FILE

PUCO EXHIBIT FILING

Date of Hearing: 7/25/2013

Case No. 09-492-EL-CSS

PUCO Case Caption:

Mary-Martha + Dennis Corrigan

vs.

The Cleveland Electric Illuminating Co.

List of exhibits being filed:

Corrigan 1-14

Company 1-3

Reporter's Signature: Julieanna Hennebert

Date Submitted: 8/8/2013

BEFORE THE PUBLIC UTILITIES COMMISSION OF OHIO

- - -

In the Matter of: Mary-Martha and Dennis Corrigan,	:	
Complainants,	:	
vs.	:	Case No. 09-492-EL-CSS
The Cleveland Electric Illuminating Company,	:	
Respondent.	:	

- - -

PROCEEDINGS

before Jonathan Tauber and Mandy W. Chiles, Attorney Examiners, at the Public Utilities Commission of Ohio, 180 East Broad Street, Room 11-C, Columbus, Ohio, called at 10:00 a.m. on Thursday, July 25, 2013.

- - -

ARMSTRONG & OKEY, INC.
222 East Town Street, 2nd Floor
Columbus, Ohio 43215
(614) 224-9481 - (800) 223-9481
Fax - (614) 224-5724

- - -

CV 535563

the Illuminating Company
A FirstEnergy Company

735 Bradley Road
Westlake, Ohio 44145

July 1, 2004

4520 Outlook Dr.
Brooklyn, OH 44144

Dear Dennis Corrigan:

Asplundh Tree Expert Company has not been able to contact you to discuss keeping our 138,000 volt electrical transmission right-of-way located on your property clear of vegetation. The Illuminating Company is required to maintain safe and reliable electrical service to all our customers. The incompatible tree species, on or adjacent to this right-of-way, are being removed because they are causing or have the potential to cause reliability and safety concerns and prevent our employees and contractors from having safe and efficient access to our electrical system. The right to remove trees on our right-of-way was granted to Cleveland Electric Illuminating Company in two easements signed by Phil J. Field et al on January 13, 1926, recorded in Volume 3435, page 302-303 of Cuyahoga County Records; and Mr. and Mrs. Herman Schmitt on July 30, 1945, recorded in Volume 6020, page 138-139 of Cuyahoga County Records.

Having inspected your property and determined that work is required, I have instructed Asplundh Tree Expert Company to remove incompatible trees on your property that have the potential to interfere with our electrical system or that impede the safe and efficient operation of our electrical system. This work will begin on or after July 11, 2004.

Your cooperation and understanding are appreciated. If you would like to discuss the specific work prescribed please contact me at 1-800-589-3101 ext. 8051.

Thank you,

Jennifer Burick

Forestry Transmission Specialist
ISA Certified Arborist

Cc: Real Estate Section
Jerry Western

PLAINTIFF'S EXHIBIT 5

PENGAD 800-631-6989 EXHIBIT Corrigan 1

AFFIDAVIT EXHIBIT 1

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894
www.forestcitytree.com

100th Anniversary 1910 - 2010

INVOICE

NO. 7830652

18515-18515.0

REMARKS/RECOMMENDATIONS

SILVER MAPLE TREE IN BACK YARD, REMOVE TWO (2) 12" LARGE SECTIONS FROM THE TOP OF EACH TRUNK DUE TO DECAY/HOLLOW AT POINT OF CONNECTION TO TRUNK. MAINTENANCE PRUE TO REDUCE HEIGHT & WEST-DIRECTED LIMBS.

Customer: Please contact our office about the following recommendations noted by our technician.

- ☐ Additional Disease or Insect Control Applications
- ☐ Tree/Shrub Pruning
- ☐ Tree/Shrub Fertilizing
- ☐ Cabling and Bracing for support
- ☐ Tree Removal

1-1/2% per month on overdue accounts

PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

CHARGE [illegible]

DUE UPON COMPLETION

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4573 OUTLOOK DR
BROOKLYN, OH 44144

LOCATION 4573 OUTLOOK DR

Thank You

Saul
Crew Chief/Applicator

DATE 4-27-12

TIME ✓

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	Would you recommend our services to your friends and relatives?			

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.
OUR BUSINESS IS BUILT ON OUR REPUTATION AND REFERRALS FROM CUSTOMERS SUCH AS YOU.

REFERRAL Name & Phone #: _____

CUSTOMER NAME [illegible]

CHARGE [illegible]
TAX [illegible]
PAID
PLEASE REMIT [illegible]
ACCOUNT NO. [illegible]

SEND PAYMENT TO:

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894
MasterCard • Visa • Discover Accepted

(please return this portion with your payment)

Card No. _____
Exp. Date _____ 3digit code _____
Signature _____

AMOUNT PAID

CHECK NO.

EXHIBIT
Corrigan
2

PENGAD 800-631-6989

Page No.	of	Pages.

0014

forest city tree protection co.
A LANPHEAR SERVICE
1884 SOUTH GREEN RD.
SOUTH EUCLID, OH 44121

(216) 381-1700 www.forestcitytree.com
VISA, M/C & DISCOVER ACCEPTED

JOB ESTIMATE

03/29/2012 RF 03/30/2012

TO

MRS. MARY MARTHA CORRIGAN
[illegible]
BROOKLYN, OH 44144

Appt: 04/17/2012 10.30 AM

PHONE 216 661-6789

DATE 4/17/12

JOB NAME / LOCATION 10517-7

Inspected by Lauren 10:50am

JOB DESCRIPTION:

CALL TO INSPECT TREE IN BACK.

I made a careful inspection of your silver maple & identified two (2) large sections, 1 at the top of each trunk, that should be removed due to decay/hollows at point of connection to trunk. Each is approx 12" diameter.
At the same time this is done the maintenance pruning to reduce height & west-directed limbs ~~should~~ be performed.
$845.00 + tax

[illegible] 50% deposit requested at time of order, w/balance due upon completion.
[illegible] 5% discount applies if prepaid in full.
[illegible] W TO RIDGE, N TO [illegible], W TO ROADWAY, W TO BENCH, W TO [illegible].

ESTIMATED JOB COST

For the sum of

THIS ESTIMATE IS FOR COMPLETING THE JOB AS DESCRIBED ABOVE. IT IS BASED ON OUR EVALUATION AND DOES NOT INCLUDE MATERIAL PRICE INCREASES OR ADDITIONAL LABOR AND MATERIALS WHICH MAY BE REQUIRED SHOULD UNFORESEEN PROBLEMS OR ADVERSE WEATHER CONDITIONS ARISE AFTER THE WORK HAS STARTED.

NOTE: This estimate may be withdrawn by us if not accepted by 10 days

ESTIMATED BY [signature]

Forest City Tree Protection Co.

a lumpkin service

100th Anniversary 1910 2010

INVOICE

REMARKS/RECOMMENDATIONS

Customer: Please contact our office about the following recommendations noted by our technician.

- [ ] Additional Disease or Insect Control Applications
- [ ] Tree/Shrub Pruning
- [ ] Tree/Shrub Fertilizing
- [ ] Cabling and Bracing for support
- [ ] Tree Removal

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

1-1/2% per month on overdue accounts
PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

CHARGE

DUE

UPON COMPLETION

LOCATION

Thank You

Crew Chief/Applicator

DATE 4/17/12

TIME 10:50 am

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE box)

YES	NO		YES	NO	
[ ]	[ ]	The technician came to your satisfaction.	[ ]	[ ]	The jobsite was left clean & neat.
[ ]	[ ]	You were treated courteously by our crew.	[ ]	[ ]	Were your questions answered satisfactorily?
[ ]	[ ]	Would you recommend our services to your friends and relatives?			

SUGGESTIONS: For inspection & maintenance work for tree health and longevity

CHARGE 900.00

TAX

PLEASE REMIT 959.96

[ ] PLEASE HAVE CREW LEADER OR REPRESENTATIVE CALL.

REFERRAL

CUSTOMER NAME

ACCOUNT NO.

Forest City Tree Protection Co.

a lumpkin service

Card No.

Exp. Date

3dig# code

Signature

AMOUNT PAID

CHECK NO.

Master Card - Visa - Discover Accepted

(please return this portion with your payment)

MARY MARTHA CORRIGAN
4520 OUTLOOK DR.
BROOKLYN, OH 44144
216-681-6789

1933
6-7572/2410

4-16-12
Date

Pay To The Order Of Forest City Tree Protection Company $ 959.96

Nine Hundred Fifty-nine Dollars and 96 Dollars

Security Features Details on Back

FIREFIGHTERS COMMUNITY CREDIT UNION Cleveland, OH 44114

For Tree Inspection & Maintenance Work Mary Martha Corrigan

⑆241075726⑆109000208 1280⑈ 1933

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894
www.forestcitytree.com

100th Anniversary 1910 - 2010

INVOICE

NO. 7827259

18515-18515.0

REMARKS & RECOMMENDATIONS

PRUNE SILVER MAPLE ON BACK LINE: REMOVE SUCKER GROWTH ON BACK/WEST SIDE; REDUCE HEIGHT BY 6-8'; THIN-OUT TO REDUCE WIND RESISTANCE & SNOW LOAD; REMOVE DEADWOOD (1 1/2" DIAMETER & LARGER); REMOVE TOP SECTION (10-12") ON NORTH TRUNK THAT HAS DECAY WHERE IT CONNECTS TO TRUNK; INSTALL ONE (1) CABLE (3/8") BETWEEN 2 MAIN SECTIONS.

Customer: Please contact our office about the following recommendations noted by our technician.

- ☐ Additional Disease or Insect Control Applications
- ☐ Tree/Shrub Pruning
- ☐ Tree/Shrub Fertilizing
- ☐ Cabling and Bracing for support
- ☐ Tree Removal

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

1-1/2% per month on overdue accounts

PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

CHARGE
895.00

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

DUE UPON COMPLETION

LOCATION 4520 OUTLOOK DR

Thank You

SAM
Crew Chief/Applicator

DATE 6-16-11

TIME _____

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	Would you recommend our services to your friends and relatives?			

3

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.
OUR BUSINESS IS BUILT ON OUR REPUTATION AND REFERRALS FROM CUSTOMERS SUCH AS YOU.

REFERRAL Name & Phone #: _____

CUSTOMER NAME MRS. MARY MARTHA CORRIGAN

CHARGE	850.25
TAX	65.89
~~PLEASE PAY~~	PREPAID
ACCOUNT NO.	18515.0

SEND PAYMENT TO:

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894

MasterCard • Visa • Discover Accepted

(please return this portion with your payment)

Card No. _____

Exp. Date _____ 3digit code _____

Signature _____

AMOUNT PAID

CHECK NO.

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894
www.forestcitytree.com

100th Anniversary 1910 - 2010

INVOICE

NO. 7826797

18515-18515.0

REMARKS/RECOMMENDATIONS

SOIL APPLICATION OF PLANT GROWTH REGULATOR TO RE-DIRECT ENERGY FROM VEGETATIVE GROWTH TO ROOT GROWTH, DEFENSE, AND STORAGE.
LARGE SILVER MAPLE ON BACK LINE.

Customer: Please contact our office about the following recommendations noted by our technician.

☐ Additional Disease or Insect Control Applications
☐ Tree/Shrub Pruning ☐ Tree/Shrub Fertilizing
☐ Cabling and Bracing for support ☐ Tree Removal

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

1-1/2% per month on overdue accounts
PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

CHARGE 275.00
DUE UPON COMPLETION

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

LOCATION 4520 OUTLOOK DR

Thank You
Nick B
Crew Chief/Applicator
DATE 21 Jun 2011
TIME 9:30

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	Would you recommend our services to your friends and relatives?			

3

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.
OUR BUSINESS IS BUILT ON OUR REPUTATION AND REFERRALS FROM CUSTOMERS SUCH AS YOU.

REFERRAL Name & Phone #: _____

CUSTOMER NAME MRS. MARY MARTHA CORRIGAN

CHARGE 275.00
TAX 21.31
PLEASE REMIT PREPAID
ACCOUNT NO. 18515.0

SEND PAYMENT TO:

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894

MasterCard • Visa • Discover Accepted

(please return this portion with your payment)

Card No. _____
Exp. Date _____ Sign Code _____
Signature _____

AMOUNT PAID

CHECK NO.

Forest City Tree Protection Co.
a lanphear service

100th Anniversary 1910 2010

INVOICE

NO. 7826634

18515-18515.0

REMARKS/RECOMMENDATIONS

INSPECT THE MAPLE TREE IN THE BACK YARD

Customer ... office about the following recommendations noted by our technician.

1-1/2% per month on overdue accounts
PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION
WITH YOUR PAYMENT

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

Thank You
Laren
Crew Chief/Applicator

CHARGE
100.00 MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

DATE 5/18/11

LOCATION 4520 OUTLOOK DR

TIME 11:30a

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES NO

The jobsite was left clean & neat.

Were your questions answered satisfactorily?

3

Payment for: Inspection & Pre-payment for: Pruning, Cabling, Growth Regulator

CHARGE 100.00
TAX 1,197.64
PLEASE REMIT 1,297.64

MRS. MARY MARTHA CORRIGAN

ACCOUNT NO. 18515.0

Forest City Tree Protection Co.

Signature

AMOUNT PAID 1,297.64

CHECK NO. 1899

MARY MARTHA CORRIGAN
4520 OUTLOOK DR.
BROOKLYN, OH 44144
216-661-6789

1899
6-7572/2410

5-21-11
Date

Pay To The Order Of Forest City Tree Protection Co. $ 1,297.64

Twelve Hundred Ninety-seven Dollars and 64/xx Dollars

FIREFIGHTERS COMMUNITY CREDIT UNION
Cleveland, OH 44114

For Inspection, Pruning, Cabling, Growth Regulator

Mary-Martha Corrigan

⑆241075726⑆109000208I280⑈ 1899

Harland Clarke
www.worldwildlife.org
WORLD WILDLIFE FUND

forest city tree protection co.
A LANPHEAR SERVICE
1884 SOUTH GREEN RD.
SOUTH EUCLID, OH 44121

(216) 381-1700 www.forestcitytree.com
VISA, M/C & DISCOVER ACCEPTED

JOB ESTIMATE

05/13/2011 RF 05/16/2011

TO

MRS. MARY MARTHA CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

PHONE	DATE
216 661-6789	
JOB NAME / LOCATION	18515-6

Appt.: 05/18/2011 11:00 AM

JOB DESCRIPTION:

INSPECT THE MAPLE TREE IN THE BACK YARD FOR PRUNING AND HEALTH CARE.

Wounds - Silver maples as a species are not real effective at closing & compartmentalizing wounds. However, insect activity is limited to dead/decaying tissue & does not affect live, healthy wood tissue. Structural integrity depends upon amount of sound wood around perimeter of trunk column(s). In my opinion, there appears to be sufficient amount of sound wood.

Recommend:

(1) Pruning - thin-out to reduce wind & snow load; remove top section (10-12") on north trunk that has decay where section connects to trunk; prune sucker growth on back/west side; remove deadwood; reduce height by 6-8'; install one (1) cable (3/8") between 2 main sections. ~~$415~~ $545.00 + 50.00 materials + tax

(2) Re-apply tree growth regulator $275.00 + tax

50% deposit at time of order w/ balance due upon completion
5% discount applies if prepaid in full.

MAP LOCATION: 15 B1
ROUTING: 3-3WEST
480 W TO RIDGE, N TO BIDDULPH, W TO ROADOAN, N TO BEECH, W TO OUTLOOK.

ESTIMATED JOB COST

For the sum of

THIS ESTIMATE IS FOR COMPLETING THE JOB AS DESCRIBED ABOVE. IT IS BASED ON OUR EVALUATION AND DOES NOT INCLUDE MATERIAL PRICE INCREASES OR ADDITIONAL LABOR AND MATERIALS WHICH MAY BE REQUIRED SHOULD UNFORESEEN PROBLEMS OR ADVERSE WEATHER CONDITIONS ARISE AFTER THE WORK HAS STARTED.

NOTE: This estimate may be withdrawn by us if not accepted by 10 days

ESTIMATED BY Laura Leigh

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894

INVOICE

NO. 7820976

18515-18515.0

REMARKS/RECOMMENDATIONS

BACK: SILVER MAPLE, REMOVE ALL NEW SHOOTS ON BACK/WEST SIDE OF TREE THAT GROW OUTWARDS FROM TREE TOWARDS WIRES (LEAVE ONLY THOSE THAT ARE GOING STRAIGHT UP OR INWARDS; REDUCE HEIGHT BY 10' MINIMUM; THIN-OUT GOOD TO REDUCE WIND AND SNOW LOAD & INCREASE INTERIOR LIGHT & AIR PENETRATION; REMOVE DEADWOOD (1 1/2"+) & RUBBING/CROSSING SECTIONS; TRIM TO PROVIDE CLEARANCE FROM BOTH GARAGE.

Customer: Please contact our office about the following recommendations noted by our technician.

☐ Additional Disease or Insect Control Applications
☐ Tree/Shrub Pruning ☐ Tree/Shrub Fertilizing
☐ Cabling and Bracing for support ☐ Tree Removal

1-1/2% per month on overdue accounts

PAYMENT DUE UPON RECEIPT

RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

Thank You

Crew Chief/Applicator

CHARGE 1331.00

DUE UPON COMPLETION

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

LOCATION 4520 OUTLOOK DR

DATE 12-2-09

TIME

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	*Would you recommend our services to your friends and relatives?*			

3

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.

OUR BUSINESS IS BUILT ON OUR REPUTATION AND REFERRALS FROM CUSTOMERS SUCH AS YOU.

REFERRAL Name & Phone #: _____

CUSTOMER NAME MRS. MARY MARTHA CORRIGAN

CHARGE 1331.00
TAX 103.15

PLEASE REMIT PREPAID

ACCOUNT NO. 18515.0

SEND PAYMENT TO:

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894
MasterCard • Visa • Discover • Amex Accepted

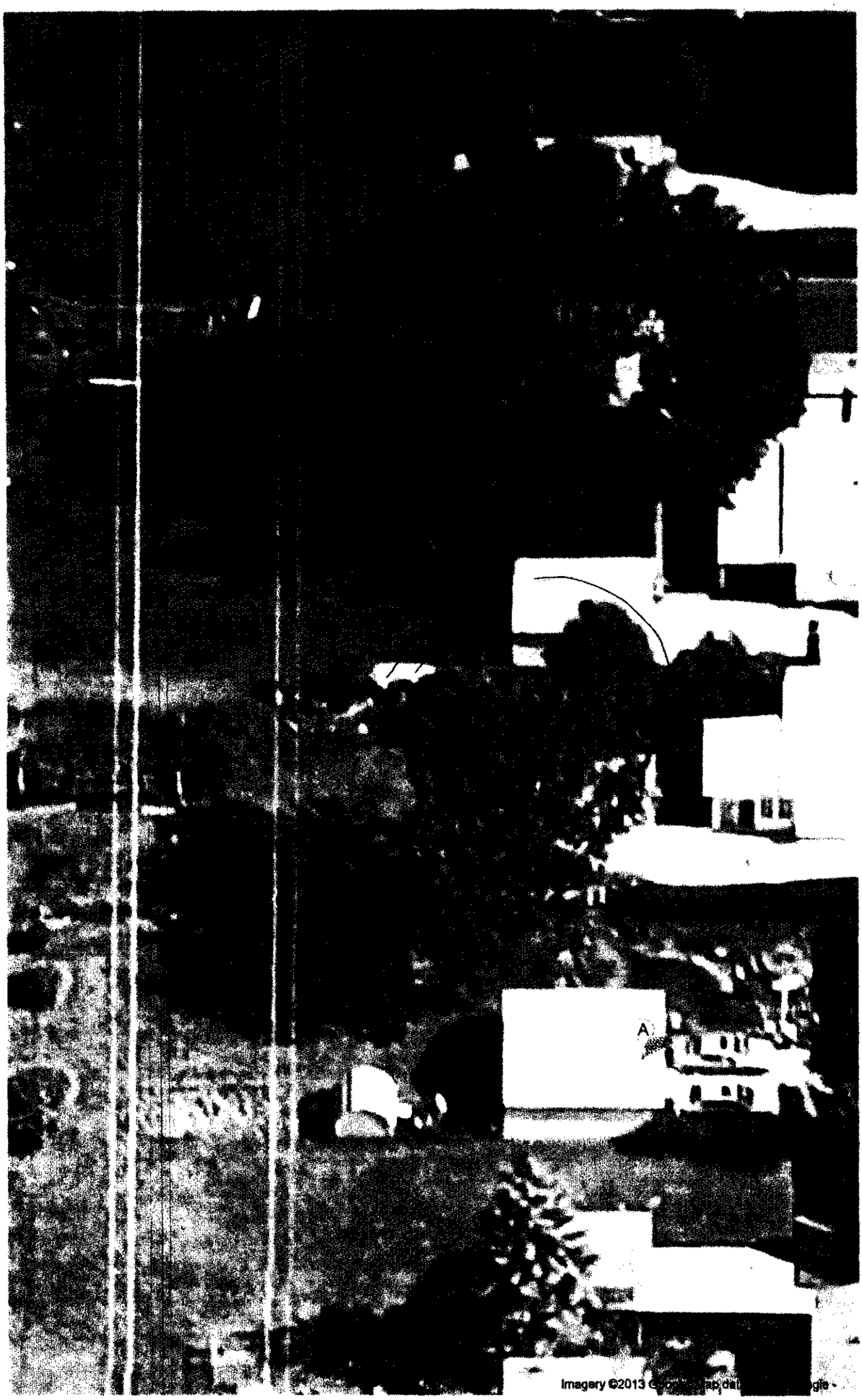
(please return this portion with your payment)

AMOUNT PAID

CHECK NO.

To see all the details that are visible on the screen, use the "Print" link next to the map.

Google



to 12 feet that tree is gone as well, right?

A. If it takes 50 years to grow up to be 12 feet, that tree would not be gone.

Q. You see, this is what I am trying to get at. The potential to grow is very ambiguous. I want to know now the policy of CEI is that any tree that is ten feet or taller, or has the potential of growing to ten feet or taller will be removed from within the right of way, correct?

A. Not all trees, no.

Q. So there are exceptions to the policy then?

A. In a case where we have a very high construction where lines are crossing ravines, and the wires are 120 feet off the ground, the trees can be a hundred feet tall or 90 feet tall and never be removed.

Q. Where is that in your Exhibit C? Where does it say that?

A. It talks about controlling incompatible vegetation. So vegetation that might be incompatible in one location could be compatible in another location. Again, it's back to the species of the tree, the location of the tree, and the electrical facilities that are there.

Q. Judgment call?

A. Yes.

Q. How far away is the trunk of the tree from -- I

A. I'm saying if the crown was reduced to the level that it was originally reduced, it would be such a severe removing of biomass from that tree it could be devastating or life threatening to the tree. I'm also saying if the biomass is removed from where the crown was reduced previously, there is no guarantee there would be five years of adequate reliable safe clearance.

Q. Do you have any reason why this crown was reduced over the years and you can't do it now?

A. The only reason that I believe it was reduced previously was at the time the accepted best practice was pruning. Now the best practice is removal.

Q. As of what date?

A. The accepted best practice as far as removal?

Q. Yes.

A. That was begun in and around 2000. Probably 1999 to 2000 when the specification book was originally written.

Q. So when CEI came in from 1999 through 2003 they did not practice the accepted best procedures in removing the trees?

A. Not on this tree, no.

Q. They felt that you could still maintain this tree?

A. Yes.

Q. Do you have any reason to believe this tree has

compilation of both utility systems plus some outside consultants who looked at industry practices throughout the entire utility industry in the United States.

Q. In your experience did Ohio Edison, prior to the merger, engage in removal of trees?

A. Yes.

Q. And how did this new policy that was developed in 2000, how has it been since implemented by First Energy?

A. It has been implemented in that it is incorporated into our contracts with all our line clearing contractors, and we are working to implement this in its entirety throughout all of First Energy.

Q. That would be Ohio and beyond?

A. Yes. After the Centerior/Ohio Edison merger there was a second merger that incorporated what was known as the GPU Companies, and this specification is now something that First Energy uses from the Toledo Edison area all the way to the Jersey Central power line.

Q. Obviously utility companies can't implement clearing specifications all at once if you have 5,000 lines throughout Ohio. Can you describe for me the process by which you would move along any given line?

A. In implementing the specifications, and also looking at the system, we began to implement the specifications and we implemented them based upon the

FirstEnergy Corp.

FORESTRY WORK REFUSAL FORM

FORM 418 (REV. 11-00)

ID NO. 58057163

1 stump

CIRCUIT / LINE NAME		POLE NO.
Q-11-FX-CL-X		3255 TO 3256
PROPERTY OWNER NAME: Dennis Corrigan	HOME PHONE NO.: 216-661-6789	WORK PHONE NO.
ADDRESS: 4520 Outlook DR	STATE: OH	ZIP CODE

SECONDARY	DISTRIBUTION				TRANSMISSION		
☐ POLE TO POLE ☐ SERVICE	☐ 1ø	☐ 3ø	☐ 23 kV	☐ 34 kV	☐ 69 kV	☒ 138 kV	☐ 345 kV

WORK REQUIRED

REMOVE 1- MAPLE BEHIND GARAGE

REASON(S) FOR REFUSAL

CAN TRIM ONLY.

DID NOT GIVE NAME ON DOOR CARD

ORIGINAL CONTRACTOR CONTACT: C. FASSOS	DATE: 6-23-04
CONTRACTOR SUPERVISOR: C FASSOS	DATE: 6.23.04
FIRSTENERGY REPRESENTATIVE	DATE

ACTION REQUIRED

Sent letter 7/1/04. Need to speak w/ GNW forester.

7/6/04: Spoke w/ Mrs. Corrigan + daughter regarding Silver maple removal in RTW. OK to remove maple on or after 7/11/04. No! Received temporary restraining order* 7/12/04.

Grind stump

WORK AUTHORIZED

DATE

EXHIBIT

Corrigan 6

VENGAD 800-631-6989

GENERAL NOTIFICATION

WORK TYPE: Tree Trimming - Inquiry

Notification: 702709187 Type: GN
CREWS Work Request No.: 5977080

Order:
Crew Code:

Short Text: FORI Tree Trimming - Inquiry TREE TRIMMI
Required Start: 06/23/2004 @ 00:00:00

Reported by: DENNIS CORRIGAN

Phone: (216)661-6789

BUSINESS PARTNER

Business Partner No.: 800912331
DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN OH 44144

Contract Acct. No.: 110021961302
Phone: (216)661-6789

PREMISE INFORMATION

Premise No.: 1450012822
4520 OUTLOOK DR
BROOKLYN OH 44144

Phone: (216)661-6789

TECHNICAL INFORMATION

Pole Key:
Circuit:
Substation:
Maintenance Group: 511 (Brooklyn)
Tax District: 00005213
Tax Location: BROOKLYN - OH
Tax County: CUYAHOGA

Meter: 4026503 1 Phase

Main Wrk Ctr: ONLBK

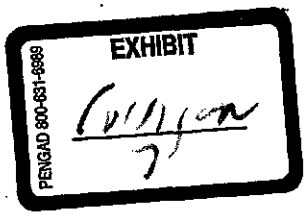
Long Text:
* mrs corrigan called to say that she doesnt want the tree cut dn she wants someone to contact her before anyone touches the tree--c.thompson
Tree Trimming - Inquiry DEVICE SERIAL NUMBER: 00000000004026503 1PH 3W FM2S 240V CL200;NO KYZ KWH1 2S2420W DIST. CONTRACT NUMBER: 0121253450 CONTRACT ACCOUNT NUMBER: 110021961302 OWNERSHIP STATUS: 01 FE Owned

Comments:

Work Complete: _____/____
(Malfunct. End) Date / Time

Name (Please Print)

Complete in: PRO(010)



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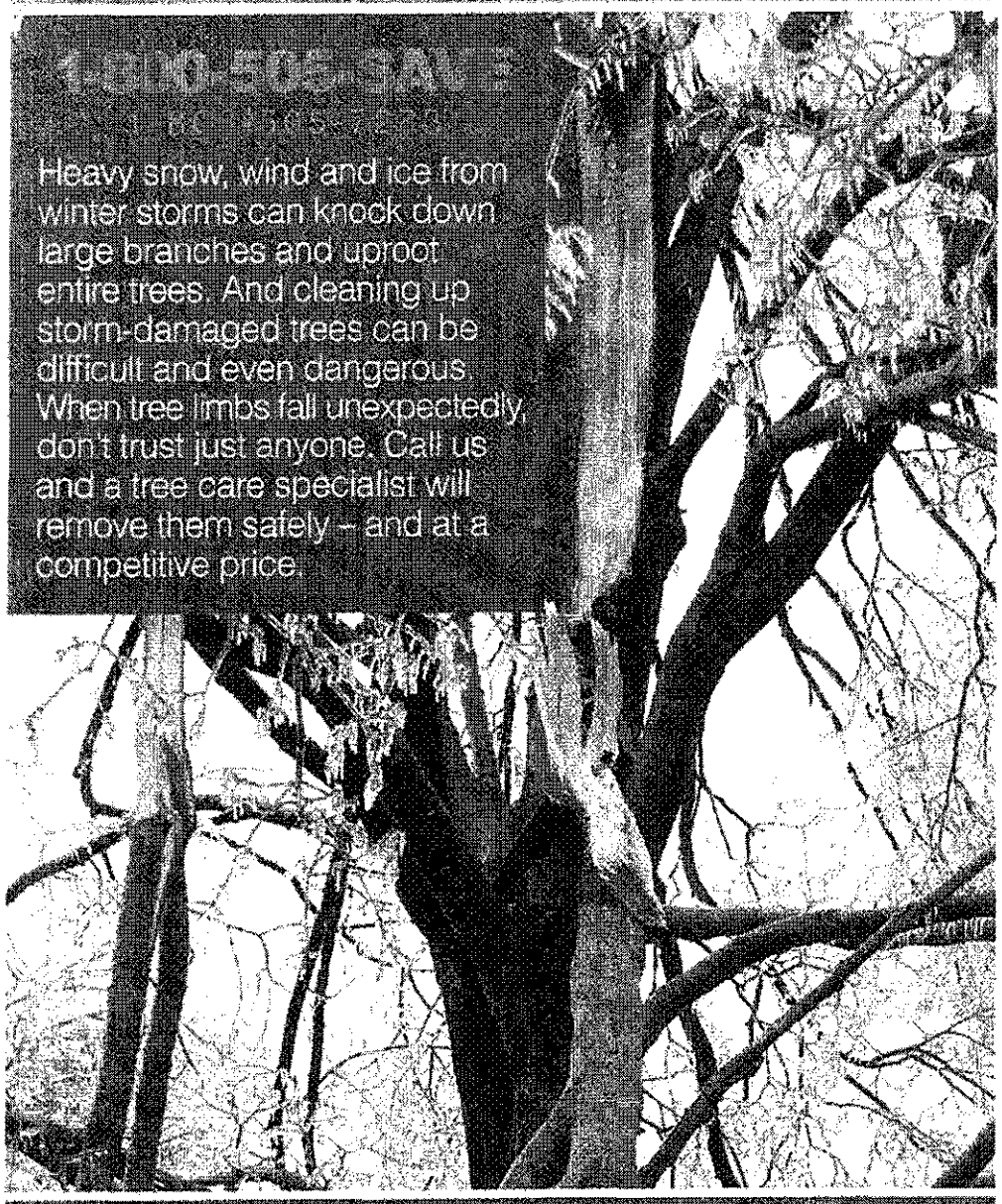

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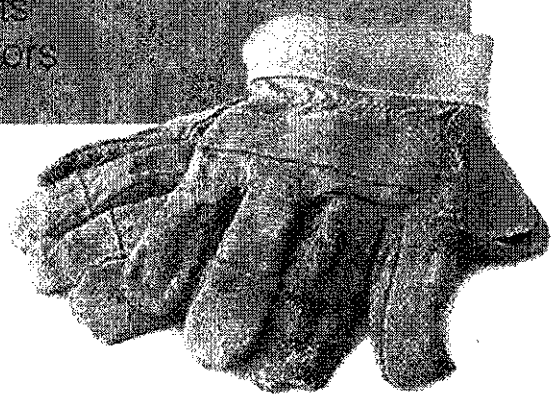

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National Aeronautics and Space Administration

System Failure Case Studies

December 2007 Volume 1 Issue 10

POWERLESS

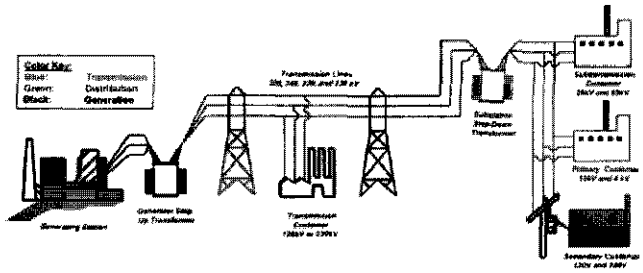
On August 14, 2003, the United States and Canada experienced the largest electrical power blackout in North American history. It was a massive power outage that affected parts of the northeastern U.S. and eastern Canada. Approximately 40 million people in eight U.S. states (about one-seventh of the population of the U.S.) and 10 million people in the Canadian province of Ontario (about one-third of the population of Canada) were impacted. The cost of financial losses related to the outage was estimated at $4 to $10 billion. The shutdown was the result of a monitoring and diagnostic systems failure coupled with communications problems between operations and support staffs, and a lack of systems understanding and planning by utility operators.

BACKGROUND: "THE GRID"

The North American power grid is one large, interconnected system, considered to be one of the greatest engineering achievements of the past 100 years. Its infrastructure is valued at more than $1 trillion, with more than 200,000 miles of transmission lines operating at 230,000 volts and greater, 950,000 megawatts of generating capability, and 3,500 utility organizations serving well over 283 million people.

The electrical power system or grid produces electricity from fuel sources, such as nuclear, coal, oil, natural gas, hydro power, geothermal, etc. Low voltage electricity from the generators (10,000 - 25,000 volts) is "stepped up" to higher voltages (230,000 - 765,000 volts) for transmission over power lines. Transmission lines are interconnected at switching stations and substations to form a network. Electricity flows through the network following the laws of physics—along "paths of least resistance," the same way that water flows through a network of canals. When the power arrives near a load center, it is stepped down to lower voltages for distribution to residential customers (120 and 240 volts) or larger industrial and commercial customers (12,000 - 115,000 volts).

Electrical power cannot easily be stored over extended periods of time, and is consumed immediately after being generated.



Basic Structure of the Electric System.

The demand load on any power grid must be matched by its supply and ability to transmit that power. Any significant overload of a power line or underload/overload of a generator requires utilities to disconnect the line or generator from the grid to prevent hard-to-repair and costly damage.

Although the power system in North America is commonly referred to as the grid, it is actually a group of three distinct power grids or that are electrically independent from each other. They are: the Eastern Interconnection, which includes the eastern two-thirds of the continental U.S. and Canada; the Western Interconnection; and the state of Texas.

In August of 2003, the largest blackout in North America occurred, affecting 50 million people at an estimated cost of $4 - $10 billion

Proximate Causes:

- Load imbalance caused by generator shutdown triggered cascading transmission line failure

Underlying Issues:

- Poor communication of software failures
- Inadequate system planning and understanding
- Tree overgrowth near high voltage lines
- Lack of thorough operator training

WHAT SHOULD HAVE HAPPENED?

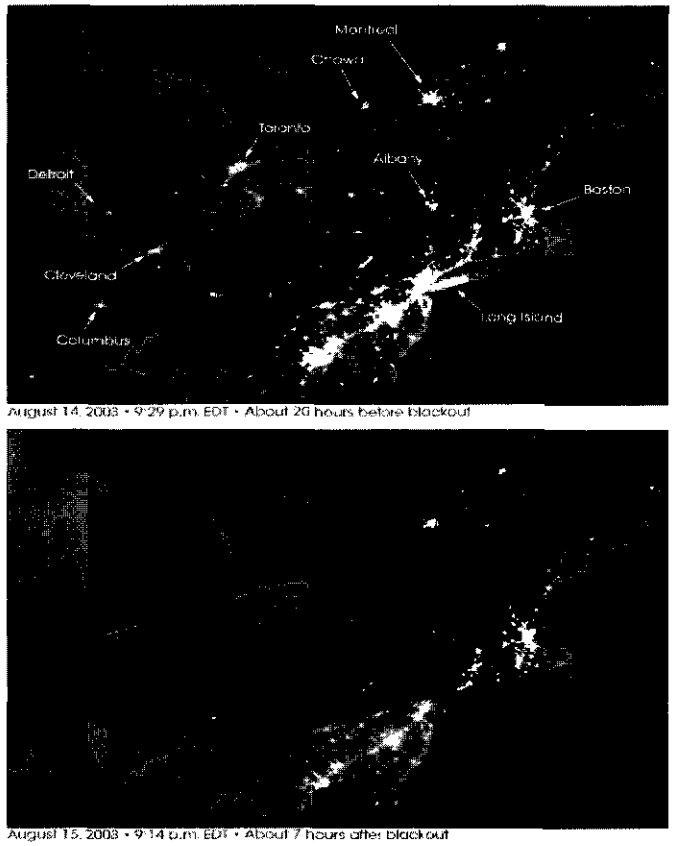
Power lines usually grow longer and sag between transmission towers when they get hotter as they carry more power, reaching a pre-determined height above the ground at a specific power level. To prevent sagging lines from contacting nearby trees resulting in short circuits, the trees are pruned. If the lines touch the trees, they are disconnected by systems which detect the sudden change in power flow from the short circuit. Power changes from an out-of-service line can sometimes cause cascading failures in adjacent areas as other parts of the system see the power fluctuations. These are normally controlled by delays built into the shutdown process and by robust power networks with alternative paths for power to take, which help reduce the size of the ripples. Utility operators at control centers ensure that the power supply, loads (customers' power demand or use), and transmission line capacity, are balanced so that the system is in a state where no single fault can cause it to fail. If a failure occurs, operators are required within 30 minutes to obtain more power from other regions or shed load (meaning cut power to some areas) as a last resort to prevent a system collapse.

Operators use sophisticated monitoring and control computer systems with backups, which issue alarms when faults occur in the transmission or generation system. They also employ power flow modeling tools to help them analyze their grid's status, find parts that are overloaded, and predict worst possible failures, so as to prevent any transmission or generator damage. If their primary and backup computer systems fail, operators are required to monitor their networks manually and invoke pre-planned contingencies if needed. They also notify adjacent area operators of their status so that they determine the effects of the failures on their systems. Backing up the operators are regional coordinating centers which collect information from adjacent areas and perform further checks on the system, looking for possible failures and alerting operators in different systems.

WHAT HAPPENED?

The Ohio Connection

The blackout started with a series of events in Northern Ohio between 12:15 and 4:06 p.m. on August 14, 2003. It was a normal day – the electrical load was moderately high due to the air conditioning demand on a hot summer day. Shortly after noon, Eastlake 5, a power station generator unit owned by FirstEnergy Corporation, an electrical utility servicing the Ohio area, tripped and shut down automatically. The unit tripped when an operator attempted to increase the unit's reactive power output but the power output exceeded the protection system limits and shut down automatically. This supply drop caused a 1,500 megawatt load imbalance to the Cleveland and Akron areas. FirstEnergy's monitoring system failed to alert operators, who were not able to see the problem and correct the imbalance. The imbalance strained and overheated several Cleveland-Akron 345-kV and 138-kV transmission lines, causing them to sag and fail after touching overgrown trees. The multiple failures resulted in a large decrease in available power which caused a heavy power surge to a key 345-kV transmission line called the Sammis-Star line, which later failed after contacting trees.



Satellite Photos of Northeastern U.S. and Canada Before and After the Blackout.

Cascading Failures

The loss of the Sammis-Star line instantly created major and unsustainable burdens on other transmission lines throughout northeastern Ohio and triggered cascading failures throughout Northeastern U.S. and Canada. The cascade started at 4:06 p.m. and spread `in less than seven minutes throughout an area of roughly 9,300 square miles, bounded by Lansing, Michigan, Sault Ste. Marie, the shore of James Bay, Ottawa, metropolitan New York and Toledo. Automatic protective relays in lines and power generating units located in Cleveland, Toledo, New York City, Buffalo, Albany, Detroit, and New Jersey were tripped. More than 508 generating units at 265 power plants, including 22 nuclear power plants, shut

down during the massive outage. FirstEnergy's operators' lack of situational awareness of the events happening in the Cleveland–Akron area was such that they did not execute their contingency plans or alert neighboring control centers to stop the cascade.

Proximate Cause

The unexplained shutdown of a generation unit at Eastlake 5 station resulted in a load imbalance that went unnoticed by operators. The imbalance strained transmission lines and eventually triggered a cascade of line shutdowns as heavy power surges overheated wires, causing them to sag, contact trees below and fail.

Underlying Issues

Failed Response to Software Errors

A "race condition" or software timing error in FirstEnergy's UNIX-based XA/21 energy management computer was found to be the primary cause of the grid event alarm failure. After the alarm system failed silently, the unprocessed events started to queue up and crashed the primary server within 30 minutes. This triggered an automatic transfer of all applications, including the stalled alarm system, from the primary to the backup server, which likewise became overloaded and failed. By 2:54 pm, all energy management applications on both servers stopped working. As a result the screen refresh rate of the operators' computer consoles slowed down from 1-3 seconds to 59 seconds per screen.

FirstEnergy IT personnel knew of the system crashes but did not notify the operators. They responded to the system's automatic pages after the primary system crashed and performed "warm-reboots" on both primary and back-up systems. However the reboots were not successful in refreshing the operators' display consoles. The operators only determined they had problems when data from phone calls received from customers, nearby utilities, and their regional coordinating center calls did not match the information on their screens.

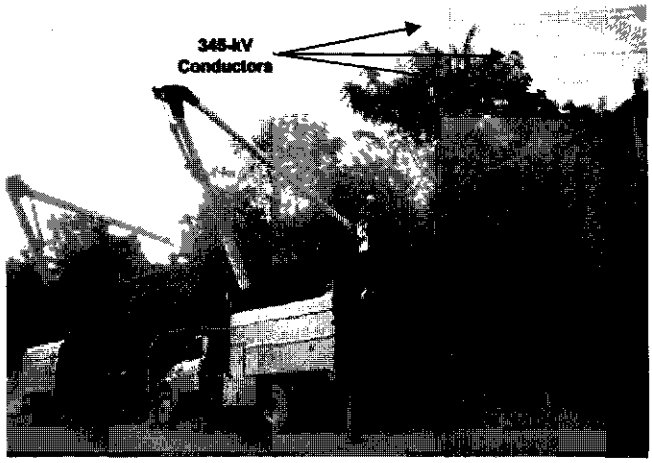
THE BLACKOUT MIGHT HAVE BEEN PREVENTED IF FIRSTENERGY'S OPERATORS ONLY KNEW WHAT WAS HAPPENING WITH THEIR GRID

Inadequate System Understanding and Planning

FirstEnergy operators and its regional coordinating center counterparts did not have a macro-view understanding of their system, leaving them unprepared to manage incidents or contingencies. Long-term operational planning studies and simulations conducted by FirstEnergy in 2002 and 2003 were not thorough enough to understand the Cleveland-Akron grid vulnerabilities and its effects on operations, particularly the 1,500 megawatt power loss from the Eastlake 5 generator. They incorrectly assumed that all transmission lines would be in service at all times. Sensitivity analyses that would have revealed that the voltage criteria triggering their alarms were set too low and severely undermined their entire monitoring system were never performed. They had no emergency response plan in place to deal with failures such as the five transmission lines and the Eastlake 5 generator shutdowns.

Overgrown Trees

FirstEnergy failed to follow its own tree trimming policies (also known as vegetation management), which resulted in the failure of the three 345-kV transmission lines and one 138-kV line in its Ohio service area.



345-kV Lines Contacting Overgrown Trees in Ohio.

Lack of Training and Operator Error

There was a lack formal training by the operators in handling major disturbance situations which contributed to their hesitation to pursue appropriate courses of actions. FirstEnergy's regional coordination center, (Midwestern Independent System Operator or MISO), was not able to warn them of the impending situation since its diagnostic systems had problems that day. The on-duty reliability analyst at MISO had to turn off their system's auto trigger and alarm functions to troubleshoot the system but forgot to turn them back on afterwards until after the blackout.

Aftermath

A year after the blackout, FirstEnergy took several steps to fix their systems. They replaced the GE XA/21 computer system with another system that included features such as: improved alarm functions for tripped transmission lines; faster and more accurate diagnosis and contingency analysis modules; and an improved user interface with visual cues to help operators identify transmission line problems faster. The reliability coordination center system was also upgraded with a user interface that visu-

ally shows grid status and key lines, generators and equipment failures. Parallel processing was incorporated in its contingency analysis program to produce results more quickly. A dynamic "map board" was installed in control centers for wide-area system visualization by controllers. Finally, backup system control centers were designed and built to address the unavailability of primary control centers.

Furthermore, FirstEnergy rewrote its operator procedures and training programs to reflect the new systems, created a certification program to ensure operators fully understand their networks and systems as well as improve their reactions to emergency situations. It established new communication protocols for computer system repair and maintenance downtimes between their operations and IT staffs. An emergency response plan was created that focused on controlled load reductions of up to 1,500 megawatts for the Cleveland-Akron area. Tree trimming procedures and compliance were tightened.

APPLICABILITY TO NASA

Project management and mission teams regularly face challenges integrating hardware/software system design, operator interface, and communication sub-systems. Overall design requirements must incorporate mission support needs and provide accurate, real-time, system wide operational status. It is also important for users of mission critical computer systems to verify output with other reliable, trusted data to mitigate input device or processing anomalies. Modeling and simulation studies must be robust enough to determine and understand how well space missions are planned and how systems work in both nominal and off-nominal environments. Considering all possible scenarios of a mission increases team situational awareness and helps in developing effective contingency plans. Formal education, on-the-job training, and mission rehearsals should go hand-in-hand in imparting knowledge and skills to personnel as well as developing the right instincts to emergency situations. Certification provides greater confidence that operators know how their system works. Lastly, the value of team communications cannot be overemphasized especially when lives and mission success are at stake.

Questions for Discussion

- How robust are your emergency plans? Have all possible accident and/or contingency scenarios been considered?
- How do your systems and their operators perform in off-nominal situations?

Questions for Discussion (cont)

- How can situational awareness be improved in relation to mission operations and maintenance?
- How well and frequent is communication between your team members with diverse mission roles?

References:

"Northeast Blackout of 2003." Wikipedia, The Free Encyclopedia. <http://en.wikipedia.org/wiki/2003_North_America_blackout>.

"Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations." U.S.-Canada Power System Outage Task Force. <https://reports.energy.gov/ BlackoutFinal-Web.pdf >.

"The August 14, 2003 Blackout One Year Later: Actions Taken in the United States and Canada To Reduce Blackout Risk." Natural Resources Canada and the U.S. Department of Energy. <http://www.nerc.com/~filez/blackout.html >

"August 14, 2003 Blackout - Summary Based on Interim Report of the United States – Canada Power Outage Task Force November 19, 2003." U.S.-Canada Power System Outage Task Force. <http://www.iwar.org.uk/cip/resources/blackout-03/Blackout-Report-Presentation-11-19-03.ppt>

"EO Newsroom: New Images - Blackout Leaves American Cities in the Dark." Earth Observatory. <http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16273 >.

"NERC Recommendation Verification Team MISO Report - July 12, 2004." North American Electric Reliability Corporation (NERC). <ftp://www.nerc.com/pub/sys/all_updl/docs/blackout/MISO_Report_0704.pdf>.

"NERC Recommendation Verification Team FirstEnergy Report - July 13, 2004." North American Electric Reliability Corporation (NERC). <http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16273 >.

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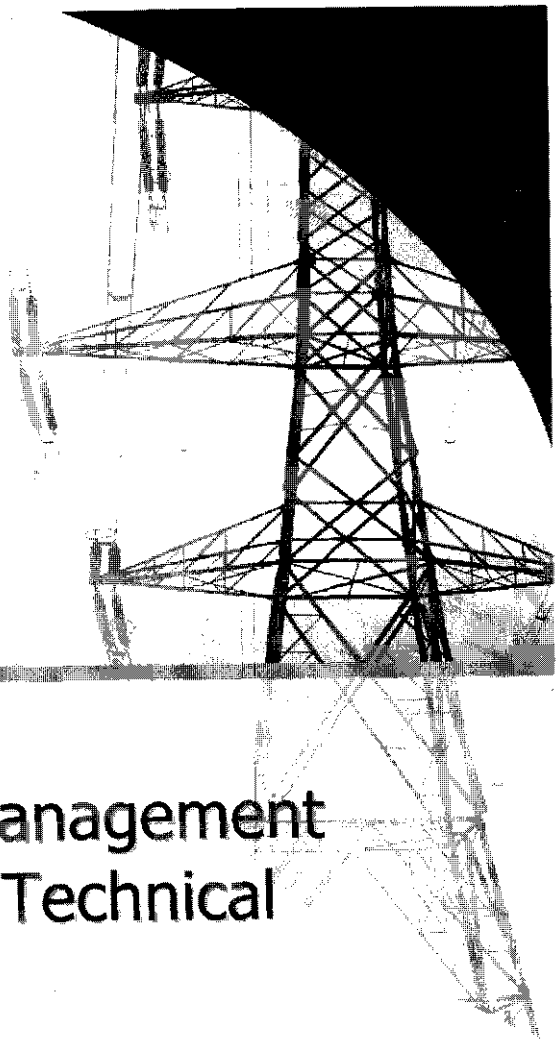
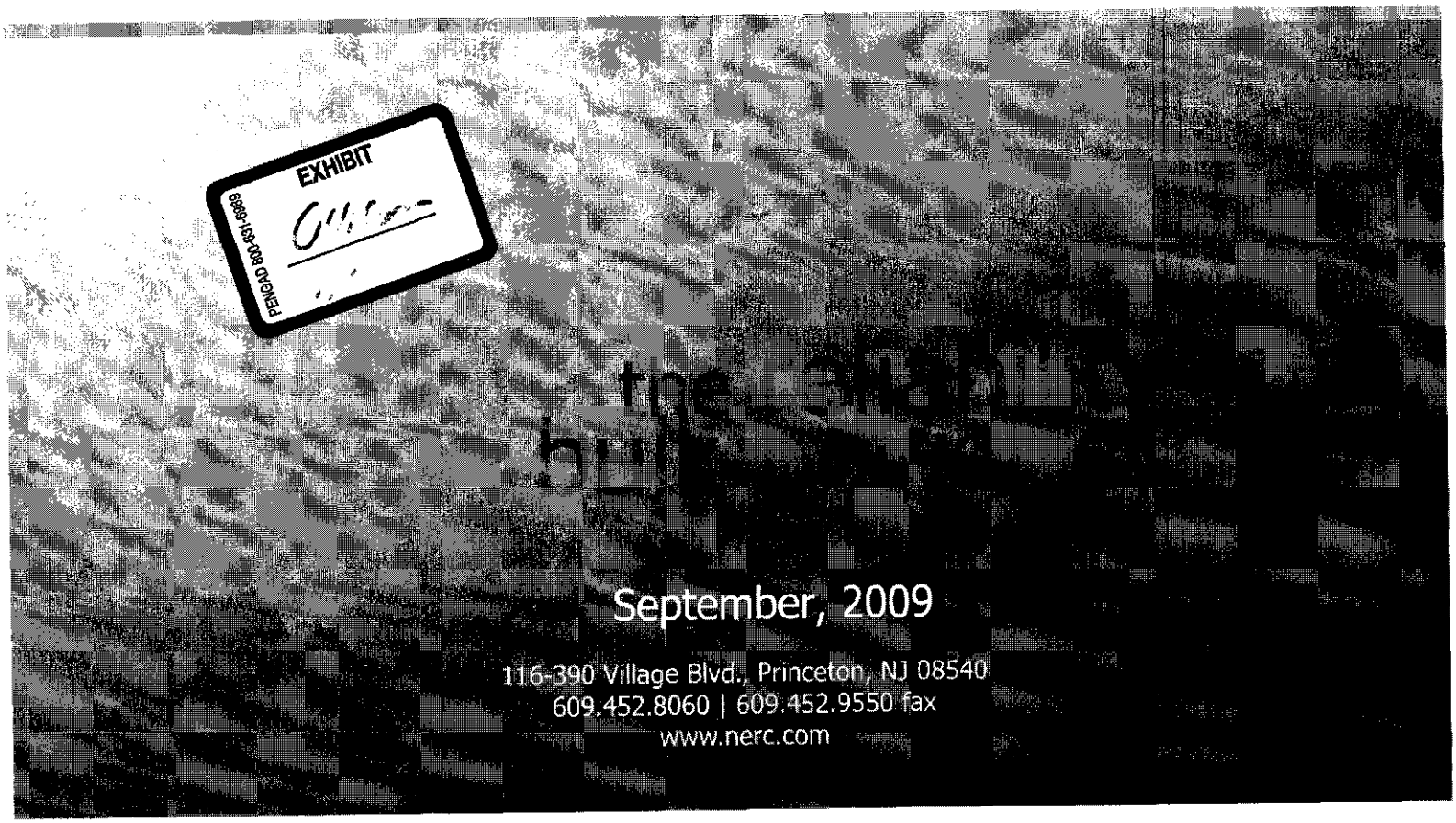


Transmission Vegetation Management NERC Standard FAC-003-2 Technical Reference

Prepared by the North American Electric Reliability Corporation
Vegetation Management Standard Drafting Team



September, 2009

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Applicability of the Standard

4. ***Applicability:***

Functional Entities:

- *Transmission Owner*
- *Planning Coordinator*

Facilities:

- *Transmission lines ("applicable lines") operated at 200kV or higher, and transmission lines operated below 200kV designated by the Planning Coordinator as being subject to this standard including but not limited to those that cross lands owned by federal[1], state, provincial, public, private, or tribal entities.*
- *Transmission lines operated below 200kV designated by the Planning Coordinator as being subject to this standard become subject to this standard 12 months after the date the Planning Coordinator initially designates the transmission line as being subject to this standard.*
- *Existing transmission lines operated at 200kV or higher which are newly acquired by a Transmission Owner and were not previously subject to this standard, become subject to this standard 12 months after the acquisition date of the transmissions lines.*

[1] EPAct 2005 section 1211c: *"Access approvals by Federal agencies"*

The reliability objective of this NERC Vegetation Management Standard ("Standard") is to prevent vegetation-related outages which could lead to Cascading by effective vegetation maintenance while recognizing that certain outages such as those due to vandalism, human errors and acts of nature are not preventable. Operating experience clearly indicates that trees that have grown out of specification could contribute to a cascading grid failure, especially under heavy electrical loading conditions.

Serious outages and operational problems have resulted from interference between overgrown vegetation and transmission lines located on many types of lands and ownership situations. To properly reduce and manage this risk, it is necessary to apply the Standard to applicable lines on any kind of land or easement, whether they are Federal Lands, state or provincial lands, public or private lands, franchises, easements or lands owned in fee. For the purposes of the Standard and this technical paper, the term "public lands" includes municipal lands, village lands, city lands, and a host of other governmental entities.

The Standard addresses vegetation management along applicable overhead lines that serve to connect one electric station to another. However, it is not intended to be applied to lines sections inside the electric station fence or other boundary of an electric station or underground lines.

The Standard is intended to reduce the risk of Cascading involving vegetation. It is not intended to prevent customer outages from occurring due to tree contact with all transmission lines and voltages. For example, localized customer service might be disrupted if vegetation were to make contact with a 69kV transmission line supplying power to a 12kV distribution station. However, this Standard is not written to address such isolated situations which have little impact on the overall Bulk Electric System. In fact, the inclusion of such a transmission line (which does not lead to the undesirable conditions listed in Requirement R11) on the Planning Coordinator's list of sub-200kV lines may constitute a violation of Requirement R11.

Vegetation growth is constant and always present. Unmanaged vegetation poses an increased outage risk when numerous transmission lines are operating at or near their Rating. This poses a significant risk of multiple line failures and Cascading. On the other hand, most other outage causes (such as trees falling into lines, lightning, animals, motor vehicles, etc.) are statistically intermittent. The probability of occurrence of these events is not dependent on heavy loads. There is no cause-effect relationship which creates the probability of simultaneous occurrence of other such events. Therefore these types of events are highly unlikely to cause large-scale grid failures.

In preparing the original vegetation management standard in 2005, industry stakeholders set the threshold for applicability of the standard at 200kV. This was because an unexpected loss of lines operating at above 200kV has a higher probability of initiating a widespread blackout or cascading outages compared with lines operating at less than 200kV. Thus, the 200kV threshold was an arbitrary proxy for those circuits whose Sustained Outage might lead to a Cascade.

The NERC vegetation management standard FAC-003-1 also allowed for application of the standard to "critical" circuits (critical from the perspective of initiating widespread blackouts or cascading outages) operating below 200kV. While the percentage of these circuits is relatively low, it remains a fact that there are sub-200kV circuits whose loss could contribute to a widespread outage. Given the very limited exposure and unlikelihood of a major event related to these lower-voltage lines, it would be an imprudent use of resources to apply the Standard to all sub-200kV lines. The drafting team, after evaluating several alternatives, selected the Planning Coordinator as the best entity to determine applicable lines below 200kV that are subject to this standard in a time horizon that best matches requirements for vegetation management methods.

Vegetation Imminent Threat Procedure

R1.

1.4 The transmission vegetation management program shall require a process or procedure for response to an imminent threat of a vegetation-related Sustained Outage. The process or procedure shall specify actions which shall include communication of the threat to the responsible control center.

M1.

1.4 The Transmission Owner's transmission vegetation management program documentation specifies an imminent threat process or procedure for responding to imminent threats of a vegetation-related Sustained Outage including communication of the threat to the responsible control center.

The term "imminent threat" refers to a vegetation condition which is likely to cause a Sustained Outage at any moment. An imminent threat requires immediate action by the Transmission Owner to alert the responsible control center (usually the Transmission Operator) that there is an increased probability of the occurrence of a Sustained Outage.

Two key elements of an acceptable imminent threat process or procedure are outlined below:

- Specify the vegetation-related conditions that warrant a response:

  Examples of these vegetation-related conditions include vegetation that is near or encroaching into the MVCD (growth issue) or vegetation that presents an imminent danger of falling into the transmission conductor (fall-in issue).

- Notify the responsible control center:

  So that the responsible control center holds situational awareness of known risks to the power system, the Transmission Owner has the responsibility to ensure the proper communication between field personnel and the responsible control center. This will allow the responsible control center to take the appropriate action until the threat is relieved. Appropriate actions may include, but are not limited to, a temporary reduction in the line loading, or switching the line out of service.

  The protocol for contacting the responsible control center should be defined. For example, some Transmission Owners' processes may require a call directly to the responsible control center, while other Transmission Owners may require a call to a supervisor or field forester who will in turn notify the responsible control center .

The urgency of vegetation-related imminent threats may be contrasted with the longer time frames of interim corrective action plans which are developed from a corrective action process as defined in Requirement R1, Part 1.5.

The imminent threat process or procedure should be implemented in terms of minutes or hours as opposed to a longer time frame for interim corrective action plans.

All serious growth or fall-in vegetation-related conditions are not necessarily considered imminent threats under the Standard. For example, some Transmission Owners may have a danger tree identification program that identifies for removal trees with the potential to fall near

the line. These trees are not necessarily considered imminent threats under the Standard unless they pose an immediate fall-in threat.

Also, there can be situations involving vegetation that are not considered vegetation-related imminent threats under the Standard. For example, a logging operation on or near the Active Transmission Line Right of Way can pose an immediate threat of a sustained outage and result in the initiation of an imminent threat process in the same manner as the presence of a nearby crane or the notification of a hot-spot on a conductor connector. Although the logging threat in this example tangentially involves vegetation, it is not considered a vegetation-related imminent threat under the Standard.

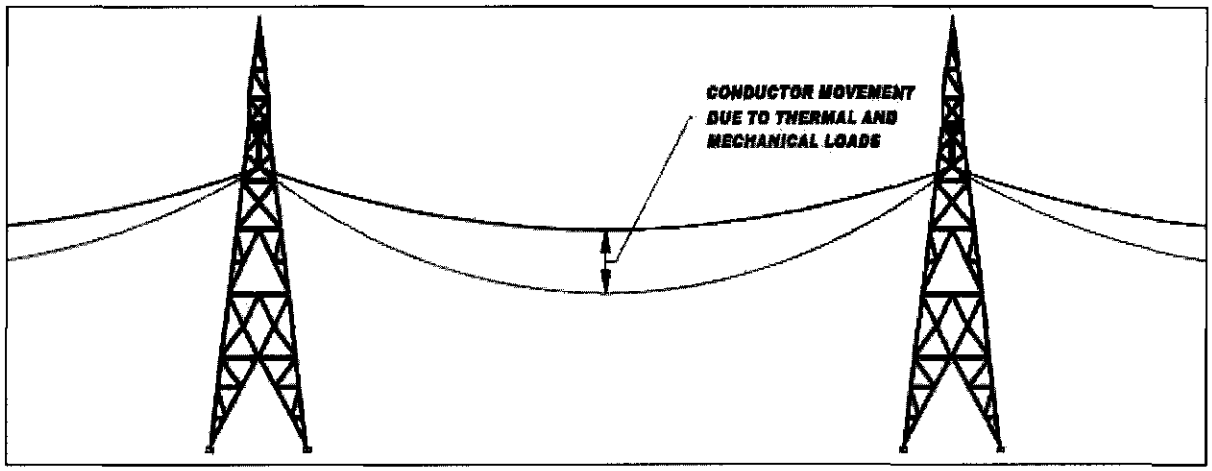


Figure 4

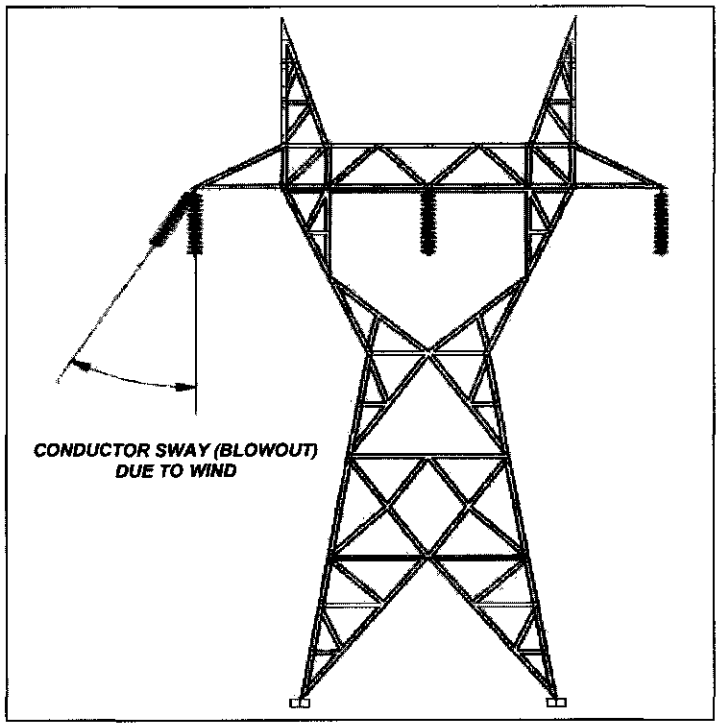


Figure 5

Encroachments within the "Minimum Vegetation Clearance Distances"

R4. *Each Transmission Owner shall prevent encroachment of vegetation into the Minimum Vegetation Clearance Distances (MVCD) listed in FAC-003-2-Attachment 1 for its applicable lines as observed in real-time operating between no-load and their Rating, with the following exceptions: [Violation Risk Factor VRF= Medium][Time Horizon – Real Time]*

- *Encroachment into the MVCD listed in FAC-003-2-Attachment 1 resulting from natural disasters.*[4]
- *Encroachment into the MVCD listed in FAC-003-2-Attachment 1 resulting from human or animal activity.*[5]
- *Brief encroachment into the MVCD listed in FAC-003-2-Attachment 1 resulting from falling vegetation.*

[4] Examples include, but are not limited to, earthquakes, fires, tornados, hurricanes, landslides, wind shear, fresh gale, major storms as defined either by the Transmission Owner or an applicable regulatory body, ice storms, and floods.

[5] Examples include, but are not limited to, logging, animal severing tree, vehicle contact with tree, arboricultural activities or horticultural or agricultural activities, or removal or digging of vegetation.

M4. *The Transmission Owner has evidence from inspections that indicate there was no vegetation encroachment into the Minimum Vegetation Clearance Distances listed in FAC-003-2-Attachment 1 for its applicable lines as observed in real-time operating between no-load and their Rating, considering exceptions. (R4)*

This requirement indicates that if a Transmission Owner observes vegetation at a distance less than that prescribed in Table 1 of FAC-003-2-Attachment 1, it is in violation of this standard since sparkover is likely to occur. Requirement R4 refers to observation in "real time". This is an actual field observation or measurement of the conductor-to-vegetation distance and is not to be a calculated separation between the conductor and the vegetation

When possible encroachments of the MVCD are discovered through inspections or other means, the Transmission Owner must take appropriate action, which might include initiating vegetation management activities or implementation of its imminent threat process. If there is a confirmed clearance violation, the Transmission Owner must report to the Regional Entity as appropriate.

Certain exceptions are recognized in the Standard, including provisions for natural disasters and human or animal activity. Also, brief encroachments by falling vegetation are not considered to be a violation.

This requirement applies to transmission lines that are operating within their Rating. If a line is intentionally or inadvertently operated beyond its rating (potentially in violation of other

TABLE 1 — Minimum Vegetation Clearance Distances (MVCD)
For **Alternating Current** Voltages

(AC) Nominal System Voltage (kV)	(AC) Maximum System Voltage (kV)	MVCD feet (meters) Sea level	MVCD feet (meters) 3,000ft (914.4m)	MVCD feet (meters) 4,000ft (1219.2m)	MVCD feet (meters) 5,000ft (1524m)	MVCD feet (meters) 6,000ft (1828.8m)	MVCD feet (meters) 7,000ft (2133.6m)	MVCD feet (meters) 8,000ft (2438.4m)	MVCD feet (meters) 9,000ft (2743.2m)	MVCD feet (meters) 10,000ft (3048m)	MVCD feet (meters) 11,000ft (3352.8m)
765	800	8.06ft (2.46m)	8.89ft (2.71m)	9.17ft (2.80m)	9.45ft (2.88m)	9.73ft (2.97m)	10.01ft (3.05m)	10.29ft (3.14m)	10.57ft (3.22m)	10.85ft (3.31m)	11.13ft (3.39m)
500	550	5.06ft (1.54m)	5.66ft (1.73m)	5.86ft (1.79m)	6.07ft (1.85m)	6.28ft (1.91m)	6.49ft (1.98m)	6.7ft (2.04m)	6.92ft (2.11m)	7.13ft (2.17m)	7.35ft (2.24m)
345	362	3.12ft (0.95m)	3.53ft (1.08m)	3.67ft (1.12m)	3.82ft (1.16m)	3.97ft (1.21m)	4.12ft (1.26m)	4.27ft (1.30m)	4.43ft (1.35m)	4.58ft (1.40m)	4.74ft (1.44m)
230	242	2.97ft (0.91m)	3.36ft (1.02m)	3.49ft (1.06m)	3.63ft (1.11m)	3.78ft (1.15m)	3.92ft (1.19m)	4.07ft (1.24m)	4.22ft (1.29m)	4.37ft (1.33m)	4.53ft (1.38m)
161*	169	2ft (0.61m)	2.28ft (0.69m)	2.38ft (0.73m)	2.48ft (0.76m)	2.58ft (0.79m)	2.69ft (0.82m)	2.8ft (0.85m)	2.91ft (0.89m)	3.03ft (0.92m)	3.14ft (0.96m)
138*	145	1.7ft (0.52m)	1.94ft (0.59m)	2.03ft (0.62m)	2.12ft (0.65m)	2.21ft (0.67m)	2.3ft (0.70m)	2.4ft (0.73m)	2.49ft (0.76m)	2.59ft (0.79m)	2.7ft (0.82m)
115*	121	1.41ft (0.43m)	1.61ft (0.49m)	1.68ft (0.51m)	1.75ft (0.53m)	1.83ft (0.56m)	1.91ft (0.58m)	1.99ft (0.61m)	2.07ft (0.63m)	2.16ft (0.66m)	2.25ft (0.69m)
88*	100	1.15ft (0.35m)	1.32ft (0.40m)	1.38ft (0.42m)	1.44ft (0.44m)	1.5ft (0.46m)	1.57ft (0.48m)	1.64ft (0.50m)	1.71ft (0.52m)	1.78ft (0.54m)	1.86ft (0.57m)
69*	72	0.82ft (0.25m)	0.94ft (0.29m)	0.99ft (0.30m)	1.03ft (0.31m)	1.08ft (0.33m)	1.13ft (0.34m)	1.18ft (0.36m)	1.23ft (0.37m)	1.28ft (0.39m)	1.34ft (0.41m)

*As designated by the Planning Coordinator

TABLE 1 (CONT.) — Minimum Vegetation Clearance Distances (MVCD)
For **Direct Current** Voltages

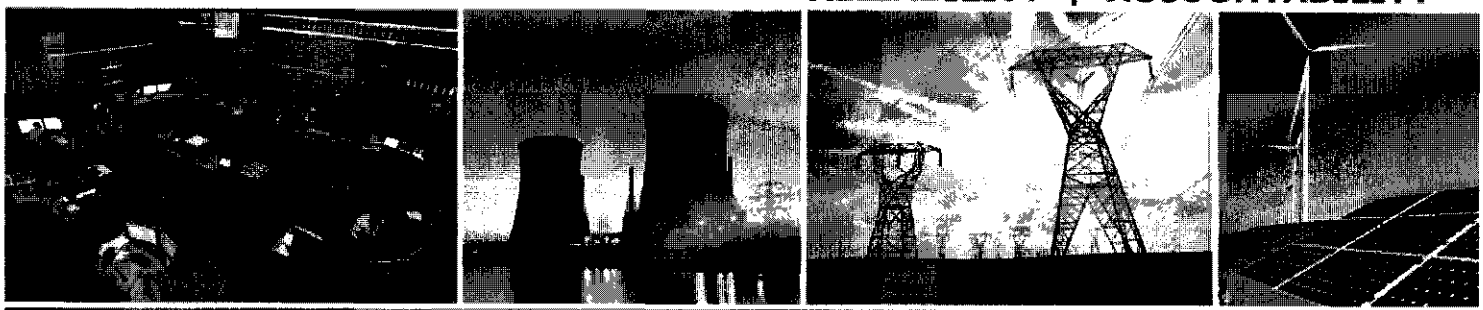
(DC) Nominal Pole to Ground Voltage (kV)	MVCD feet (meters) sea level	MVCD feet (meters) 3,000ft (914.4m) Alt.	MVCD feet (meters) 4,000ft (1219.2m) Alt.	MVCD feet (meters) 5,000ft (1524m) Alt.	MVCD feet (meters) 6,000ft (1828.8m) Alt.	MVCD feet (meters) 7,000ft (2133.6m) Alt.	MVCD feet (meters) (8,000ft (2438.4m) Alt.	MVCD feet (meters) 9,000ft (2743.2m) Alt.	MVCD feet (meters) 10,000ft (3048m) Alt.	MVCD feet (meters) 11,000ft (3352.8m) Alt.
±750	13.92ft (4.24m)	15.07ft (4.59m)	15.45ft (4.71m)	15.82ft (4.82m)	16.2ft (4.94m)	16.55ft (5.04m)	16.9ft (5.15m)	17.27ft (5.26m)	17.62ft (5.37m)	17.97ft (5.48m)
±600	10.07ft (3.07m)	11.04ft (3.36m)	11.35ft (3.46m)	11.66ft (3.55m)	11.98ft (3.65m)	12.3ft (3.75m)	12.62ft (3.85m)	12.92ft (3.94m)	13.24ft (4.04m)	(13.54ft 4.13m)
±500	7.89ft (2.40m)	8.71ft (2.65m)	8.99ft (2.74m)	9.25ft (2.82m)	9.55ft (2.91m)	9.82ft (2.99m)	10.1ft (3.08m)	10.38ft (3.16m)	10.65ft (3.25m)	10.92ft (3.33m)
±400	4.78ft (1.46m)	5.35ft (1.63m)	5.55ft (1.69m)	5.75ft (1.75m)	5.95ft (1.81m)	6.15ft (1.87m)	6.36ft (1.94m)	6.57ft (2.00m)	6.77ft (2.06m)	6.98ft (2.13m)
±250	3.43ft (1.05m)	4.02ft (1.23m)	4.02ft (1.23m)	4.18ft (1.27m)	4.34ft (1.32m)	4.5ft (1.37m)	4.66ft (1.42m)	4.83ft (1.47m)	5ft (1.52m)	5.17ft (1.58m)

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Vegetation–Related Transmission Outage Report

Fourth Quarter 2012

RELIABILITY | ACCOUNTABILITY



3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
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Category 3 — Fall-ins

Two (2) outages caused by vegetation falling into lines from outside the right-of-way were reported during the fourth quarter of 2012. These outages were reported to the Northeast Power Coordinating Council and the SERC Reliability Corporation:

Northeast Power Coordinating Council

Reported one 345kV vegetation-related transmission outage from outside the right-of-way:

1. The transmission owner reported one 345kV vegetation-related transmission outage caused by vegetation falling from outside the ROW on October 29, 2012 with a duration of 23 hours. During Hurricane Sandy, a white pine tree approximately 100 feet tall and a 40 inch Diameter at Breast Height (DBH) broke approximatley 8 feet from the base of the tree, made contact with the closest phase and then cleared itself from the conductor. The tree was located 10 feet outside the ROW easement and 70 feet from the closest phase. Internal insect damage where the tree split and burn marks on the top of the leader were observed. Aerial patrols were also conducted following the outage.

SERC Reliability Corporation

Reported one 230kV vegetation-related transmission outage from outside the right-of-way:

1. The transmission owner reported one 230kV vegetation-related transmission outage caused by vegetation falling from outside the ROW on December 21, 2012 with a duration of 7 hours. A live Loblolly Pine tree, approximately 82 feet tall and a 12 inch DBH, located 1 foot off the ROW fell across two phases resulting in a sustained outage. Local wind gusts may have contributed to the cause. The pine tree was removed from the line and spans in the area assessed. No additional trees in the area were determined to be of concern.

Table 2 summarizes the number of transmission outages by voltage level, region, and category during 2012.

Figure 1 illustrates the number of outages caused by vegetation growing into transmission lines from within the right-of-way that have been reported since 2004.

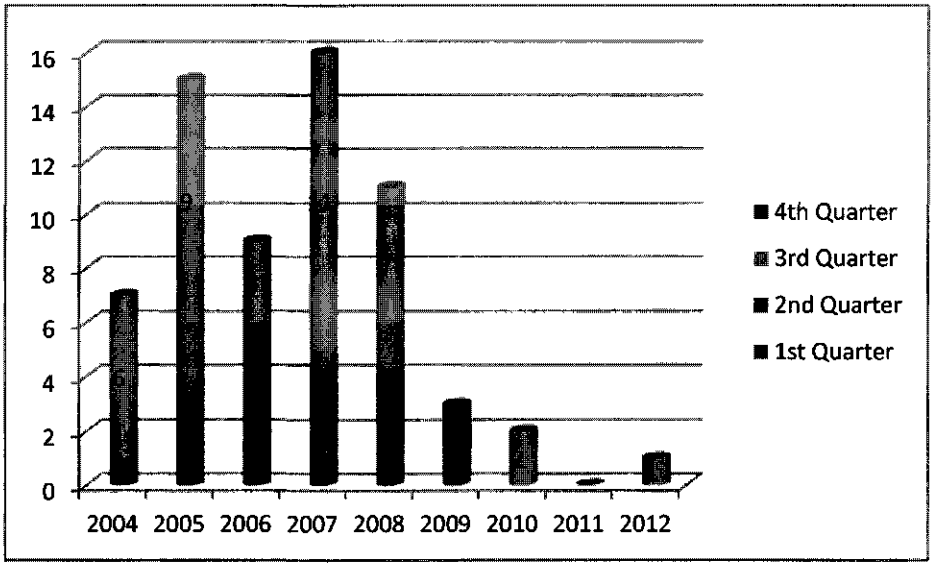
Figure 2 provides this information by voltage class for each year from 2004 to 2012.

Table 2: Summary of Vegetation-Related Transmission Outages[1] by Region and by Outage Category for Each Quarter in 2012

Region	First Quarter			Second Quarter			Third Quarter			Fourth Quarter			TOTAL		
	Category 1 GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	***Category 1*** **GROW-INS (inside/ outside ROW)**	***Category 2*** **FALL-INS (inside ROW)**	***Category 3*** **FALL-INS (outside ROW)**
FRCC															
MRO															
NPCC			1-345kV			1-230kV							1-230kV		1-230Kv 2-345Kv
RFC															
SERC			2-230kV									1-230kV			9-230kV
SPP															
TRE															
WECC			2-<200kV 4-230kV												2-<200kV 4-230kV
TOTAL			2-<200kV 6-230kV 1-345kV						kV			1-230kV 1-345kV	1-230kV		2-<200kV 14-230kV 2-345kV

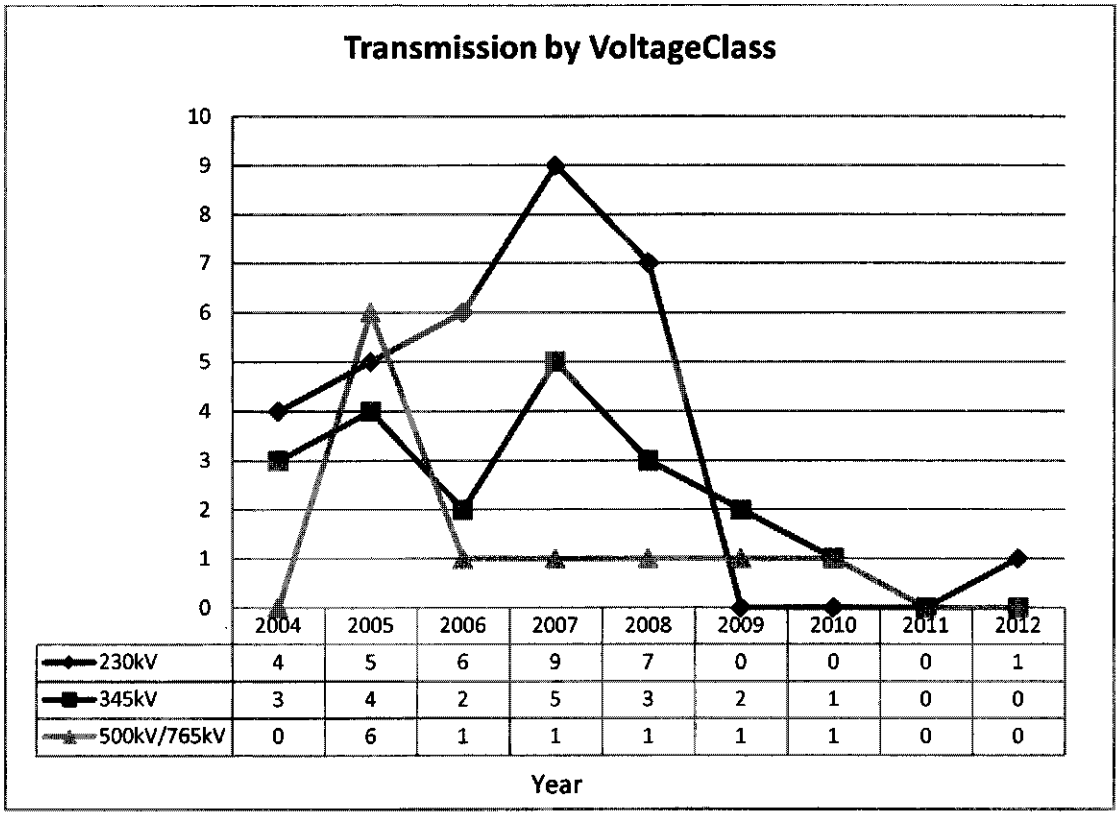
[1] Contains only sustained outages of transmission lines and does not include violations resulting from momentary outages or encroachments into the clearance zone as described in Reliability Standard FAC-003.

Figure 1: Category 1 — Grow-in Outages Caused by Vegetation Growing into Lines from Inside and/or Outside the ROW.[1]



[1] Includes one 2007 Category 1 outage caused by vegetation growing into a Regional Entity-designated critical line greater than 200 kV pursuant to Reliability Standard FAC-003-1.

Figure 2: Category 1 —Grow-In Vegetation Related Outages of 230 kV and Higher



	2004	2005	2006	2007	2008	2009	2010	2011	2012
230kV	4	5	6	9	7	0	0	0	1
345kV	3	4	2	5	3	2	1	0	0
500kV/765kV	0	6	1	1	1	1	1	0	0

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Vegetation-Related Transmission Outages
Fourth Quarter 2006

February 20, 2007

The Board of Trustees adopted version 1 of standard FAC-003 — *Transmission Vegetation Management Program* on February 7, 2006. Since the effective date of the version 1 standard is April 7, 2006, NERC Compliance modified the 2006 Compliance Enforcement Program by replacing version 0 of this standard with the revised standard. As a result, the vegetation-related transmission outages that occurred in the second, third, and fourth quarters of 2006 are being reported in accordance with standard FAC-003-1.

The revised standard requires each outage to be categorized as one of the following:

- Category 1 — Grow-ins: Outages caused by vegetation growing into lines from vegetation inside and/or outside of the ROW.
- Category 2 — Fall-ins: Outages caused by vegetation falling into lines from inside the ROW.
- Category 3 — Fall-ins: Outages caused by vegetation falling into lines from outside the ROW.

All Category 1 and 2 outages are now considered to be violations of NERC standard FAC-003-1, with corresponding levels of noncompliance defined in the standard. The reporting of these violations is handled separately as part of the NERC performance reporting process. Category 3 outages are not considered to be violations of NERC standard FAC-003-1.

Category 3 — Outages Caused by Vegetation Falling Into Lines from Outside the Right-Of-Way

ReliabilityFirst Corporation
Reported two 230-kV vegetation-related transmission outages from outside the right-of-way.

- The transmission owner reported a 230 kV vegetation-related outage occurred on November 12, 2006, with a duration of three hours and fifty-eight minutes. The transmission line relayed open and locked open after an attempted reclose. An off-ROW tree was pushed into a conductor by a tree from further outside the ROW that fell. The failure of the second tree was due to recent land clearing, excavation, and changing of grade for new development. Other trees in the immediate area that were affected by the same land clearing were inspected. Three trees were identified as similarly being at risk of falling due to the land clearing. These three trees were removed.

- The transmission owner reported a 230 kV vegetation-related outage occurred on October 29, 2006, with a duration of two hours and twenty-nine minutes. High winds were

recorded in the area, up to 41 MPH, with an average wind speed of 20 MPH. A large hickory tree split at its base 30 feet from the edge of the ROW and fell into the 230 kV conductors located on the railroad corridor (on the downhill side of the tree). The 230 kV line is located on a shared railway structure. A foot patrol of the area involved was performed after the event occurred. No new potential issues were identified and no further corrective actions were implemented.

Western Electricity Coordinating Council
Reported one 230-kV vegetation-related transmission outages from outside the right-of-way.

- The transmission owner reported a 230 kV vegetation-related outage occurred on November 13, 2006, with a duration of 7.82 hours. A tree fell from outside the right-of-way into the transmission line. The transmission owner has an annual proactive vegetation management program and has a vegetation consultant analyzing their system. The tree was removed.

In addition to the three total vegetation-related outages reported for 200 kV and higher transmission lines, WECC reported 14 vegetation-related transmission outages caused by vegetation falling into lines from outside the right-of-way for RRC designated critical lines <200 kV.

Table 1 summarizes the number of transmission outages by voltage level and category. Table 2 utilizes the same data as Table 1, but reclassifies the outages based upon the categories identified in FAC-003-1. In addition, Table 2 excludes outages that are no longer reportable under FAC-003-1.

Table 1 — 2006 Vegetation-Related Transmission Outages Reported

Region	First Quarter			Second Quarter		Third Quarter			Fourth Quarter		
	Category 1 ALL (within ROW)	*Category 2* ALL (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)
ERCOT	0	0	0	0	0	0	0	0	0	0	0
FRCC	1-230 kV	0	0	0	0	0	0	0	0	0	0
MRO	0	0	0	0	0	0	0	0	0	0	0
NPCC	0	0	0	0	1-230 kV	0	0	0	0	0	0
RFC	0	0	0	0	0	1-345 kV	0	0	0	0	2-230 kV
SERC	0	1-230 kV	1-230 kV	0	1-230 kV	0	0	2-230 kV	0	0	0
SPP	0	0	1-345 kV	0	0	0	0	0	0	0	0
WECC	0	2<200 kV 9-230 kV 1-500 kV	2-230 kV 1-500 kV	0	0	2-230 kV	0	1-230 kV 4-<200 kV	0	0	1-230 kV 14-<200 kV
Subtotal	1-230 kV	2<200 kV 10-230 kV 1-500 kV	3-230 kV 1-345 kV 1-500 kV	0	2-230 kV	2-230 kV 1-345 kV	0	3-230 kV 4-<200 kV	0	0	3-230 kV 14-<200 kV

Table 2 — First Quarter Adjusted to FAC-003-1*

	First Quarter Adj			Second Quarter			Third Quarter			Fourth Quarter		
	Category 1 GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)	*Category 1* GROW-INS (inside/ outside ROW)	*Category 2* FALL-INS (inside ROW)	*Category 3* FALL-INS (outside ROW)
ERCOT	0	0	0	0	0	0	0	0	0	0	0	0
FRCC	1-230 kV	0	0	0	0	0	0	0	0	0	0	0
MRO	0	0	0	0	0	0	0	0	0	0	0	0
NPCC	0	0	0	0	0	1-230 kV	0	0	0	0	0	0
RFC	0	0	0	0	0	0	1-345 kV	0	0	0	0	2-230 kV
SERC	0	0		1-230 kV	0	1-230 kV	0	0	2-230 kV	0	0	0
SPP	0	0	0	1-345 kV	0	0	0	0	0	0	0	0
WECC	0	0	2<200 kV	2-230 kV 1-500 kV	0	0	2-230 kV	0	1-230 kV 4-<200 kV	0	0	1-230 kV 14-<200 kV
Subtotal	1-230 kV	0	2-<200 kV	3-230 kV 1-345 kV 1-500 kV	0	2-230 kV	2-230 kV 1-345 kV	0	3-230 kV 4-<200 kV	0	0	3-230 kV 14-<200 kV
TOTAL	Category 1 (Grow-ins inside/outside ROW)			Category 2 (Fall-ins inside ROW)			Category 3 (Fall-ins outside ROW)					
	6-230 kV; 2-345kV; 1-500 kV			0			20-<200 kV; 8-230 kV					

*First Quarter Adjustment — not reportable under FAC-003-1: 1-230 kV outage was due to human activity, 9-230 kV outages were due to natural disasters, and 1-500 kV outage was due to wind shear.

U.S.-Canada Power System Outage Task Force

Final Report on the August 14, 2003 Blackout in the United States and Canada:

Causes and Recommendations

April 2004

3. Causes of the Blackout and Violations of NERC Standards

Summary

This chapter explains in summary form the causes of the initiation of the blackout in Ohio, based on the analyses by the bi-national investigation team. It also lists NERC's findings to date concerning seven specific violations of its reliability policies, guidelines, and standards. Last, it explains how some NERC standards and processes were inadequate because they did not give sufficiently clear direction to industry members concerning some preventive measures needed to maintain reliability, and that NERC does not have the authority to enforce compliance with the standards. Clear standards with mandatory compliance, as contemplated under legislation pending in the U.S. Congress, might have averted the start of this blackout.

Chapters 4 and 5 provide the details that support the conclusions summarized here, by describing conditions and events during the days before and the day of the blackout, and explain how those events and conditions did or did not cause or contribute to the initiation of the blackout. Chapter 6 addresses the cascade as the blackout spread beyond Ohio and reviews the causes and events of the cascade as distinct from the earlier events in Ohio.

The Causes of the Blackout in Ohio

A dictionary definition of "cause" is "something that produces an effect, result, or consequence."[1] In searching for the causes of the blackout, the investigation team looked back through the progression of sequential events, actions and inactions to identify the cause(s) of each event. The idea of "cause" is here linked not just to what happened or why it happened, but more specifically to the entities whose duties and responsibilities were to anticipate and prepare to deal with the things that could go wrong. Four major causes, or groups of causes, are identified (see box on page 18).

Although the causes discussed below produced the failures and events of August 14, they did not leap into being that day. Instead, as the following chapters explain, they reflect long-standing institutional failures and weaknesses that need to be understood and corrected in order to maintain reliability.

Linking Causes to Specific Weaknesses

Seven violations of NERC standards, as identified by NERC,[2] and other conclusions reached by NERC and the bi-national investigation team are aligned below with the specific causes of the blackout. There is an additional category of conclusions beyond the four principal causes—the failure to act, when it was the result of preceding conditions. For instance, FE did not respond to the loss of its transmission lines because it did not have sufficient information or insight to reveal the need for action. Note: NERC's list of violations has been revised and extended since publication of the Interim Report. Two violations (numbers 4 and 6, as cited in the Interim Report) were dropped, and three new violations have been identified in this report (5, 6, and 7, as numbered here). NERC continues to study the record and may identify additional violations.[3]

Group 1: FirstEnergy and ECAR failed to assess and understand the inadequacies of FE's system, particularly with respect to voltage instability and the vulnerability of the Cleveland-Akron area, and FE did not operate its system with appropriate voltage criteria and remedial measures.

- FE did not monitor and manage reactive reserves for various contingency conditions as required by NERC Policy 2, Section B, Requirement 2.
- NERC Policy 2, Section A, requires a 30-minute period of time to re-adjust the system to prepare to withstand the next contingency.

Causes of the Blackout's Initiation

The Ohio phase of the August 14, 2003, blackout was caused by deficiencies in specific practices, equipment, and human decisions by various organizations that affected conditions and outcomes that afternoon—for example, insufficient reactive power was an issue in the blackout, but it was not a cause in itself. Rather, deficiencies in corporate policies, lack of adherence to industry policies, and inadequate management of reactive power and voltage caused the blackout, rather than the lack of reactive power. There are four groups of causes for the blackout:

Group 1: FirstEnergy and ECAR failed to assess and understand the inadequacies of FE's system, particularly with respect to voltage instability and the vulnerability of the Cleveland-Akron area, and FE did not operate its system with appropriate voltage criteria. *(Note: This cause was not identified in the Task Force's Interim Report. It is based on analysis completed by the investigative team after the publication of the Interim Report.)*

As detailed in Chapter 4:

A) FE failed to conduct rigorous long-term planning studies of its system, and neglected to conduct appropriate multiple contingency or extreme condition assessments. (See pages 37-39 and 41-43.)

B) FE did not conduct sufficient voltage analyses for its Ohio control area and used operational voltage criteria that did not reflect actual voltage stability conditions and needs. (See pages 31-37.)

C) ECAR (FE's reliability council) did not conduct an independent review or analysis of FE's voltage criteria and operating needs, thereby allowing FE to use inadequate practices without correction. (See page 39.)

D) Some of NERC's planning and operational requirements and standards were sufficiently ambiguous that FE could interpret them to include practices that were inadequate for reliable system operation. (See pages 31-33.)

Group 2: Inadequate situational awareness at FirstEnergy. FE did not recognize or understand the deteriorating condition of its system.

As discussed in Chapter 5:

A) FE failed to ensure the security of its transmission system after significant unforeseen contingencies because it did not use an effective contingency analysis capability on a routine basis. (See pages 49-50 and 64.)

B) FE lacked procedures to ensure that its operators were continually aware of the functional state of their critical monitoring tools. (See pages 51-53, 56.)

C) FE control center computer support staff and operations staff did not have effective internal communications procedures. (See pages 54, 56, and 65-67.)

D) FE lacked procedures to test effectively the functional state of its monitoring tools after repairs were made. (See page 54.)

E) FE did not have additional or back-up monitoring tools to understand or visualize the status of their transmission system to facilitate its operators' understanding of transmission system conditions after the failure of their primary monitoring/alarming systems. (See pages 53, 56, and 65.)

Group 3: FE failed to manage adequately tree growth in its transmission rights-of-way.

This failure was the common cause of the outage of three FE 345-kV transmission lines and one 138-kV line. (See pages 57-64.)

Group 4: Failure of the interconnected grid's reliability organizations to provide effective real-time diagnostic support.

As discussed in Chapter 5:

A) MISO did not have real-time data from Dayton Power and Light's Stuart-Atlanta 345-kV line incorporated into its state estimator (a system monitoring tool). This precluded

(continued on page 19)

Causes of the Blackout's Initiation (Continued)

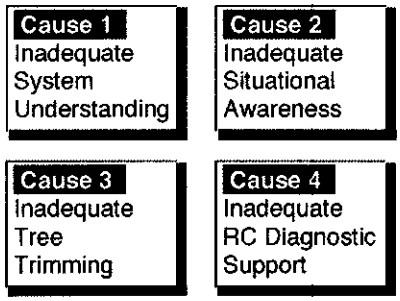
MISO from becoming aware of FE's system problems earlier and providing diagnostic assistance or direction to FE. (See pages 49-50.)

B) MISO's reliability coordinators were using non-real-time data to support real-time "flowgate" monitoring. This prevented MISO from detecting an N-1 security violation in FE's system and from assisting FE in necessary relief actions. (See pages 48 and 63.)

C) MISO lacked an effective way to identify the location and significance of transmission line breaker operations reported by their Energy Management System (EMS). Such information would have enabled MISO operators to become aware earlier of important line outages. (See page 48.)

D) PJM and MISO lacked joint procedures or guidelines on when and how to coordinate a security limit violation observed by one of them in the other's area due to a contingency near their common boundary. (See pages 62-63 and 65-66.)

In the chapters that follow, sections that relate to particular causes are denoted with the following symbols:



- NERC is lacking a well-defined control area (CA) audit process that addresses all CA responsibilities. Control area audits have generally not been conducted with sufficient regularity and have not included a comprehensive audit of the control area's compliance with all NERC and Regional Council requirements. Compliance with audit results is not mandatory.
- ECAR did not conduct adequate review or analyses of FE's voltage criteria, reactive power management practices, and operating needs.
- FE does not have an adequate automatic undervoltage load-shedding program in the Cleveland-Akron area.

Group 2: Inadequate situational awareness at FirstEnergy. FE did not recognize or understand the deteriorating condition of its system.

Violations (Identified by NERC):

- **Violation 7:** FE's operational monitoring equipment was not adequate to alert FE's operators regarding important deviations in operating conditions and the need for corrective action as required by NERC Policy 4, Section A, Requirement 5.
- **Violation 3:** FE's state estimation and contingency analysis tools were not used to assess system conditions, violating NERC Operating Policy 5, Section C, Requirement 3, and Policy 4, Section A, Requirement 5.

Other Problems:

- FE personnel did not ensure that their Real-Time Contingency Analysis (RTCA) was a functional and effective EMS application as required by NERC Policy 2, Section A, Requirement 1.
- FE's operational monitoring equipment was not adequate to provide a means for its operators to evaluate the effects of the loss of significant transmission or generation facilities as required by NERC Policy 4, Section A, Requirement 4.
- FE's operations personnel were not provided sufficient operations information and analysis tools as required by NERC Policy 5, Section C, Requirement 3.
- FE's operations personnel were not adequately trained to maintain reliable operation under emergency conditions as required by NERC Policy 8, Section 1.
- NERC Policy 4 has no detailed requirements for: (a) monitoring and functional testing of critical EMS and supervisory control and data acquisition (SCADA) systems, and (b) contingency analysis.
- NERC Policy 6 includes a requirement to plan for loss of the primary control center, but lacks specific provisions concerning what must be addressed in the plan.
- NERC system operator certification tests for basic operational and policy knowledge.

Significant additional training is needed to qualify an individual to perform system operation and management functions.

Group 3: FE failed to manage adequately tree growth in its transmission rights-of-way. This failure was the common cause of the outage of three FE 345-kV transmission lines and affected several 138-kV lines.

- FE failed to maintain equipment ratings through a vegetation management program. A vegetation management program is necessary to fulfill NERC Policy 2, Section A, Requirement 1 (Control areas shall develop, maintain, and implement formal policies and procedures to provide for transmission security . . . including equipment ratings.)
- Vegetation management requirements are not defined in NERC Standards and Policies.

Group 4: Failure of the interconnected grid's reliability organizations to provide effective diagnostic support.

Violations (Identified by NERC):

- **Violation 4**: MISO did not notify other reliability coordinators of potential system problems as required by NERC Policy 9, Section C, Requirement 2.
- **Violation 5**: MISO was using non-real-time data to support real-time operations, in violation of NERC Policy 9, Appendix D, Section A, Criteria 5.2.
- **Violation 6**: PJM and MISO as reliability coordinators lacked procedures or guidelines between their respective organizations regarding the coordination of actions to address an operating security limit violation observed by one of them in the other's area due to a contingency near their common boundary, as required by Policy 9, Appendix C. **Note**: Policy 9 lacks specifics on what constitutes coordinated procedures and training.

Other Problems:

- MISO did not have adequate monitoring capability to fulfill its reliability coordinator responsibilities as required by NERC Policy 9, Appendix D, Section A.
- Although MISO is the reliability coordinator for FE, on August 14 FE was not a signatory to the MISO Transmission Owners Agreement and was not under the MISO tariff, so MISO did not have the necessary authority as FE's Reliability Coordinator as required by NERC Policy 9, Section B, Requirement 2.
- Although lacking authority under a signed agreement, MISO as reliability coordinator nevertheless should have issued directives to FE to return system operation to a safe and reliable level as required by NERC Policy 9, Section B, Requirement 2, before the cascading outages occurred.
- American Electric Power (AEP) and PJM attempted to use the transmission loading relief (TLR) process to address transmission power flows without recognizing that a TLR would not solve the problem.
- NERC Policy 9 does not contain a requirement for reliability coordinators equivalent to the NERC Policy 2 statement that monitoring equipment is to be used in a manner that would bring to the reliability coordinator's attention any important deviations in operating conditions.
- NERC Policy 9 lacks criteria for determining the critical facilities lists in each reliability coordinator area.
- NERC Policy 9 lacks specifics on coordinated procedures and training for reliability coordinators regarding "operating to the most conservative limit" in situations when operating conditions are not fully understood.

Failures to act by FirstEnergy or others to solve the growing problem, due to the other causes.

Violations (Identified by NERC):

- **Violation 1:** Following the outage of the Chamberlin-Harding 345-kV line, FE operating personnel did not take the necessary action to return the system to a safe operating state as required by NERC Policy 2, Section A, Standard 1.
- **Violation 2:** FE operations personnel did not adequately communicate its emergency operating conditions to neighboring systems as required by NERC Policy 5, Section A.

Other Problems:

- FE operations personnel did not promptly take action as required by NERC Policy 5, General

Criteria, to relieve the abnormal conditions resulting from the outage of the Harding-Chamberlin 345-kV line.

- FE operations personnel did not implement measures to return system operation to within security limits in the prescribed time frame of NERC Policy 2, Section A, Standard 2, following the outage of the Harding-Chamberlin 345-kV line.
- FE operations personnel did not exercise the authority to alleviate the operating security limit violation as required by NERC Policy 5, Section C, Requirement 2.
- FE did not exercise a load reduction program to relieve the critical system operating conditions as required by NERC Policy 2, Section A, Requirement 1.2.
- FE did not demonstrate the application of effective emergency operating procedures as required by NERC Policy 6, Section B, Emergency Operations Criteria.
- FE operations personnel did not demonstrate that FE has an effective manual load shedding program designed to address voltage decays that result in uncontrolled failure of components of the interconnection as required by NERC Policy 5, General Criteria.
- NERC Policy 5 lacks specifics for Control Areas on procedures for coordinating with other systems and training regarding "operating to the most conservative limit" in situations when operating conditions are not fully understood.

Institutional Issues

As indicated above, the investigation team identified a number of institutional issues with respect to NERC's reliability standards. Many of the institutional problems arise not because NERC is an inadequate or ineffective organization, but rather because it has no structural independence from the industry it represents and has no authority to develop strong reliability standards and to enforce compliance with those standards. While many in the industry and at NERC support such measures, legislative action by the U.S. Congress is needed to make this happen.

These institutional issues can be summed up generally:

1. Although NERC's provisions address many of the factors and practices which contributed to the blackout, some of the policies or guidelines are inexact, non-specific, or lacking in detail, allowing divergent interpretations among reliability councils, control areas, and reliability coordinators. NERC standards are minimum requirements that may be made more stringent if appropriate by regional or subregional bodies, but the regions have varied in their willingness to implement exacting reliability standards.
2. NERC and the industry's reliability community were aware of the lack of specificity and detail in some standards, including definitions of Operating Security Limits, definition of planned outages, and delegation of Reliability Coordinator functions to control areas, but they moved slowly to address these problems effectively.
3. Some standards relating to the blackout's causes lack specificity and measurable compliance criteria, including those pertaining to operator training, back-up control facilities, procedures to operate when part or all of the EMS fails, emergency procedure training, system restoration plans, reactive reserve requirements, line ratings, and vegetation management.
4. The NERC compliance program and region-based auditing process has not been comprehensive or aggressive enough to assess the capability of all control areas to direct the operation of their portions of the bulk power system. The effectiveness and thoroughness of regional councils' efforts to audit for compliance with reliability requirements have varied significantly from region to region. Equally important, absent mandatory compliance and penalty authority, there is no requirement that an entity found to be deficient in an audit must remedy the deficiency.
5. NERC standards are frequently administrative and technical rather than results-oriented.
6. A recently-adopted NERC process for development of standards is lengthy and not yet fully understood or applied by many industry participants. Whether this process can be adapted to support an expedited development of clear and auditable standards for key topics remains to be seen.

7. NERC has not had an effective process to ensure that recommendations made in various reports and disturbance analyses are tracked for accountability. On their own initiative, some regional councils have developed effective tracking procedures for their geographic areas.

Control areas and reliability coordinators operate the grid every day under guidelines, policies, and requirements established by the industry's reliability community under NERC's coordination. If those policies are strong, clear, and unambiguous, then everyone will plan and operate the system at a high level of performance and reliability will be high. But if those policies are ambiguous and do not make entities' roles and responsibilities clear and certain, they allow companies to perform at varying levels and system reliability is likely to be compromised.

Given that NERC has been a voluntary organization that makes decisions based on member votes, if NERC's standards have been unclear, nonspecific, lacking in scope, or insufficiently strict, that reflects at least as much on the industry community that drafts and votes on the standards as it does on NERC. Similarly, NERC's ability to obtain compliance with its requirements through its audit process has been limited by the extent to which the industry has been willing to support the audit program.

Endnotes

[1] *Webster's II New Riverside University Dictionary*, Riverside Publishing Co., 1984.

[2] A NERC team looked at whether and how violations of NERC's reliability requirements may have occurred in the events leading up to the blackout. They also looked at whether deficiencies in the requirements, practices and procedures of NERC and the regional reliability organizations may have contributed to the blackout. They found seven specific violations of NERC operating policies (although some are qualified by a lack of specificity in the NERC requirements).

The Standards, Procedures and Compliance Investigation Team reviewed the NERC Policies for violations, building on work and going beyond work done by the Root Cause Analysis Team. Based on that review the Standards team identified a number of violations related to policies 2, 4, 5, and 9.

Violation 1: Following the outage of the Chamberlin-Harding 345-kV line, FE did not take the necessary actions to return the system to a safe operating state within 30 minutes. (While Policy 5 on Emergency Operations does not address the issue of "operating to the most conservative limit" when coordinating with other systems and operating conditions are not understood, other NERC policies do address this matter: Policy 2, Section A, Standard 1, on basic reliability for single contingencies; Policy 2, Section A, Standard 2, to return a system to within operating security limits within 30 minutes; Policy 2, Section A, Requirement 1, for formal policies and procedures to provide for transmission security; Policy 5, General Criteria, to relieve any abnormal conditions that jeopardize reliable operation; Policy 5, Section C, Requirement 1, to relieve security limit violations; and Policy 5, Section 2, Requirement 2, which gives system operators responsibility and authority to alleviate operating security limit violations using timely and appropriate actions.)

Violation 2: FE did not notify other systems of an impending system emergency. (Policy 5, Section A, Requirement 1, directs a system to inform other systems if it is burdening others, reducing system reliability, or if its lack of single contingency coverage could threaten Interconnection reliability. Policy 5, Section A, Criteria, has similar provisions.)

Violation 3: FE's state estimation/contingency analysis tools were not used to assess the system conditions. (This is addressed in Operating Policy 5, Section C, Requirement 3, concerning assessment of Operating Security Limit violations, and Policy 4, Section A, Requirement 5, which addresses using monitoring equipment to inform the system operator of important conditions and the potential need for corrective action.)

Violation 4: MISO did not notify other reliability coordinators of potential problems. (Policy 9, Section C, Requirement 2, directing the reliability coordinator to alert all control areas and reliability coordinators of a potential transmission problem.)

Violation 5: MISO was using non-real-time data to support real-time operations. (Policy 9, Appendix D, Section A, Criteria For Reliability Coordinators 5.2, regarding adequate facilities to perform their responsibilities, including detailed monitoring capability to identify potential security violations.)

Violation 6: PJM and MISO as Reliability Coordinators lacked procedures or guidelines between themselves on when and how to coordinate an operating security limit violation observed by one of them in the other's area due to a contingency near their common boundary (Policy 9, Appendix 9C, Emergency Procedures). **Note:** Since Policy 9 lacks specifics on coordinated procedures and training, it was not possible for the bi-national team to identify the exact violation that occurred.

Violation 7: The monitoring equipment provided to FE operators was not sufficient to bring the operators' attention to the deviation on the system. (Policy 4, Section A, System Monitoring Requirements regarding resource availability and the use of monitoring equipment to alert operators to the need for corrective action.)

[3] NERC has not yet completed its review of planning standards and violations.

Company Ex. 1

RSGS

INVOICE

NO. 7830652

18515-18515.0

Forest City Tree Protection Co.
a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894
www.forestcitytree.com

100th Anniversary 1910 - 2010

REMARKS/RECOMMENDATIONS

SILVER MAPLE TREE IN BACK YARD, REMOVE TWO (2) 12" LARGE SECTIONS FROM THE TOP OF EACH TRUNK DUE TO DECAY/HOLLOW AT POINT OF CONNECTION TO TRUNK. MAINTENANCE PRUE TO REDUCE HEIGHT & WEST-DIRECTED LIMBS.

Customer: Please contact our office about the following recommendations noted by our technician.

☐ Additional Disease or Insect Control Applications
☐ Tree/Shrub Pruning ☐ Tree/Shrub Fertilizing
☐ Cabling and Bracing for support ☒ Tree Removal

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

REFLECTS 3% WINTER RATE DISCOUNT

1-1/2% per month on overdue accounts
PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

CHARGE
845.00

DUE UPON COMPLETION

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

LOCATION 4520 OUTLOOK DR

Thank You

Sam
Crew Chief/Applicator

DATE 4-27-12

TIME ✓

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	Would you recommend our services to your friends and relatives?			

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.

OUR BUSINESS IS BUILT ON OUR REPUTATION AND REFERRALS FROM CUSTOMERS SUCH AS YOU.

REFERRAL Name & Phone #: _____

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CHARGE 802.75
TAX 61.21
PLEASE REMIT 864.96
ACCOUNT NO. 18515.0

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Exp. Date _____ 3digit code _____

Signature _____

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CHECK NO.

(please return this portion with your payment)

Company Ex. 2

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216-381-1700 Fax 216-381-1894
www.forestcitytree.com

100th Anniversary 1910 - 2010

INVOICE

NO. 7827259

18515-18515.0

REMARKS/RECOMMENDATIONS

PRUNE SILVER MAPLE ON BACK LINE: REMOVE SUCKER GROWTH ON BACK/WEST SIDE; REDUCE HEIGHT BY 6-8'; THIN-OUT TO REDUCE WIND RESISTANCE & SNOW LOAD; REMOVE DEADWOOD (1 1/2" DIAMETER & LARGER); REMOVE TOP SECTION (10-12") ON NORTH TRUNK THAT HAS DECAY WHERE IT CONNECTS TO TRUNK; INSTALL ONE (1) CABLE (3/8") BETWEEN 2 MAIN SECTIONS.

Customer: Please contact our office about the following recommendations noted by our technician.

- ☐ Additional Disease or Insect Control Applications
- ☐ Tree/Shrub Pruning
- ☐ Tree/Shrub Fertilizing
- ☐ Cabling and Bracing for support
- ☐ Tree Removal

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

1-1/2% per month on overdue accounts

PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

CHARGE 895.00

DUE UPON COMPLETION

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

LOCATION 4520 OUTLOOK DR

Thank You
SAM
Crew Chief/Applicator

DATE 6/16/11

TIME _____

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	Would you recommend our services to your friends and relatives?			

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.
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REFERRAL Name & Phone #: _____

CUSTOMER NAME MRS. MARY MARTHA CORRIGAN

CHARGE	850.25
TAX	65.89
[illegible]	PREPAID
ACCOUNT NO.	18515.0

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INVOICE

NO. 7827259

18515-18515.0

REMARKS/RECOMMENDATIONS

PRUNE SILVER MAPLE ON BACK LINE: REMOVE SUCKER GROWTH ON BACK/WEST SIDE; REDUCE HEIGHT BY 6-8'; THIN-OUT TO REDUCE WIND RESISTANCE & SNOW

Company Ex. 3

INVOICE

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a lanphear service
1884 South Green Road, South Euclid, Ohio 44121-4246
216-381-1700 Fax 216-381-1894

NO. 7820976

18515-18515.0

REMARKS/RECOMMENDATIONS

BACK: SILVER MAPLE, REMOVE ALL NEW SHOOTS ON BACK/WEST SIDE OF TREE THAT GROW OUTWARDS FROM TREE TOWARDS WIRES (LEAVE ONLY THOSE THAT ARE GOING STRAIGHT UP OR INWARDS; REDUCE HEIGHT BY 10' MINIMUM; THIN-OUT GOOD TO REDUCE WIND AND SNOW LOAD & INCREASE INTERIOR LIGHT & AIR PENETRATION; REMOVE DEADWOOD (1 1/2"+) & RUBBING/CROSSING SECTIONS; TRIM TO PROVIDE CLEARANCE FROM BOTH GARAGE.

Customer: Please contact our office about the following recommendations noted by our technician.

☐ Additional Disease or Insect Control Applications
☐ Tree/Shrub Pruning ☐ Tree/Shrub Fertilizing
☐ Cabling and Bracing for support ☐ Tree Removal

INSECT & DISEASE CONTROL AND FERTILIZATION SERVICES ARE CONTINUOUS FROM APPLICATION TO APPLICATION, YEAR TO YEAR, UNLESS WE ARE NOTIFIED OTHERWISE.

1-1/2% per month on overdue accounts
PAYMENT DUE UPON RECEIPT
RETURN THE BOTTOM PORTION WITH YOUR PAYMENT

Thank You

Crew Chief/Applicator

CHARGE 1331.00
DUE UPON COMPLETION

MRS. MARY MARTHA CORRIGAN
MR. DENNIS CORRIGAN
4520 OUTLOOK DR
BROOKLYN, OH 44144

LOCATION 4520 OUTLOOK DR

DATE 12-2-09

TIME —

CUSTOMER SATISFACTION SURVEY (PLEASE CHECK THE APPROPRIATE BOX)

YES	NO		YES	NO	
☐	☐	The job was done to your satisfaction.	☐	☐	The jobsite was left clean & neat.
☐	☐	You were treated courteously by our crew.	☐	☐	Were your questions answered satisfactorily?
☐	☐	Would you recommend our services to your friends and relatives?			

3

SUGGESTIONS _____

☐ PLEASE HAVE TREE CARE REPRESENTATIVE CALL.
OUR BUSINESS IS BUILT ON OUR REPUTATION AND REFERRALS FROM CUSTOMERS SUCH AS YOU.

REFERRAL Name & Phone #: _____

CUSTOMER NAME MRS. MARY MARTHA CORRIGAN

CHARGE	1331.00
TAX	103.15
~~PLEASE REMIT~~	PREPAID
ACCOUNT NO.	18515.0

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