

North Dakota Public Service Commission
STAFF REPORT
October 4, 2010

Public Service Commission
Service Reliability – Northern States Power
Investigation

Case No. PU-10-577

Summary of Issue: On September 7, 2010 the Commission received a letter petition from 20 residents affected by a power disruption occurring August 27, 2010 in the neighborhood of 16th Ave and 7th / 8th Streets North in Fargo, North Dakota. The residents alleged that a power surge caused by a shorting out of aging and inadequate power lines resulted in about \$100,000 of damages to appliances and electronics in their homes. The petitioners request that NSP update the electric lines and compensate them for the resulting damages to their property.

NSP reports that a disruption did occur and believes it was caused by a combination of wind and hot weather causing a tree branch to create a fault between a conductor and neutral wire of the secondary power lines running overhead in the alley between 7th and 8th streets. The lines were not insulated and the resulting high current on the neutral wire caused it to burn open, thus removing the ground reference and causing up to 240 volts to be delivered to customer's 120 volt circuits. NSP's report of the incident is attached.

Staff Findings: A site visit was conducted on Wednesday, September 22nd. The failed neutral wire had been repaired with a splice and the tree, located in the backyard of 715 16th Ave N, was still too close to the secondary lines, though the offending branch had been removed and saved. It was the only tree anywhere near the secondary lines and appears to have been the cause of the disturbance.

The secondary lines involved were older and not insulated with a spacing between the three wires of about 9 inches at the pole. NSP reports it quit using this type of secondary around the early 2000's and now uses a "lashed" type of line for new installations. The lashed lines have stronger and higher-capacity ANSI conductors that are insulated and twisted together to protect against contact faults.

There was also a mid-span service tap installed on the secondary lines just south of the tree. The tap was pulling on the secondary wires and causing them to angle into the proximity of the tree. The mid-span service tap was to the 715 16th Ave N property where it appeared the service line had been moved to mid-span from the utility pole just south of the tree - possibly to avoid a small younger tree between the pole and the house.

Fuses on the primary side of the transformers on either side of the break in the neutral (T52 and T53) did not operate. NSP reports that the fuse at T53 was slightly oversized with a 30T rating, compared to a 25T that is standard for this

application. The slightly oversized fuse at T53 does not appear to have been a factor.

Discussion:

The residents request in their petition that electric lines in the neighborhood be updated to prevent further disturbances and they seek compensation from NSP for damages. NSP reports it has already upgraded the secondary lines with “lashed” conductors and will trim the tree as soon as possible.

Regarding the request for damage compensation, NSP’s ND electric rates tariff, Sheet No. 6.1.1 provides:

“1.4 CONTINUITY OF SERVICE

The Company will endeavor to provide continuous service but does not guarantee an uninterrupted or undisturbed supply of electric service. The Company will not be responsible for any loss or damage resulting from the interruption or disturbance of service for any cause other than gross negligence of the Company. The company will not be responsible for any loss of profits or other consequential damages resulting from the use of service or any interruption or disturbance of service.”

The meaning of the term “gross negligence” as used in the tariff is subject to legal interpretation, but it does appear that NSP was at fault to some degree:

First, NSP found a work order for the 715 16th Ave N service line dated October 2003 and that is likely when the mid-span tap was installed. It is unknown how big the tree was then or how close the newly-installed tap would have pulled the secondary wires to the tree, but it is likely this incident would have been avoided if the mid-span tap had not been installed or if the secondary span by the tree would have been replaced with a lashed conductor when the mid-span tap was installed.

Secondly, NSP reports tree trimming is done on a four year cycle and was last performed in this neighborhood during spring 2008. NSP states its clearance objective when trimming trees near secondary conductors is to ensure minimal risk of a tree-related outage prior to the next scheduled pruning in the four-year cycle. That objective was not met for this tree.

Prepared by: Jerry Lein



2302 Great Northern Drive
P O Box 2747
Fargo, ND 58108-2747
(701) 241-8632
dave.sederquist@xcelenergy.com

September 21, 2010

Jerry Lein, Public Utility Analyst
North Dakota Public Service Commission
State Capitol Building, Dept. 408
600 East Boulevard
Bismarck, ND 58505-0480

Re: Data Request Response – Fargo Power Disruption (Case No. PU-10-577)

Dear Mr. Lein:

Attached is the response of Northern States Power Company, a Minnesota corporation with operations in North Dakota, to your Request for Information emailed to the Company on September 15. The request was related to the Commission's pending investigation into the north Fargo power disruption that occurred on August 27. An electronic version (.pdf) of this response is being emailed today and a hardcopy will be provided to you when you arrive in Fargo tomorrow (Wednesday) to inspect the site.

Your information request was as follows:

Please provide a full explanation complete with pictures and any other supporting information showing the causes of the August 27th Fargo power disruption and what the company believes happened.

Our response, enclosed here, is comprised of the following documents:

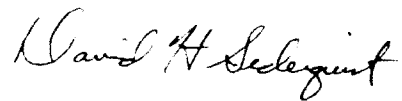
- The technical review of the system equipment and events involved in the disruption, summary of the investigation, and conclusion regarding the cause;
- A map of the affected area showing locations of the system equipment (Attachment A);
- Photos of the location, equipment, and tree branch we believe caused the fault (Attachment B); and
- Xcel Energy's vegetation management guidelines (Attachment C).

It is my understanding that you are planning to arrive late morning tomorrow to conduct a site visit and speak to Xcel Energy personnel about the power disruption

and our findings. We will have engineering and operations personnel on hand to address any questions you may have and facilitate your inspection of the equipment and other evidence relevant to the incident.

Please contact me if you have any questions about the material provided.

Sincerely,

A handwritten signature in black ink that reads "David H. Sederquist". The signature is written in a cursive style with a large, prominent 'D' and 'S'.

David H. Sederquist
Sr. Consultant, Regulation/Finance

Enclosures

North Fargo Power Disruption Technical Review

Incident Review

On August 27, 2010 at approximately 4:28 PM, customers located on the 1600 block of 7th and 8th Streets N in Fargo reported line sparking and partial power outages.

These customers are served by the Red River Substation Feeder 83 via the North Broadway stepdown transformer. The two local transformers serving the immediate area are identified on our system as T52 (to the north) and T53 (on the south end). Transformer T52 serves 10 customers and transformer T53 serves 13 customers. See Attachment A.

A troublecrew was dispatched at 4:30 PM on August 27. Upon arrival, the crew observed the following:

- The neutral conductor between the poles where T52 and T53 are attached was broken and down on the ground.
- The ground wire at the T52 pole had burned open near the transformer.
- The ground wire at the T53 pole had burned open near the transformer.
- Burn marks were evident on the secondary wire lead at transformer T52.

The crew opened the fuses at T53 and T52 to isolate the system. They installed new neutral conductor for the two spans on either side of T53 and connected the existing neutral conductor on the span south of T52. They reconnected the ground wire at each transformer pole and installed a new secondary lead to T52. Finally, they closed the fuses and took voltage readings. The voltage readings were within the acceptable range.

When a secondary line comes into contact with a neutral wire, it will cause fault current to flow in the neutral of the electrical system. The neutral is designed and built to handle the current, but in this instance the neutral may have been weakened or otherwise compromised, causing it to burn open at the first pole north of T53 and fall to the ground. Once the neutral wire failed, there was no ground reference, causing the voltage delivered to the customer to vary between 0 and 240 volts depending on the electrical connections and household equipment turned on at the time of the event.

On the day of the event, the temperature was roughly 92 degrees with a wind speed of 25 to 31 mph and gusts up to 38 mph, according to the National Weather Service.

Investigation

Further investigation into the neighborhood's distribution system during the days following the incident revealed no unusual outage or power quality issues and that the system serving these customers has performed well over the last few years. During this year, these customers experienced one outage on April 25 lasting 54 minutes due to the feeder breaker opening for an issue not in this neighborhood. In 2009, the area experienced two outages, one on April 23 lasting one minute, and a momentary on September 17. In 2008 these customers experienced two outages, a momentary on March 28 and one on May 21 lasting one minute. Though not outage-related, on April 25, 2009, crews repaired a loose connection at the weatherhead of one premise in response to a call regarding flickering lights.

The fuses on the 4 kV side of transformers T52 and T53 were removed and brought back to the Fargo service center for inspection. The standard size fuse for this application would be a 25T, and this was the size serving T52. It was determined that a 30T fuse was serving T53. This larger fuse has similar time-current characteristics of operation as the 25T. Even if the fuse had been a 25T it most likely would not have operated.

While removing the fuses in the field, crews noticed a tree branch extending underneath the lower secondary line, just south of T53 (see pictures in Attachment B). Based on observations made by a Fargo engineer on site it appears that the branch, with burn marks and damaged bark, appears to have been moved by the wind into the secondary line causing it to make contact with the neutral wire. Our maintenance records show that the trees near this line were trimmed according to guidelines (see Attachment C) during the spring of 2008. This area is on a four year line clearance cycle, with the next trimming scheduled for spring 2012. Above average precipitation in Fargo and the passage of three summer growth seasons since the previous pruning may have contributed to the branch extending far enough to contact the line.

Because this system has historically performed very well, the technical team sees no reason to suspect a load issue. Engineering personnel will monitor this area and, if conditions warrant, will set recording meters in the area next summer to more specifically identify and quantify line loads. Setting recording meters this fall and winter will not provide any useful information because peak energy use is generally experienced during the summer months.

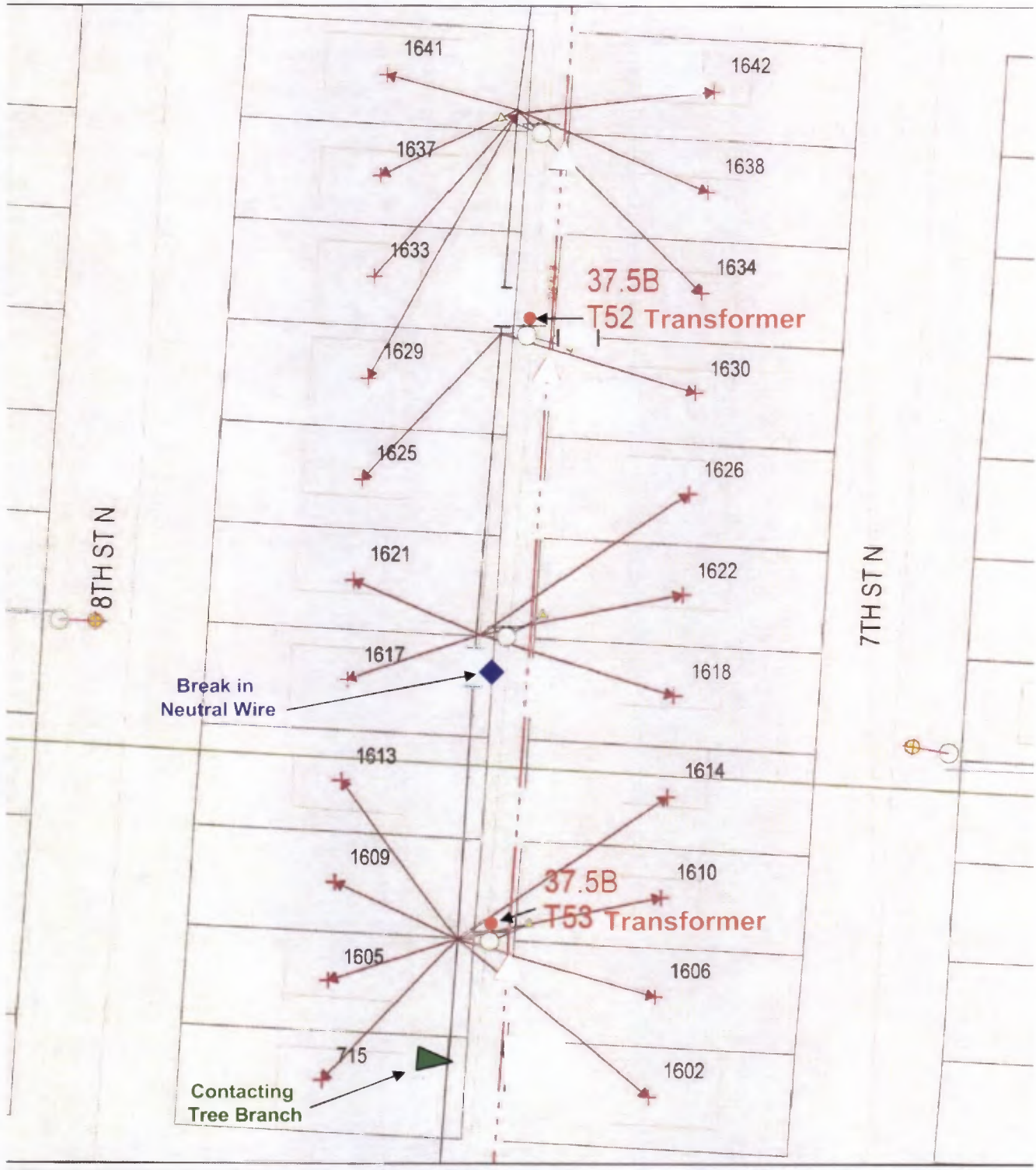
Conclusion

It is the conclusion of the technical team that the damage to the neutral and ground wires on our system and the resulting customer power disruption was caused by fault current during a high-impedance fault event due to a tree branch contacting the secondary bus.

17TH AV N

(Note: a shed on the north side of 17th Ave. N is also served by T52)

Attachment A



16TH AV N

SCALE: 1 IN = 70 FT

Picture # 1



Picture was taken from the south end of the alley between 7th and 8th streets, looking to the north. Crews are working near the T53 transformer. The contacting tree branch on the west side of the alley is slightly visible (see red circle) below the secondary wires.

Picture # 2



This picture was taken from a position below and slightly north and west of the contacting branch. The damaged branch extensions without foliage are visible below the secondary lines (red circle).

Picture # 3



This picture was taken from a position below and slightly north and east of the contacting branch. The secondary and neutral conductors are visible above the smaller, bare branch extensions (red circle). The clean copper wire on the lower secondary line just north of the branch is evidence of damage caused by tree contacts.

Picture # 4



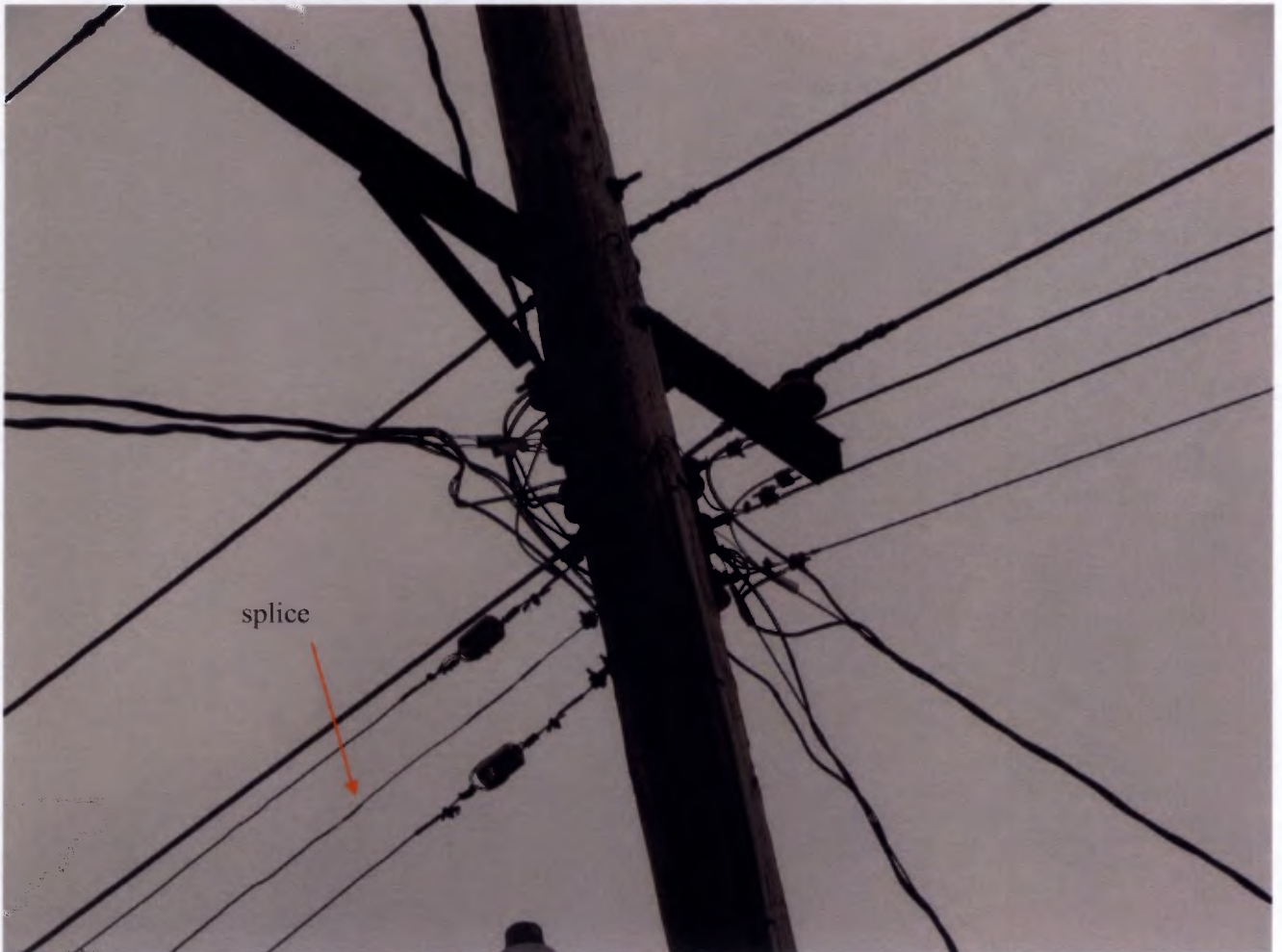
Close-up of removed elm tree branch showing worn bark and burned areas caused by contact with the secondary wires. The smaller, outer branches lacking foliage were extending underneath the secondary lines.

Picture # 5



Closer view of removed branch showing the area of primary damage.

Picture # 6



Pole and associated wiring located between transformers T53 to the south and T52 to the north. In the repairs made on August 27, new neutral wire was installed on the spans south and north of T53 and spliced to the existing neutral wire at a point just south of this pole (see arrow).

Picture # 7



Pole near north end of the alley where transformer T52 is hanging. Shiny copper portion of the ground wire is the new wire spliced to the existing ground as part of the repairs performed on August 27. Pole shows burn marks from the damage to the ground wire during the fault.

Picture # 8



Transformer T53 located near the south end of the block. Ground wire serving this transformer also burned open (not visible here). Crews are removing the fuses for inspection.

Picture # 9



View of the alley from the north end. Trees on the right and near the far south end of the alley are where the contacting branch was located.



Vegetation Management Guidelines

Revised May 2010

Table of Contents

About this Information	2
Safety Policy	2
OSHA Requirements (1910.269)	2
ANSI Requirements (Z-133.1)	2
State Requirements	3
SECTION 1: General Line Clearance	4
1.1 – Why Electric Utilities Are Required To Perform The Work	4
1.1.1 – National Electric Safety Code (NESC) Requirements	4
1.1.2 – Public Utilities Commission (PUC) and Public Service Commission (PSC) Tariffs	4
SECTION 2: Integrated Vegetation Management (IVM)	6
2.1– General Philosophy	6
2.2 – Hazard Tree Mitigation	6
2.3 – Work Quality Guidelines	6
2.3.1 ANSI A-300	6
2.3.2 Pruning	6
2.3.3 Removal	7
2.3.4 Other Methods Used	8
SECTION 3: Distribution Line Clearance	9
3.1 Clearance Guidelines	9
3.1.1 Definition of Conductor Types	9
3.1.2 Rights of Way/Easements/Fee-Owned Rights of Way	9
3.2 Work Descriptions	10
3.2.1 Routine Maintenance/Scheduled Work	10
3.2.2 External and Safety Zone Requests	10
3.2.3 Internal Requests	11
3.2.4 Emergency/Storm Response	11
SECTION 4: Transmission Line Clearance	12
4.1 – General Guidelines and Program Philosophy	12
4.1.1 Minimum Clearance Guidelines	14
4.2 – Work Descriptions	17
4.2.1 Routine Maintenance /Scheduled Work	17
4.2.2 External Requests and Safety Zone Requests	18
4.2.3 Internal Requests	18
4.2.4 Emergency/Storm Response	19
SECTION 5: Overhead Safety Inspection Program	20
SECTION 6: Landscape Maintenance & Weed Abatement	21
SECTION 7: Miscellaneous Vegetation Management	22
7.1 – Vegetation Management System (VMS)	22
7.2 – Herbicide Guidelines	22
7.3 – Special Conditions Documents	23
7.4 – Avian Protection	23
7.5 – Responsible Tree Planting	23

Introduction

ABOUT THIS INFORMATION & SAFETY POLICY

SAFETY STATEMENT

There is no job we do nor service we perform so urgent that we cannot take time and use the necessary equipment to do it safely.

ABOUT THIS INFORMATION

The following information is intended as a guide for use when performing vegetation management services. Vegetation management includes the services of distribution and transmission line clearance, overhead safety inspection program, landscape maintenance and bare-ground weed abatement. Regardless of the service performed, every work site has its own safety and work requirements.

Note: This information addresses reliability for Xcel Energy operating companies and is not intended for use as personal safety guidelines. Contractors are responsible for developing and following their own safety procedures.

Contractors who are performing vegetation management services are required to have a copy of this information with them in the field. Those performing line clearance activity are also required to have the book "Best Management Practices for Utility Pruning of Trees" by the International Society of Arboriculture on each truck or work location at all times.

**This information supersedes all previous manuals and guidelines for line clearance and vegetation management work for Xcel Energy operating companies including Northern States Power Minnesota, Northern States Power Wisconsin, Public Service Company of Colorado, and Southwestern Public Service Company.

SAFETY

All personnel performing vegetation management work on or near Xcel Energy facilities or rights of way shall follow approved safety guidelines and procedures. All contractors performing work for Xcel Energy shall comply with all applicable governmental safety and health regulations, and the safety and health provisions of their contracts.

There are two important standards for tree worker safety in the United States, OSHA 1910.269 and ANSI Z133.1. Contract line clearance tree workers must meet the requirements of these standards as well as any other applicable federal, state or local laws, codes or regulations.

OSHA Requirements (1910.269)

OSHA 1910.269 is the Occupational Safety and Health Administration's vertical standard pertaining to the generation, transmission and distribution of electricity. A specific section of OSHA 1910.269 requires that everyone performing tree work in proximity to electric hazards must be qualified and their training has to be documented.

ANSI Requirements (Z-133.1)

ANSI Z-133.1 is the American National Standard for Arboricultural Operations – Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements. It has the force of law because it is the document an OSHA compliance officer would reference when identifying safety violations of employees engaged in tree work. Therefore, it is considered the definitive safety standard for arboricultural operations.

In short, ANSI Z-133.1 defines an electric hazard to exist anytime a tree worker, tool, tree or any other conductive object is closer than 10 feet from an energized conductor with a voltage of 50,000 volts or LESS. From this 10-foot baseline, 0.4 inches of required clearance is added for every 1,000 volts above the 50,000-volt baseline. **ANSI Z-133.1 provides tables that outline minimum approach distances for both qualified and non-qualified tree workers based on voltage and elevation.**

Contractor managers are required to provide ANSI Z-133.1 minimum approach distance tables to their employees.

State Requirements

COLORADO: Colorado Revised Statutes Title 9 Safety – Industrial and Commercial, Article 2.5 - High Voltage Power lines – Safety Requirements. Only qualified employees of an electric utility can perform any activity that may bring an individual or equipment within 10 feet of high voltage (lines in excess of 600 volts) overhead lines. Contractors working directly for the utility are considered qualified. Non-qualified employees or individuals must contact the appropriate utility to make arrangements for safe activity.

TEXAS: Texas Statutes Chapter 752 – High Voltage Power lines. Only qualified employees of an electric utility can perform any activity that may bring an individual or equipment within 6 feet of high voltage (lines in excess of 600 volts) overhead lines. Contractors working directly for the utility are considered qualified. Non-qualified individuals must contact the appropriate utility to make arrangements for actions to be taken to mitigate the hazard.

All contractors must be aware at all times of the nature and characteristics of the Xcel Energy electric and/or gas facilities to be worked before any work begins. Contractors need to understand that electric facilities must remain energized during the performance of work unless special arrangements are made with an authorized Xcel Energy representative.

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

- The contractor shall obtain full information as to the voltage of its circuits and minimum approach distances before starting the work.
- The contractor shall at all times conduct work in a manner to safeguard the public from injury and property from damage.
- The contractor must use all necessary protection for its employees and the public, and guard against interference with normal operation of the circuits. If, in the judgment of the contractor's general foreman/supervisor, it is too hazardous to prune or remove trees with the circuits energized, the contractor must contact an authorized Xcel Energy representative(s). If appropriate, Xcel Energy will provide the necessary protective materials or de-energize circuits to ensure the safe pruning or removal of the tree(s). Should the contractor knock down or come into contact with Xcel Energy conductors (power lines), the contractor must notify Xcel Energy immediately and take the necessary protective measures. All contractor-caused electric service interruptions are subject to repair at the contractor's expense.
- In the event a contractor becomes aware of any dangerous, broken, loose or faulty Xcel Energy line facilities in the normal course of its line clearance performance, the contractor shall promptly advise Xcel Energy as to the exact equipment location(s) and nature of the condition found in accordance with the Overhead Safety Inspection Program. (See section 5, OHSI program).
- Any contractor personnel entering substation equipment yards must be qualified employees (OSHA 1910.269) and must have attended Xcel Energy sponsored substation hazard awareness training. Contractor personnel must notify dispatch/area control prior to entering any substation, must lock the gate behind them while in the substation, notify dispatch/area control when leaving the substation, and must close and lock the gate behind them.

Colorado Substations: Either 303-273-4813 or 303-278-4703

Texas North Dispatch: 806-796-3255

Texas South & New Mexico Dispatch: 806-796-3250

Minnesota Metro East: 651-229-2575

Minnesota Metro West: 612-321-7435

Greater Minnesota, South Dakota, and North Dakota: 612-321-7434

Wisconsin: 715-839-2618

Section 1

GENERAL LINE CLEARANCE

1.1 – WHY ELECTRIC UTILITIES ARE REQUIRED TO PERFORM THE WORK

State regulatory entities such as Public Utility Commissions (PUC) and Public Service Commissions (PSC) require electric utilities to maintain their electrical systems in accordance with the National Electric Safety Code (NESC). The NESC generally requires the pruning or removal of interfering trees.

In addition, trees are a major contributor of electric service interruptions nationwide. Trees cause outages in two ways, mechanical and electrical. Mechanical damage refers to entire trees or portions of trees falling and physically damaging facilities (knocking down wires, poles, etc.). Because trees can be conductive, electrical outages can also occur. These interruptions are caused when a portion of a tree becomes a short-circuit path for electricity to flow causing a protective device to operate and stop the flow of electricity. Therefore, trees must be maintained an adequate distance from the conductors in an attempt to prevent interruptions of electric service.

1.1.1 National Electric Safety Code (NESC) Requirements

The National Electric Safety Code, Vegetation Management Section 218.A.1 states:

Vegetation that may damage ungrounded supply conductors should be pruned or removed. Vegetation management should be performed as experience has shown to be necessary.

Note: Factors to consider in determining the extent of vegetation management required include, but are not limited to: line voltage class, species' growth rates and failure characteristics, right-of-way limitations, the vegetation's location in relation to the conductors, the potential combined movement of vegetation and conductors during routine winds, and sagging of conductors due to elevated temperatures or icing

1.1.2 Public Utilities Commission (PUC) and Public Service Commission (PSC) Tariffs

Tariffs and agreements with various state regulatory entities give utility companies and their contractors the ability to enter private property for maintenance purposes regardless of the existence of an easement or prescriptive rights.

Specific documents include:

COLORADO: Rules and Regulations, General, R43, Access For Company's Employees

TEXAS: Rules, Regulations, and Conditions of Service, Section V, Rule No. 10, Sheet V-11, Access To Premises

NEW MEXICO: New Mexico Rules and Regulations, Original Rule 10, Access To Premises

MICHIGAN: Rules and Regulations Part 1, Sheet 20, Access To Premises

MINNESOTA: Minnesota Electric Rate Book, No. 2, General Rules and Regulations, Section 1.3, Sheet 6-3, Access To Customer's Premises

NORTH DAKOTA: General Rules and Regulations, Section 1.3, Sheet E 78, Access To Customer's Premises

SOUTH DAKOTA: General Rules and Regulations, Section 1.3, Sheet 6-3, Access To Customer's Premises

WISCONSIN: Rules and Regulations, Sheet E 90, Schedule Ex-22, Access To Customer's Premises

Copies of tariffs applicable to each state within Xcel Energy's service territory can be found in their entirety at xcelenergy.com. Search: Tariffs, select the specific state's Energy Rates link, select Rules and Regulations under Electric Rate Books.

Section 2

SUSTAINABILITY – INTEGRATED VEGETATION MANAGEMENT (IVM)

2.1– GENERAL PHILOSOPHY

IVM is a data-driven, progressive system of information gathering utilized to best plan and complete work, including follow-up auditing, to ensure the desired results are achieved. It involves the use of various types of vegetation management treatment including the removing, pruning and mowing of vegetation and the treatment of vegetation with herbicides. The overall goal of a utility IVM program is to develop compliant, site-specific, environmentally sensitive, cost-effective and socially responsible solutions to vegetation control near electric and natural gas facilities.

2.2 – HAZARD TREE MITIGATION

Any tree on or off the right-of-way with the potential to contact electric supply lines is considered a “danger tree”. A “hazard tree” is a danger tree that has an unacceptable risk of failing before the next maintenance cycle. Hazard trees should be topped/pruned below line height, or felled, with the debris to be left on site for the tree owner’s disposal.

Conditions that might indicate the presence of a “hazard tree” could include but are not limited to the following:

Biological Factors

- Decay/deadwood/dead trees
- Cracks
- Weak branch unions
- Cankers/fungal bodies

Environmental Factors

- Root damage, restrictions
- Changes in exposure
- Poor architecture (leaning, structural overloading, imbalance due to wounding, etc.)

2.3 – WORK GUIDELINES

2.3.1 ANSI A-300

The American National Standard Institute’s A-300 standard presents performance standards for the care and maintenance of trees, shrubs, and other woody plants. The standard is intended as a guide for federal, state, municipal, and private authorities including property owners, property managers and utilities.

Whenever possible and practical, contractor tree workers are expected to adhere to this standard when pruning trees near electric facilities.

The International Society of Arboriculture’s booklet titled “Best Management Practices for Utility Pruning of Trees” provides a good working summary of the principals included in ANSI A-300. Contract tree workers are expected to have a copy of this booklet in the field for reference purposes.

2.3.2 Pruning

Tree pruning is the selective removal of branches that are not an adequate distance from the primary line, or that will grow too close to the power line before the next maintenance cycle. Secondary, street light and service wires are not routinely pruned for clearance unless overbuilt primary exists. In addition, secondary or streetlight wires may be pruned if major interference, such as a broken limb, exists.

Tree pruning is done to provide adequate clearance from Xcel Energy facilities while making proper cuts. If practical, pruning methods will be based on procedures and examples set forth by ANSI A300. As a general rule, trees should be pruned to improve or re-establish the clearance provided from previ-

ous tree maintenance performed.

Remove or shorten dangerous limbs, such as those overhanging wires that have a high potential for breaking or bending into Xcel Energy conductors due to ice, snow or wind loading. Be aware of the possibility of included bark at the branch bark ridge.

Some factors to consider when pruning include:

- Tree species
 - Growth rates (how fast the branches grow back)
 - Wood strength (the chance of the branch breaking under the load of strong wind, snow or ice)
 - Conductivity (how well the wood can conduct electricity)
- Branch size (Larger-diameter branches coming in contact with conductors by failure or deflection create the greatest risk for tree-related interruptions.)
- Voltage conducted by the line and the line's construction (the higher the voltage, the greater the clearance required)
- Framing and spacing between phases of multi-phase lines (compact design and multi-phase lines pose higher risk to tree-related interruptions). See voltage gradient tables for each operating company.
- Location of the tree in relationship to protective devices
- Critical customers on the circuit (hospitals, etc)
- General public safety (existence of tree houses, public places, climbability of tree, etc.)
- Risk of wildfire ignition

Vegetation Screens

Where required by federal, state and/or local laws or regulations, screens of trees may be left on the right-of-way so the natural tree line is not interrupted.

2.3.3 Removal

Tree removal is the selective clearing of entire trees and brush at ground level. Contractors will consult their Xcel Energy Vegetation Management representative for specific removal criteria for the area in which they are working. Please see "Supplemental Guidelines" document for appropriate operating area.

Generally:

- Remove tall-growing trees that fit the removal criteria for that geographic territory.
- Remove tall-growing brush that has the potential to grow into the conductor.
- Apply the "wire zone/border zone" concept for transmission facilities.
- All trees and brush should be cut as close to the ground as practical.
- Remove all second growth from stumps cut on previous pruning cycles.
- Whenever possible, all deciduous stumps should be treated with herbicide to prevent resprouting.
- Mitigate all trees that present an unacceptable risk to Xcel Energy facilities. (See Hazard Tree Section 2.2.)
- Keep all poles, guy wires and switch grates clear of vegetation.

Trees are not removed from the vicinity of secondary, streetlight and service wires. Customers that want to have trees cleared from these conductors on their own may request that the conductor be de-energized by Xcel Energy for private removal by calling 1-800-895-4999.

Section 2

2.3.4 Other Methods Used

- Mechanical pruning
- Mechanical mowing
- Foliar herbicide spraying
- Cut-stubble herbicide spraying
- Pellet or granular herbicide applications
- Low volume basal herbicide applications
- Tree growth regulators

DISTRIBUTION LINE CLEARANCE

3.1 – CLEARANCE GUIDELINES

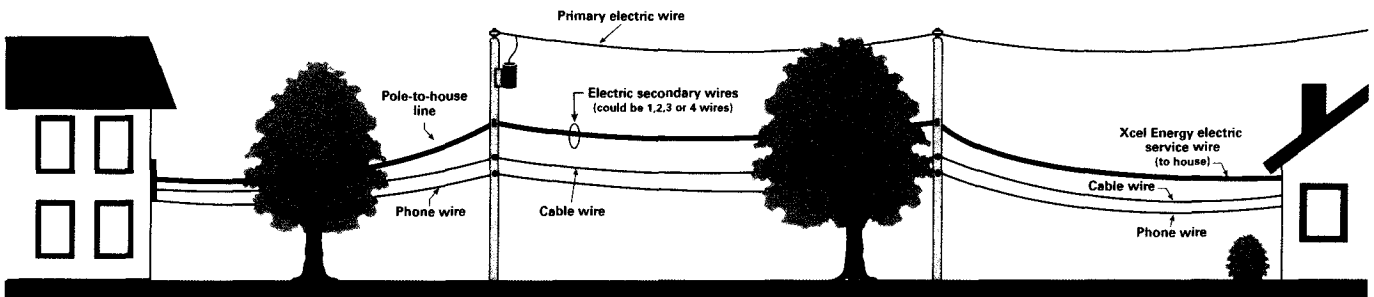
Xcel Energy's clearance guidelines are based on local tree growth rates, specific to individual trees on specific circuits. Specific clearances are determined based on species growth rates, as well as line voltage, construction of facilities, electric reliability performance and other factors.

Therefore, each individual tree needs to be assessed to determine adequate clearance required from the conductor to prevent service interruption, damage to Xcel Energy facilities and threats to public safety. Xcel Energy expects qualified line-clearance tree workers to use their professional judgment to determine what these clearances will be in each situation, based on the proposed maintenance cycle for the circuit on which they are working. Please see "Supplemental Guidelines" document for appropriate operating area.

Contractors shall not rely on the accuracy of the line circuit or feeder maps. Contractors are responsible for obtaining the appropriate clearances on all facilities existing in the field. Xcel Energy does not purposely clear non-company conductor including cable and phone wires.

3.1.1 Definition of Conductor Types

An understanding of the basic distribution system is necessary to determine clearances.



Notification

Xcel Energy expects that a reasonable attempt be made by contractors to notify property owners regarding work to be done. Contractors need to be aware that there are special conditions that may apply to each region (see section 1.1.2).

It is recommended that contractors obtain written acknowledgement from the landowner for all tree and brush removal, including the application of herbicide. (See the Herbicide section for further detail section 7.2)

Refusal

If clearing is necessary and the landowner refuses either access or to allow appropriate pruning and/or removal, the crew will notify their supervisor. If necessary, the supervisor will notify the appropriate Xcel Energy Vegetation Management representative for resolution.

3.1.2 Rights of Way/Easements

Contractors need to be aware that transmission and distribution lines may be constructed where legal easements exist. Special conditions may apply regarding vegetation management activities. If questions arise, contact the appropriate Xcel Energy Vegetation Management representative.

Section 3

3.1.3 Fee-Owned Rights-of-Way

Xcel Energy fee-owned rights-of-way or land is property owned by Xcel Energy. Xcel Energy may have total control of this property subject to conditions, reservations and encumbrances or lease agreements. Adjacent property owner acknowledgement may be required for access. If questions arise, contact the appropriate Xcel Energy Vegetation Management representative.

3.2 – WORK DESCRIPTIONS

3.2.1 Routine Maintenance /Scheduled Work

Routine Maintenance is proactive, scheduled work performed on a circuit/maintenance map basis. In general, all debris is removed, while logs are cut into manageable-sized pieces and left on the property for the customer.

3.2.2 External and Safety Zone Requests

Only qualified tree workers can work on trees that have grown closer than non-qualified tree worker minimum approach distances (see Safety section on page 2). Therefore, Xcel Energy provides adequate clearance so that work by non-qualified workers can be performed safely. These clearance requests are known as “safety zone” requests.

It is important that contractor personnel respond to these requests in a timely manner and in accordance with any laws and regulations. Contractor personnel must also determine the most cost effective course of action to provide adequate clearance. Examples include:

- Pruning the portion of the tree back an adequate distance
- Dropping the tree on the ground
- Requesting that the conductor be de-energized
- If the request pertains to a service line, street light wire or other secondary line, advise the requesting party to call Xcel Energy Customer Service at 1-800-895-4999 and request a “line drop” to temporarily remove the wire from the work zone.

Xcel Energy does not currently charge a fee for the pruning or dropping of trees related to safety zone requests, but it is important that the contractor clearly communicate to the requesting party that all debris will be left on site.

A service fee may apply to the de-energizing of conductors and for line drops. The requesting party should consult Xcel Energy Customer Service for more information by calling 1-800-895-4999.

If inspection by contractor personnel determines that the tree in question has adequate clearance, the requesting party has the option to have any necessary work performed on their own or wait until routine maintenance is performed.

3.2.3 Internal Requests

Various entities within Xcel Energy may request assistance from tree crews to mitigate tree issues. The majority of these requests are due to service reliability problems or to clear trees for the installation of new facilities and the upgrade of existing facilities.

Service Reliability Related Requests

It is important that contractors respond to these requests in a timely manner and in accordance with any instructions provided with the request. In many cases we expect contractors to make a judgment call as to the necessity of pruning. Contractors need to consider all factors, including when the tree is due for routine maintenance when making this decision.

Construction/Cross Charge

These requests pertain to the installation of new facilities and the upgrade of existing facilities. In many cases contractor personnel will be asked to identify trees requiring clearance and to provide information that will be used to estimate the cost of tree clearing. It is important that contractor personnel respond to these requests in a timely manner and in accordance with any instructions provided with the request.

3.2.4 Emergency/Storm Response

Contractor personnel are required to respond to storm situations in accordance with the regional storm response process. Contact the Vegetation Management representative to confirm applicable regional processes. Only work necessary for the restoration of power will be performed. A reasonable attempt should be made to notify customers. No debris disposal will be attempted for any tree work performed.

Section 4

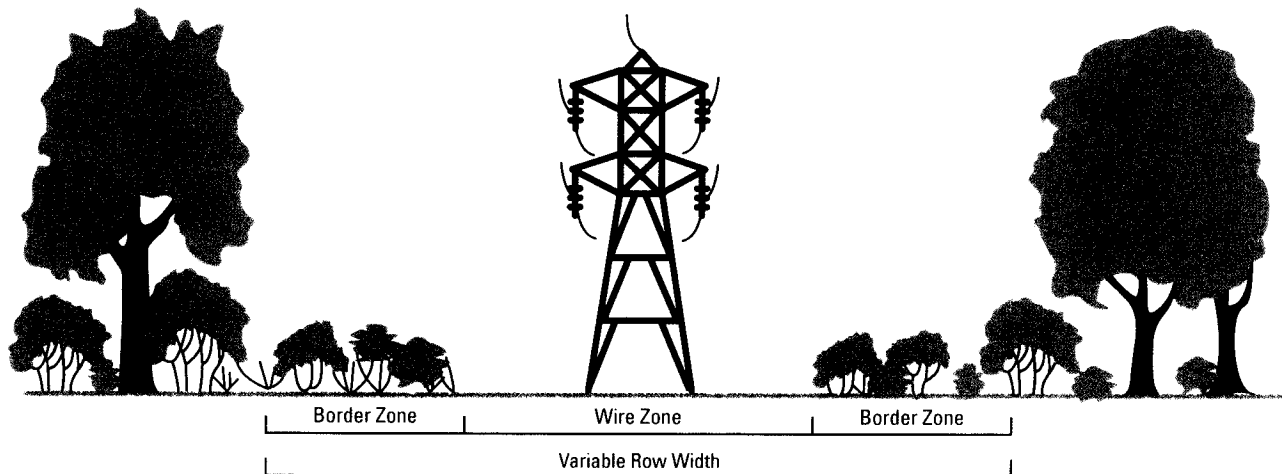
TRANSMISSION LINE CLEARANCE

4.1 – GENERAL GUIDELINES AND PROGRAM PHILOSOPHY

The primary objective of the transmission line clearance program is to keep transmission facilities clear of all tall-growing trees, brush and other vegetation that could grow too close to conductors. This is accomplished by routine maintenance on each transmission circuit including tree removal, pruning, mowing and herbicide application. Each transmission right-of-way (ROW) has an established maintenance cycle depending on work required.

Maintenance objectives include:

- Public and worker safety
- Compliance with regulatory and legal requirements
- Reliable electric service that allows for operational flexibility
- Environmental stewardship and habitat enhancement



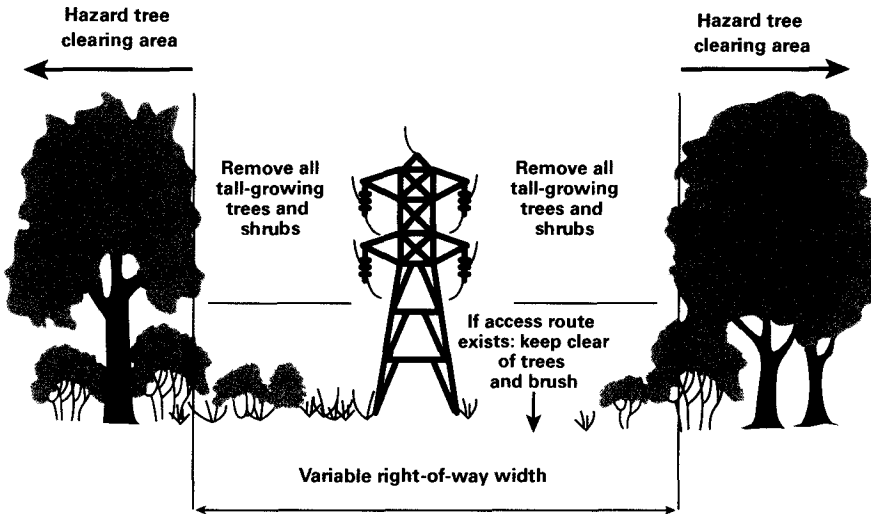
Wherever feasible, the wire zone/border zone concept (Bramble and Byrnes) shall be integrated into the vegetation management program to allow for different types and heights of vegetation in the ROW. The International Society of Arboriculture's booklet titled "Best Management Practices – Integrated Vegetation Management" provides a good working summary of this concept. This concept differentiates between the wire zone directly under the conductors and the remaining border zone.

Generally, this concept allows for different, yet compatible, vegetation types in these separate zones.

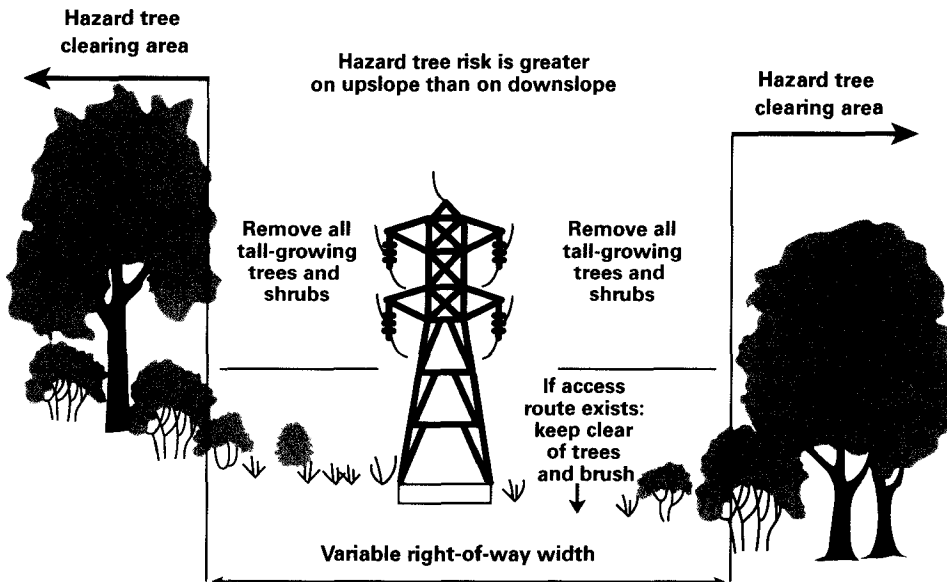
- **Wire Zone:** Area directly underneath the conductor(s). Vegetation in the wire zone consists of low-growing forbs and grasses.
- **Border Zone:** Area that begins at the outside edge of the wire zone and extends to the edge of the easement. The border zone may contain additional low-growing woody plants and trees.
- The wire zone/border zone concept, as applied by Xcel Energy, does not require removal of tall-growing trees if, at maximum mature height, the tree would not come within the distances set forth in the Minimum Clearance Guidelines, even if the tree were to fall toward the conductors.

Areas outside the border zone must be patrolled for hazard trees (see Hazard Tree Mitigation Section 2.2).

Cross-Section of Typical Transmission Right of Way



Special Considerations for Clearing Hazard Trees on Slopes of Right of Way



Section 4

4.1.1 Minimum Clearance Guidelines

If, for any reason, the Wire Zone/Border Zone concept cannot be achieved, the following minimum clearance guidelines are to be maintained at all times, where conductor to ground clearance allows.

Transmission: Maintained Clearances for Trees

All States, All Elevations

**Table A – Horizontal Maintained Tree Clearances at Lowest Sag Point/
Greatest Sway Point**

Voltage(kV)	Up to 400 Ft Span	Up to 800 Ft Span	Up to 1200 Ft Span
69	11 ft	18 ft	28 ft
88	12 ft	19 ft	29 ft
115	13 ft	20 ft	30 ft
161	14 ft	21 ft	31 ft
230	18 ft	25 ft	35 ft
345	22 ft	29 ft	39 ft
500	27 ft	34 ft	44 ft

Table B – Horizontal Maintained Tree Clearances at Structure

Voltage(kV)	Up to 400 Ft Span	Up to 800 Ft Span	Up to 1200 Ft Span
69	11 ft	11 ft	11 ft
88	12 ft	12 ft	12 ft
115	13 ft	13 ft	13 ft
161	14 ft	14 ft	14 ft
230	18 ft	18 ft	18 ft
345	22 ft	22 ft	22 ft
500	27 ft	27 ft	27 ft

**Table C – Vertical Maintained Tree Clearances at Lowest Sag Point/
Greatest Sway Point**

Voltage(kV)	Up to 400 Ft Span	Up to 800 Ft Span	Up to 1200 Ft Span
69	14 ft	18 ft	22 ft
88	15 ft	19 ft	23 ft
115	16 ft	20 ft	24 ft
161	17 ft	21 ft	25 ft
230	20 ft	24 ft	28 ft
345	23 ft	27 ft	31 ft
500	26 ft	30 ft	34 ft

Table D – Vertical Maintained Tree Clearances at Structure			
Voltage(kV)	Up to 400 Ft Span	Up to 800 Ft Span	Up to 1200 Ft Span
69	11 ft	11 ft	11 ft
88	12 ft	12 ft	12 ft
115	13ft	13 ft	13 ft
161	14 ft	14 ft	14 ft
230	17 ft	17 ft	17 ft
345	20 ft	20 ft	20 ft
500	23 ft	23 ft	23 ft

In order to maintain these minimum clearances at all times, crews performing tree work must consider the tree species, growing environment, re-growth rate, maintenance cycle length, etc. in order to determine the amount of clearance required at the time of pruning. The following tables are provided as a guideline only. Each tree requires the evaluation of these factors in order to determine specific re-growth rates.

Table 1 – Operating Area: NSP-MN, NSP-WI		
10 Most Common Tree Species	Average re-growth after trimming (ft)	
	4 Year Cycle	5 Year Cycle
Ash	12	15
Linden	10	12
Box-Elder	24	29
American Elm	20	24
Black Locust	27	32
Silver Maple	22	26
Sugar Maple	14	17
Red Oak	10	12
Weeping Willow	24	31
Cottonwood	24	32

Table 2 – Operating Area: PSC, Less than 6,000 ft	
10 Most Common Tree Species	Average re-growth after trimming (ft): 3 Year Cycle
Spruce/Douglas Fir	5
Pine	5
Russian Olive	11
Silver Maple	12
Tree of Heaven	9
Aspen	5
Cottonwood	20
Siberian Elm	20
Willow	20
Poplar	20

Section 4

Table 3 – Operating Area: PSC, Greater than 6,000 ft

10 Most Common Tree Species	Average re-growth after trimming (ft): 5 Year Cycle
Engleman Spruce	5
Blue Spruce	5
Douglas Fir	5
Lodgepole Pine	5
Ponderosa Pine	5
Aspen	5
Cottonwood	20
Siberian Elm	20
Willow	20
Poplar	20

Table 4 – Operating Area: SPS

10 Most Common Tree Species	Average re-growth after trimming (ft)	
	3 Year Cycle	4 Year Cycle
Siberian Elm	12	14
American Elm	10	12
Willow	10	12
Cottonwood	12	14
Poplar	12	14
Locust	10	12
Pecan	10	12
Mulberry	12	14
Sycamore	10	12
Silver Maple	10	12

The following calculations must be performed to determine clearances necessary at time of pruning:

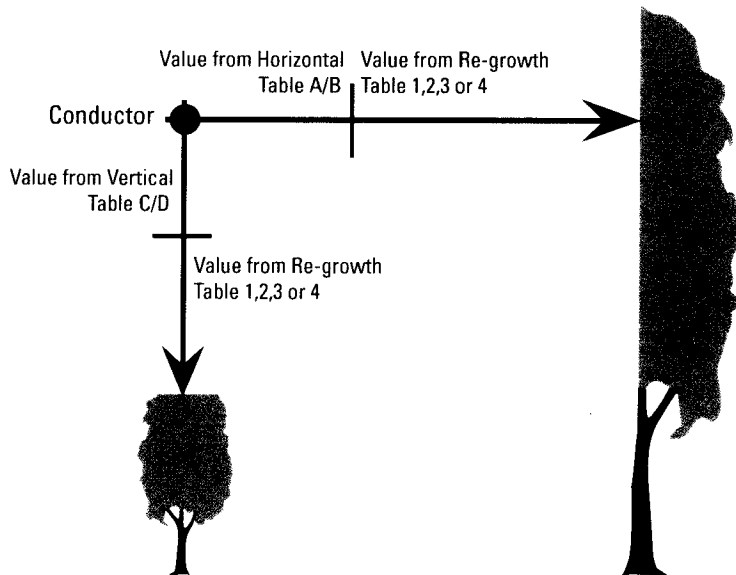
Horizontal Clearance at time of pruning =
(Value from table A/B*) + (Value from table 1, 2, 3 or 4**)

Vertical Clearance at time of pruning =
(Value from Table C/D*) + (Value from Table 1, 2, 3 or 4**)

* Please note that clearances are provided at two points along the span for both horizontal and vertical clearance. There is one table for clearances at the low point of the conductor (belly of the line) and the second table for clearance at the structure. The difference between tables A & C, and B & D is the sag/sway factor. Depending on where the tree is located, determine best number to use utilizing these numbers as a guideline.

**Chose table based on which operating area you are working in as well as species and established maintenance cycle. This table is intended as a guideline only. For species and maintenance cycles not listed, determine appropriate clearance from twig growth increment.

Calculating Horizontal and Vertical Minimum Clearances



Rights of Way/Easements

Contractors need to be aware that transmission and distribution lines may be constructed where legal easements exist. Special conditions may apply regarding vegetation management activities. If questions arise, contact the appropriate Xcel Energy Vegetation Management representative.

Fee-Owned Rights-of-Way

Xcel Energy fee-owned rights-of-way or land is property owned by Xcel Energy. Xcel Energy may have total control of this property subject to conditions, reservations and encumbrances or lease agreements. Adjacent property owner acknowledgement may be required for access. If questions arise, contact the appropriate Xcel Energy Vegetation Management representative.

4.2 – WORK DESCRIPTIONS

4.2.1 Routine Maintenance /Scheduled Work

Routine Maintenance is proactive scheduled work performed on a circuit/maintenance map basis.

Maintenance Work Within the Easement

- Before entering any easement tract or private property for the purpose of right-of-way clearing, as a courtesy, an effort shall be made to contact the property owner.
- The property owner shall be informed of the work to be done, and an agreement reached on the disposal of debris. Be aware that a landowner's easement may contain specific language pertaining to vegetation issues.
- Contractors are expected to determine the most cost-effective method of completing all work performed.
- If the contractor is unable to contact/locate the owner of any property where work is required, report the situation to an Xcel Energy Vegetation Management representative.

Section 4

- If it is necessary to enter the property owner's land to gain access to the right of-way, an agreement should be reached on the best route. If an agreement cannot be reached or in the case of an absentee owner, the contractor shall notify their Xcel Energy Vegetation Management representative.
- If any damage to property or crops results, the contractor is responsible for the related claims unless other provisions are made with Xcel Energy.
- If a property owner submits a claim, the contractor should contact the owner immediately.

Maintenance Work Outside the Easement:

The contractor shall obtain a signed, written acknowledgement for any removal or herbicide work done beyond the bounds of Xcel Energy easement or rights of way.

4.2.2 External and Safety Zone Requests

Only qualified tree workers can work on trees that have grown closer than non-qualified tree worker minimum approach distances (see Safety section on page 2). Therefore, Xcel Energy provides adequate clearance so that work by nonqualified workers can be performed safely. These clearance requests are known as "safety zone" requests.

It is important that contractor personnel respond to these requests in a timely manner and in accordance with any laws and regulations. Contractor personnel must also determine the most cost effective course of action to provide adequate clearance. Examples include:

- Prune the portion of the tree back an adequate distance
- Drop the tree on the ground

Xcel Energy does not currently charge a fee for the pruning or dropping of trees related to safety zone requests, but it is important that the contractor clearly communicate to the requesting party that all debris will be left on site.

If inspection of a request by contractor personnel determines that the tree in question has adequate clearance, the requesting party has the option to perform any necessary work or wait until routine maintenance is performed.

4.2.3 Internal Requests

Various entities within Xcel Energy may request assistance from tree crews to mitigate tree issues. The majority of these requests are due to service reliability problems (results of routine patrol process) or to clear trees for the installation of new facilities and the upgrade of existing facilities.

Service Reliability Related Requests

It is important that contractors respond to these requests in a timely manner and in accordance with any instructions provided with the request. In many cases we expect contractors to make a judgment call as to the necessity of pruning. Contractors need to consider all factors including when the tree is due for routine maintenance when making this decision.

Construction/Cross Charge

These requests pertain to the installation of new facilities, the upgrade of existing facilities or work on facilities that are jointly owned. In many cases contractor personnel will be asked to identify trees requiring clearance and to provide information that will be used to estimate the cost of tree clearing. It is important that contractor personnel respond to these requests in a timely manner and in accordance with any instructions provided with the request.

4.2.4 Emergency/Storm Response

Contractor personnel are required to respond to storm situations in accordance with the regional storm response process. Only work necessary for the restoration of power will be performed. A reasonable attempt should be made to notify customers. No debris disposal will be attempted for any tree work performed.

Contractors shall report hazards found as part of the overhead safety inspection program, which is performed in concert with transmission and distribution line clearance operations.

Section 5

OVERHEAD SAFETY INSPECTION PROGRAM

5.1 – Scope

Contractors perform this inspection as part of their normal duties. During the course of routine line clearance operations, all spans of overhead primary conductor will be inspected, regardless of the presence of vegetation. While on each job site, contractors should also inspect secondary and service conductors.

Contractors are to identify obvious safety hazards on Xcel Energy's distribution and transmission overhead facilities that could pose a threat to the general public as well as our employees and contracted workers. Hazards that present an imminent threat to personal or public safety must be resolved immediately. Depending upon the urgency of the situation, it may be necessary for the inspector to stay on site until a utility representative arrives at the scene.

When a hazard is identified, complete the "Overhead Safety Inspection Form." The completed original document shall be given to the Xcel Energy Vegetation Management representative for distribution to the appropriate Field Operations manager.

Sample List of Hazards

The following is a sample list of safety hazards that contractors should be able to recognize. Please note that all situations cannot be listed and good judgment must be used when inspecting.

Overhead Facilities

- Cracked or broken cross arms
- Missing cross arm braces
- Guy wires missing or damaged
- Tripping hazards, such as ground wire sticking out from pole
- Oil-filled equipment leaks
- Equipment ready to fall down
- Transmission right-of-way encroachment
- Clearances of conductors – from buildings, tree houses, ladders, transmission, etc.
- Leaning pole, tower or footing
- Rotted or eroding pole, tower or footing
- Bird nest on a structure
- Significant woodpecker damage to a pole or tower
- Wires down or broken
- Severely frayed conductor or neutral/static wires
- Wires off insulator or pin
- Ground clearances
- Damage to insulator
- Damage to pole top pin
- Damage to pole steps
- Accessible objects hanging from lines

Other Facilities

- Meter housing loose from structure
- Mast or riser pulling from housing
- Wires exposed
- Doors to underground equipment and vaults unlocked or open

LANDSCAPE MAINTENANCE & WEED ABATEMENT

Xcel Energy's Vegetation Management group is also responsible for maintaining vegetation at electric substations and high- and low-pressure gas facilities. In some areas, Xcel Energy Vegetation Management is also responsible to provide vegetation control services at power plants and at facilities such as offices and service centers, microwave sites, and other corporate-owned property.

Facilities located on federal lands and some private properties require special notification and treatment types. Contractors are required to contact the appropriate Xcel Energy Vegetation Management representative, who will provide site-specific information.

Section 7

MISCELLANEOUS VEGETATION MANAGEMENT

7.1 – VEGETATION MANAGEMENT SYSTEM (VMS)

The VMS application houses all the contractor activity, circuit and facility detail and work history, and customer request information.

7.1.1 Activity Reporting

Xcel Energy will provide contractors with crew activity booklets. Line clearance contractors are to record their time and activity daily, according to each type of activity performed on these sheets.

7.2 – HERBICIDE GUIDELINES

7.2.1 Applying Herbicide

All herbicide and treatment methods used by the contractor shall have prior approval by an Xcel Energy Vegetation Management representative. Product labels and Material Safety Data Sheets (MSDS) must be provided to the appropriate Xcel Energy Vegetation Management representative.

Precautions

- Do not apply herbicides outside of easement right-of-way boundaries except in cases where land-owner's written acknowledgement has been obtained.
- If a property owner should object to any of the herbicide treatments, the operation shall immediately be discontinued on that property until any issues are resolved.
- Bare-ground treatment should be applied to transmission switch grates.

Spills or Accidents

Any spill, leak, fire or other accident involving herbicides **must be reported immediately** to Xcel Energy (see Special Conditions for North and South) and the appropriate state agency.

Xcel Energy Contacts				
	Colorado	Texas, New Mexico	Minnesota, South Dakota, North Dakota	Wisconsin
Emergency Pager	303-556-1244	806-674-1890	612-534-5007	N/A
24 Hour Hotline	800-541-0918	If no answer, leave a message with your name, phone number, location and the nature of the emergency. You will be contacted as soon as possible.	800-393-3900	715-577-0003
General Hotline	303-571-7544		Access Codes: 3900 for Delivery 2 for Energy Supply	715-577-0003
PCB Hotline	303-571-3512		Spill Hotline: 612-330-5972	N/A
General Office	721-497-2147	806-378-2196	612-330-7873	715-839-1346 or 715-839-2691

7.3 – SPECIAL CONDITIONS DOCUMENTS

Specific operational work requirements apply to the company's different operating areas. A copy of the appropriate special conditions should be included with this guideline document. Please request current copies from an Xcel Energy Vegetation Management representative.

7.4 – AVIAN PROTECTION

Xcel Energy's long-term Avian Protection Plan details the company's efforts to improve facilities, primarily distribution lines, and to reduce risks to birds from interactions with company facilities. This plan is part of an agreement outlined in a Memorandum of Understanding with the U.S. Fish and Wildlife Service. The following items in the Avian Protection Plan relate to tree maintenance activity:

- An inactive bird nest is defined as not having eggs or young. If birds are building a nest that doesn't have eggs or young, it is also inactive.
- If line clearance tree workers encounter an inactive nest in a part of the tree which requires pruning, they can remove the nest. There are only two exceptions:
 - Eagle Nest: An inactive eagle nest **cannot** be removed.
 - Osprey Nest: An Xcel Energy/Vegetation Management representative must be contacted prior to the removal of an osprey nest.
- If line clearance tree workers encounter an active nest (eggs or young present), in part of a tree requiring work, the nest cannot be removed until it becomes inactive. The tree may be cleared from the wires, as long as the nest and birds are not disturbed. It is possible that the crew may need to return to complete the tree work once the nest becomes inactive. These situations must be reported to the Xcel Energy Vegetation Management representative, who will contact the appropriate Environmental Services representative.
- If line clearance tree workers find a dead or injured bird that had come into contact with a line, they must contact their general foreman. The general foreman will then contact the assigned Xcel Energy Vegetation Management representative, who will contact the appropriate Environmental Services representative.
- Contract general foremen are responsible for keeping the avian protection glove box kit, including the U.S. Fish & Wildlife Service Special Purpose Permit, on their trucks at all times.

7.5 – RESPONSIBLE TREE PLANTING

Xcel Energy's "Plant a Better Future" book provides customers detailed information regarding power line compatible tree planting. Please note that there are three versions, one each for Texas/New Mexico, Colorado, and the combined northern states. Call Xcel Energy Customer Service at 1-800-895-4999 to request copies.

Notes
