developed the computerized Trim Report & Evaluation System (TRES) for...
  - ✓ Maintaining weekly cost and productivity records for over 500 electric utility vegetation management crews from numerous contractors.
  - ✓ Monitoring national data on all elements of a tree crew's workday. Production data demonstrates cost effectiveness of crew types, sizes, etc.



- Familiarity with the management and operational problems of utilities of all sizes.
- Made comparisons of time and materials, firm price, and unit price contracts, and of Cycle versus Just-in-Time pruning.
- Completed research on the long-term cost and effectiveness of brush control alternatives in the northeastern United States.
- Developed the ESEERCO Cost-Effectiveness Model and the Minnesota Power Right-of-way Planning Prediction Model for evaluating vegetation management alternatives. ECI maintains an exclusive license to market this software.
- Developed a Tree Growth Simulator, which models regrowth after pruning and helps identify optimum clearances and maintenance cycles.
- A consistent record of accurate budget projections.
- Conducted multi-utility comparative analysis benchmarking studies and process benchmarking focused on vegetation management.
- Implements vegetation management processes at several electric utilities.
- Wrote the Vegetation Management Manual for the National Rural Electric Cooperative Association Cooperative Research Network.
- Prepared the Utility Specialist Certification Guide for the International Society of Arboriculture.
- Conducted highly insightful research into how trees cause sustained outages and the impact of tree-to-conductor contact on momentary interruptions







**PHILIP M. CHARLTON**  
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pcharlt@eci-consulting.com

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## **PROFESSIONAL EXPERIENCE**

**ENVIRONMENTAL CONSULTANTS, INC.,** Stoughton, Wisconsin **1980 Present**

**President** (2003-Present)

Dr. Charlton provides corporate leadership of all members of the ECI Family of Companies. He serves as President of both ECI and EC International, Ltd., which is an affiliate offering, related services throughout the Pacific Rim. Dr. Charlton is also a Director on the board of ECI's independent affiliate, Western ECI.

**Chief Operating Officer** (2000-2003)

Responsible for oversight of all field operations including Consulting Services, Total Management Services, Field Services, and information Management Services.

**Previously held positions** (1980-2000)

Previously held positions (1980-2000) within ECI include Executive Vice President, Vice President, Director of Information Management and Consulting Services, Manager TRES, Forester.

Dr. Charlton has been a part of ECI's team since 1980, serving in numerous capacities. He has provided leadership in the development of ECI's Trim Report & Evaluation System, which has been used by dozens of utilities for 20 years. Dr. Charlton has worked with over 100 utilities in the United States, Canada, the UK, Australia, New Zealand and Malaysia to develop business cases and comprehensive management plans for vegetation maintenance. He helped develop ECI's reputation as the leading consultant in the area of utility vegetation management research. Dr. Charlton provided oversight of, and assisted in development of the NRECA's Utility Vegetation Management Manual and led the International Society of Arboricultures's effort to write the Utility Arborist Specialists Guide in 2003.

**WESTERN ECI,** Citrus Heights, CA **1997 to Present**

**Director** (1997 to present)

Western ECI provides Field Services throughout fire-prone areas of North America. Dr. Charlton has served as a member of Western ECI's board since its formation in 1997. He provided oversight during the transition, when ECI assigned activities in this region to the new, independent company, and continues to serve in that capacity.

**ENVIRONMENTAL CONSULTANTS INTERNATIONAL, LTD.****1995 to Present****President (1995 to present)**

Dr. Charlton oversaw sales and delivery of ECI's services through its affiliate EC International, Ltd., first to utilities in the UK and Ireland, then throughout the Pacific Rim. EC International, Ltd. maintains an active presence in the Australian and New Zealand electric utility and municipal market. It has also aggressively expanded into the commercial forest industry, particularly in Tasmania.

**WEST VIRGINIA UNIVERSITY, Morgantown, WV****1977 to 1980****Research Assistant (1977 to 1980)**

Dr. Charlton has several years' research experience concerning the effects of silvicultural treatment on hardwood forest ecosystems of the Northeast. His research at West Virginia University included evaluating 30 years of growth data on continuous forest inventory plots. This work culminated in the writing of a Master's thesis, "Effects of Intermediate Cuttings in Appalachian Hardwoods."

Later research placed emphasis on developing mathematical models of hardwood forest growth and simulating response to various treatment regimes. During this period, Dr. Charlton assisted in the development of biomass yield equations and informal weight yield estimation procedures, analysis of optimal angle factors for variable plot sampling, derivation of upper-stem and total tree height relationships, optimization of scaling standards for various timber height relationships, and optimization of scaling standards for various timber products.

**EDUCATION**

Ph.D. - Forest Science, West Virginia University, 1983.

M.S.F. - Silviculture/Mensuration, West Virginia University, 1978.

B.S.F. - Forest Management, West Virginia University, 1977.

**PUBLICATIONS/PAPERS**

"The Impact of Deferred Maintenance on the Cost of Distribution Line Clearance." 1997. Presented to the British Arborist Association, Exeter, England.

"The EEI Vegetation Management Task Force's Vegetation Management Benchmarking Study." 1996. Presented to the Western Chapter ISA Meeting, Honolulu, HI.

Norris, L. A., and P. M. Charlton. 1995. "Determination of the Effectiveness of Herbicide Buffer Zones in Protecting Water Quality." Pages 147-152 in G. J. Doucet, C. Sequin, and M. Giguere (eds.). "Proceedings: Fifth International Symposium on Environmental Concerns in Rights-of-Way Management." 9/19-22/1993. Hydro-Quebec, Montreal, Canada.

"Professionalism in the Utility Arboriculture Industry." 1995. Presented to the Western Chapter ISA Meeting, Monterey, CA.

Abrahamson, L. A., C. A. Nowak, P. M. Charlton, and P. G. Snyder. 1992. "Cost Effectiveness of Vegetation Management Methods for Electric Utility Rights-of-Way in the Northeast." Niagara Mohawk Power Corp., Syracuse, NY.

Computerized Tree-Selection: Matching the Right Tree to the Right Site." 1990. Presented to the Pennsylvania Electric Association, Valley Forge, PA.

Developing a Productivity Evaluation System for Line Clearance." 1987. Presented to the Wisconsin Utilities Association, Green Bay, WI.

White, D. E., P. A. Johnston, and P. M. Charlton. 1986. "ROW Vegetation Compaction Control: The Never-Ending Process." Electrical World, August, 1986.

"Recordkeeping and Productivity Evaluation of Vegetation Management Crews." 1985. Presented to the EEIT&D Committee, Baltimore, MD.

Wiant, H. V., Jr., and P.M. Charlton. 1984. "Estimating Volumes of Appalachian Hardwoods Using the Behre Hyperboloid." Journal of Forestry, Vol. 82, No. 3.

Charlton, P. M. 1983. "Utilization of Taper Systems for Estimating Total Tree Height of Appalachian Hardwood Species." West Virginia Forestry Notes, No. 10.

Wiant, H. V., Jr., and P. M. Charlton. 1982. "Influence of Merchantable Limits on Board-Foot Volume Estimates of Hardwoods." Resource Evaluation Journal, No., 2.

Charlton, P. M., H. V. Wiant, Jr., and K. L. Carvell. 1980. "Effects of Intermediate Cuttings in Appalachian Hardwood Stands: A 30-Year Study." West Virginia Forestry Notes, No. 8.

Wiant, H. V., Jr., and P. M. Charlton. 1978. "Rapid Weight Estimates for Upland Oak Stands." West Virginia Agriculture and Forestry, Vol. 17, No. 3

### **PROFESSIONAL AFFILIATIONS**

International Society of Arboriculture.  
Utility Arborists Association.

Rocky Mountain Electric League

2001 recipient of the Utility Arborists Association's Utility Arborist Award.

### **EXPERT WITNESS**

British Columbia Hydro: Civil Litigation  
Washington Water Power: Civil Litigation  
Pacific Gas and Electric Co., CA: Criminal Litigation  
Monongalia District Court, WV: Timber Trespass  
Maine Public Utility Commission, ME: Rate Hearing  
West Virginia Public Utility Commission: Rate Hearing  
Pennsylvania Public Utility Commission: Rate Hearing



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## PROFESSIONAL EXPERIENCE

**ENVIRONMENTAL CONSULTANTS, INC., Stoughton, Wisconsin** **1999 to Present**

**Vice President, Consulting Services** (2003-Present)

Provides leadership of ECI's consulting services business unit. This business unit focuses on assisting utility management through diagnostic vegetation management program assessments, vegetation management program development, research-based reliability improvement strategies and outsourcing of line clearance program management. Other consulting services provided include: litigation support, wood pole and joint facilities management planning, transmission right-of-way studies, training services, practical research projects, special studies and information services (production monitoring software and record keeping services, and handheld data collection).

**Director, Consulting Services** (2000-2002)

Responsible for oversight and direction of the consulting services business unit including distribution line clearance studies, wood pole and joint facilities management plans, transmission ROW studies, turnkey vegetation management operations, training services, practical research projects, information services, litigation support and special studies.

**Senior Project Manager** (1999-2000)

Responsible for management of ECI's benchmarking programs and development of management planning services for utility wood pole maintenance/joint attachments, litigation related consulting services.

**COMMONWEALTH EDISON COMPANY, Chicago, Illinois** **1985 to 1999**

**System Vegetation Management Superintendent** (1993 to 1999)

Responsible for vegetation management including: line clearance, tree maintenance, landscape repair, landscape site maintenance as well as wood pole inspection and maintenance throughout the 44,000 mile transmission and distribution (T&D) system. Managed \$40 million to \$70 million in contracts annually.

- Supervised 27-member department, which directed activities for 1200 contract personnel.
- Led development and implementation of incentive based landscape repair contracts, which reduced completion times by over 50% while maintaining or increasing quality.
- Initiated studies resulting in efficiency improvements:
  - NPV analysis of tree removal/replacement versus periodic pruning.
  - Efficacy of wood pole supplemental preservative treatment.
  - Wood pole replacement versus reinforcement.

- Co-chaired teams which developed innovative approaches to tree maintenance and wood chip disposal contracting that aligned cost reduction objectives while improving effectiveness.
- Functioned as expert witness on serious claims litigation.
- Assisted in negotiations with regional telephone company regarding shared costs for pole maintenance and tree maintenance related to jointly owned facilities.
- Designed research based brochures addressing customer concerns about tree maintenance.
- Implemented pruning standards change together with a customer notification program based on a combination of personal contact and written materials; recognized by Chairman of the Illinois Commerce Commission for public relations initiative.
- Prepared company responses to inquiries from regulators including Illinois Commerce Commission.

**System Line Clearance Coordinator** (1988 to 1993)

Responsible for functional control of all line clearance activities and right-of-way vegetation management on the T&D system including contracts specification creation. Direct responsibility for administration and planning of wood pole maintenance contracts.

- Implemented first company electronic database for line clearance records.
- Initiated major review and analysis of distribution line clearance program achieving cost, customer service, reliability and safety objectives. Presented to company officers.

**Foreman – Northwest Area** (1985 to 1988)

Supervised seven contract line clearance crews and the right-of-way mowing contract in the area.

**VILLAGE OF DOWNERS GROVE, Downers Grove, Illinois****1976 to 1985****Village Forester**

Responsible for general administration of forestry department programs including: parkway tree maintenance, Dutch elm disease and gypsy moth control, grounds maintenance, tree planting and leaf pick up. Additional responsibilities included: supervision of personnel, budget preparation, policy and program recommendation, contract management, technical arboricultural consultation to individual homeowners, tree appraisal, landscape planning, public relations and assistance with general administration of Public Works Department.

**DAVEY TREE EXPERT COMPANY, Kent, Ohio****1975 to 1976****Foreman**

Progressive experience gained in all aspects of residential tree care including pruning, cabling and bracing, planting, spraying, fertilizing, systemic injection and utility line clearance.

**CITY OF APPLETON, Appleton, Wisconsin****1975****Forestry Technician**

Responsible for Dutch elm disease surveillance and resident notification, cost analysis of wood disposal/utilization operation, arboricultural consultation to individual homeowners.

**EDUCATION**

B.S., Forestry, Michigan Technological University, Houghton, Michigan, 1975

**PUBLICATIONS/PAPERS**

Appelt, Paul. 1985. "A New Eradication Strategy for Small, Remote Gypsy Moth Infestations." Journal of Arboriculture, Vol. 11, No. 8, August 1985.

Appelt, Paul and Herbert Schroeder. 1985. "Public Attitudes Toward A Municipal Forestry Program." Journal of Arboricultural, Vol. 11, No. 1, January 1985.

Appelt, Paul and John Goodfellow. 2004. "Research on How Trees Cause Interruptions – Applications to Vegetation Management." IEEE Rural Electric Power Conference, May 2004.

**PROFESSIONAL AFFILIATIONS**

International Society of Arboriculture	Illinois Arborist Association, President,
International Society of Arboriculture, Board of Directors, 1989 to 1995	1986 (Board member and officer previous years)
Journal of Arboriculture Editorial Board, 1993-1995	American Wood Preservers Association
Illinois Urban Forestry Advisory Council, 1990-1995	Edison Electric Institute
	Utility Arborist Association