FILED[3]
DEC 4 2008
Missouri Public
Service Commission

Exhibit No 019
Issues Storm Responses, Reliability Improvement Efforts, Customer Communications
Witness Richard J Mark
Sponsoring Party Union Electric Company
Type of Exhibit Direct Testimony
Case No ER-2008-0318
Date Testimony Prepared April 1, 2008

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. ER-2008-0318

DIRECT TESTIMONY

OF

RICHARD J. MARK

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a AmerenUE

St Louis, Missouri
April, 2008

Exhibit No. 19
Case No(s). ER-2008-0318
Date 11/25/08 Rptr MV

Exhibit No	
Issues	Storm Responses, Reliability Improvement Efforts, Customer Communications
Witness	Richard J Mark
Sponsoring Party	Union Electric Company
Type of Exhibit	Direct Testimony
Case No	ER-2008-____
Date Testimony Prepared	April 1, 2008

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. ER-2008-____

DIRECT TESTIMONY

OF

RICHARD J. MARK

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a AmerenUE

St Louis, Missouri
April, 2008

TABLE OF CONTENTS

I. INTRODUCTION 1

II. PURPOSE AND SUMMARY OF TESTIMONY 2

III. EFFORTS TO IMPROVE SYSTEM RELIABILITY 3

- A Undergrounding and Reliability Improvement 7
- B. Circuit and Device Inspection and Repair Program 8
- C. Vegetation Management Program 10

IV. EFFORTS TO HARDEN THE DISTRIBUTION SYSTEM AND TO IMPROVE RESTORATION OF SERVICE AFTER A MAJOR OUTAGE 12

V. CUSTOMER COMMUNICATION EFFORTS 15

DIRECT TESTIMONY

OF

RICHARD J. MARK

CASE NO. ER-2008-____

I. <u>INTRODUCTION</u>

Q Please state your name and business address.

A Richard J Mark, Union Electric Company d/b/a AmerenUE ("AmerenUE" or "Company"), One Ameren Plaza, 1901 Chouteau Avenue, St Louis, Missouri 63103

Q. What is your position with AmerenUE?

A I am the Senior Vice President of Missouri Energy Delivery I am responsible for AmerenUE's electric and natural gas distribution systems and operation, as well as the Company's customer service operations, consisting of the customer contact center, customer accounts, and customer credit assistance, including AmerenUE's Dollar More Program and community relations I am also responsible for managing AmerenUE's Government Relations division

Q. Please describe your educational background and employment experience.

A I joined Ameren Services as Vice President of Customer Relations in January of 2002 and then became Vice President of Governmental Policy and Consumer Affairs In December of 2004, I was promoted to my current position at AmerenUE Prior to my current employment, I spent seven years as President and Chief Executive of St Mary's Hospital of East St Louis and five years as the hospital's Chief Operating Officer I have a Bachelor of

Science Degree in Child Development from Iowa State University and a Master of Science in Business Management from National Louis University

II. PURPOSE AND SUMMARY OF TESTIMONY

Q. What is the purpose of your direct testimony in this proceeding?

A The purpose of my direct testimony is to discuss the important operational changes which have occurred at AmerenUE and how these will positively impact our customers I will detail our renewed efforts to improve both the reliability of our service to customers and our ability to restore power in a timely manner when it is interrupted These efforts include a direct response to every customer-specific complaint expressed at local public hearings held in the Commission's storm investigation docket (Case No EO-2007-0037) and in the Company's last rate proceeding (Case No ER-2007-0002), organizational changes to improve identification and correction of areas where reliability improvements can be made, implementation of the Commission's recently adopted Infrastructure Inspection and Vegetation Management Rules, and the initiation of various reliability improvements programs, including Project Power On

In addition, my testimony details AmerenUE's commitment to improve our ability to communicate important information about these efforts to our customers, addresses efforts we are undertaking to better "harden" our system against severe storms, and discusses some of the costs associated with these efforts and the controls we are using to ensure we are investing wisely in our system

An executive summary of my testimony is attached hereto as Attachment A

III. EFFORTS TO IMPROVE SYSTEM RELIABILITY

Q. In AmerenUE's last rate case, Case No. ER-2007-0002, the Company was criticized for not providing reliable service to its customers. Do you think that criticism was fair?

A In part, yes, in particular given changing customer expectations and the increase in our customers' reliance on electricity for virtually every aspect of their lives that has occurred over the past several years The last rate case became a focal point for this criticism, particularly because of the severe July 2006 storms which occurred shortly after the rate case was filed Prior to the hearings on the rate request, another severe storm, this time bringing large quantities of ice, hit in late November of that year and yet another ice storm occurred in January of 2007 All of these storms resulted in large and extended outages Understandably, these back-to-back-to-back outages left our customers frustrated and they expressed that frustration at both the public hearings that were held in the storm investigation docket (Case No EO-2007-0037) and in the many local public hearings held in our last rate case (Case No ER-2007-0002)

Q. What has AmerenUE done to address these concerns and frustrations?

A We have followed up on each complaint lodged at these hearings and have made corrections in those situations where the customer had pointed out an accurate and correctable concern Interestingly, a member of the MPSC Staff also followed up on reliability complaints which were voiced at some of the public hearings and testified at the rate case hearing that, after looking into complaints of individuals who claimed to have experienced overall reliability problems, 92% of the outages were related to storm damage, with the remaining outages tied to tree damage, device outage or vehicle accidents ER-2007-0002, Tr P 4364 and 4369

It is important to note that not every complaint we investigated was found to be accurate[1] Regardless, after suffering through the 2006 - 2007 storm outages, we have found that customer tolerance for both storm and non-storm related outages has sharply decreased and our customers have become very critical of virtually any interruption of their electric service When added to our customers' increasing reliance on electricity for every aspect of life today, it became apparent that the Company must refocus its efforts to improve customer reliability

We are listening to our customers' concerns and working to respond to their needs Historically, the Company has been focused on being a low-cost provider of electricity to its customers, as evidenced by the fact that AmerenUE's rates are among the lowest in the nation It is now apparent that while our customers still expect us to provide electric service at a reasonable cost, the reliability of our electric service occupies an increasingly important role in our customers' satisfaction We have taken on the challenge of improving the reliability of our electric service and are in the midst of implementing several programs to enable us to achieve that goal

AmerenUE has listened, and will continue to listen, to the concerns of its customers As part of this commitment, AmerenUE has proactively sought additional feedback from its customers Throughout 2007, the Company held more than 525 meetings with individuals, community leaders, neighborhood associations, senior citizen centers, legislators and business owners to receive input on their concerns and to discuss how those

[1] Some referred to wires that turned out to be cable or telephone, some incorrectly stated there had never been tree trimming in their area and some referred to outages that our records do not confirm

concerns could be addressed We are using the information we obtained through those meetings to focus our efforts on improving reliability as promptly and cost-effectively as possible

Q. Other than system reliability, were there any other themes that were commonly expressed at these meetings?

A Yes, over and over we heard about a need for an increased level of communication with our customers, both during storms as well as during the regular day-to-day operation of our business Customers want to know what we are doing to improve our system and why we are taking those particular actions Our customers expect AmerenUE to invest wisely to improve and maintain system reliability, and want to be informed about those efforts

Q. Please tell us what changes came out of the process of listening to your customers' concerns.

A Organizationally, the Company has made several changes We have set up a designated group within AmerenUE to analyze customer information in order to identify and communicate improvement opportunities The goal is to review and analyze various sources of customer input to allow the Company to better recognize and respond to the concerns of our customers This process suggested that some of our customers felt their concerns had been ignored, and we are working very hard to avoid a repeat of that situation

The Company created a Reliability Improvement Department within AmerenUE and promoted Mark Nealon to the position of Manager of Reliability Improvement Mr Nealon is responsible for a focused reliability improvement effort for particularly troublesome areas of our distribution system where the undergrounding of facilities is the most effective solution Mr Nealon reports to Ron Zdellar, who is Vice President of Energy Delivery-Distribution Services This places the responsibility for and oversight of our undergrounding reliability projects in one area, which will enable us to take a more consistent and effective approach We believe this will help to promote real reliability improvement for our customers

Q. After undertaking this effort, did AmerenUE develop any programs specifically designed to improve reliability?

A Yes AmerenUE has implemented several projects designed to help the Company improve the reliability of its system, including its most significant system investment program, called Project Power On Beyond Project Power On, AmerenUE contracted with a consulting firm, KEMA, to obtain an independent, expert opinion on how the Company could harden its electric system to minimize service interruptions and to identify ways to improve system restoration after major storms The Company has also taken steps to improve the flow of information about its efforts in these areas to its customers

Q. You noted that Project Power On was the most significant of the Company's reliability improvement efforts. Please describe Project Power On.

A Project Power On is designed to address our customers' current and future energy and environmental needs This program is a three-year initiative which includes four components

- a $300 million core line undergrounding and reliability improvement program,
- an $84 million circuit and device inspection and repair program,
- a $150 million vegetation management program, and
- a $500 million investment to reduce emissions from our Sioux plant

A. <u>Undergrounding and Reliability Improvement</u>

Q. Please provide a brief description of what each component of Project Power On includes and how it will work to improve system reliability. Please start with the undergrounding and reliability improvement program.

A The undergrounding and reliability improvement portion of the project is designed to better protect susceptible portions of our delivery system against the forces of nature Where electric service is provided through an underground cable, a falling tree limb cannot interrupt service This effort will result in substantial underground cabling in areas where three important criteria are met: where undergrounding is feasible, where it improves areas of poor reliability and where it makes economic sense Because undergrounding AmerenUE's entire distribution system would be prohibitively expensive,[2] AmerenUE is targeting cost-effective projects which will have the greatest ability to improve reliability for customers

AmerenUE believes approximately 1,000 undergrounding projects will be completed during the three years of Project Power On These projects will be spread across the entirety of the AmerenUE electric service territory We are working with our operating division managers as well as county and municipal governments to identify these projects To ensure that the criteria outlined above is met, AmerenUE selects projects from among those suggested by its district managers and local government officials and uses objective criteria in its decisionmaking process These criteria include the recent reliability of the lines that are being considered for undergrounding, the potential for improvement by undergrounding those lines, the number of customers that would be positively impacted by

---

[2] The average cost to bury a mile of existing overhead distribution circuit is estimated to be $1 million Applied to the approximately 27,000 miles of distribution line on AmerenUE's system the cost to underground the entire distribution system could exceed $27 billion

the project, the ease of design and construction for each proposed project, and the proposed project's expected cost

Q. How much progress has been made in undergrounding lines?

A During 2007 in the start-up phase, we spent approximately $7 million on undergrounding projects An additional $5 million was spent in January and February of 2008 Overhead to underground projects are under construction in North St Louis County, Des Peres, Chesterfield, St Peters and St Charles Over twenty miles of underground cable were installed under this program in 2007 and 140 projects began in January of 2008 In total, Project Power On currently has approximately 300 active undergrounding projects in some stage of design and construction spread throughout AmerenUE's service territory

There is a lot of preparation work which must precede this undergrounding effort, in order to ensure we are making this investment in our distribution system wisely We are in the planning stages for the majority of the circuits which will be placed underground Currently, an engineering group is working on the design and construction plans for each project Once the design phase is completed, we expect the amount of money and the number of lines placed underground to expand significantly by the end of the calendar year and throughout 2009

B. <u>Circuit and Device Inspection and Repair Program</u>

Q. Please describe the circuit and device inspection and repair program.

A We spent over $6 million in the test year for circuit inspections and expect that number to increase in the future The circuit and device inspection and repair program is designed as an ongoing inspection and maintenance program to help us identify, repair and replace, as needed, poles and other equipment before failures occur We started a foot patrol inspection program for subtransmission lines that will cycle every two years through urban areas and every three years through rural areas These foot patrols are designed to identify areas where repair and replacements need to be made As part of this program, we will continue to supplement these foot patrols with field personnel who do other work, such as tree-trimmers, who will be able to provide an additional set of eyes to do visual inspections of our equipment and to report observed concerns before they affect reliability

The improvement program marks the Company's early adoption of the 2007 National Electrical Safety Code and implementation of the Commission's recently-adopted Infrastructure Inspection Rules Prior to this program, we did not have a program to regularly inspect distribution equipment such as line reclosers, capacitors and voltage regulators We now perform a comprehensive inspection of all distribution line poles, hardware and equipment As noted, the Company is visually inspecting each pole and its hardware every four years and is performing strength assessments on all wood poles once every twelve years These efforts include the creation of a Circuit and Device Inspection System ("CDIS") database to track this information, and we are working to incorporate the CDIS data into our efforts to improve the reliability of the distribution system

Q. How large is this program?

A In 2007, AmerenUE visually inspected over 5,000 miles of overhead electric lines That is the equivalent distance of a round trip between New York and Los Angeles This number includes over 1,400 miles in St Louis City and County Additionally, over 64,000 wood poles were physically inspected, over 11,000 of which were located in St Louis City and County

Looking forward, we anticipate spending over $84 million for circuit inspection and for repairs to the system deficiencies brought to light by these inspections during the next three years alone We will also spend over $1 million annually on streetlight inspections and repairs As required by the Commission's new Infrastructure Inspection Rules, the Company will also begin visual inspections of its underground distribution system, including transformers, pedestals and manholes, and will fully comply with the substantial reporting required by the Commission's rules

C. Vegetation Management Program

Q. Please explain the vegetation management portion of Project Power On.

A Vegetation management is an area where AmerenUE has already made a significant investment in order to improve the reliability of its system Prior to our last rate case, we were trimming vegetation according to a schedule approved by the Commission in Case No EW-2004-0583 However, as I stated above, it became clear that we needed to increase our tree trimming efforts Accordingly, in Case No ER-2007-0002 we made a commitment to the public and to the Commission that we would spend at least $45 million a year on vegetation management That amount is nearly double the amount of money spent on tree-trimming and other vegetation management as recently as just 2003 We have met our $45 million commitment and, in fact, we are exceeding that commitment as AmerenUE spent more than $50 million on vegetation management in the last year We expect to continue to spend at least $50 million on vegetation management on an annual basis in coming years

The Company has moved to a schedule of trimming urban distribution lines once every four years and rural distribution lines once every six years Not only will line trimming occur more often, but trimming will be much more aggressive than in the past For example, AmerenUE is trimming for complete vertical clearance on the backbone section of circuits, where before it only trimmed the area directly around the line but left vegetation which was overhanging the line from above Another example is our increased effort to promote off-easement trimming and tree removal, where it makes sense to do so and where landowner permission can be obtained Recognizing the threat that can be posed by trees located off our easements, we have started working closely with our customers to identify vegetation which may pose a threat during a severe wind or ice storm These trees are sometimes referred to as "danger trees" If we are able to get permission from the landowner, we are trimming or, in some cases, completely removing those trees Our experience has been a mostly positive one and many landowners have been willing to work with us to lessen the threat that danger trees may pose to the electric system in their area

In 2007, the Company trimmed more than 1,500 overhead line miles in St Louis City and County and over 4,700 overhead line miles in its entire service territory We have increased the number of crews working on vegetation management projects to approximately 640 individuals That number is double the workforce used for vegetation management work as recently as 2004 Currently, 380 tree trimming personnel are dedicated to the St Louis City and County portion of our service territory

Q. Please summarize the goal of these reliability improvement programs, including the reliability part of Project Power On.

A We have committed a substantial amount of money to underground distribution circuits, to inspect and repair distribution circuits more effectively, and to more aggressively trim vegetation We are complying with the Commission's Infrastructure

Inspection and Vegetation Management Rules, and are engaging in a systematic review of areas where undergrounding distribution lines makes sense, comparing the costs versus the benefits Our ultimate goal is to positively impact the reliability of our distribution system in a cost effective manner

Q. Have you touched on all aspects of Project Power On?

A No My testimony only addresses Project Power On as it relates to the Company's distribution system and, specifically, the portion of the program that is associated with system reliability

IV. EFFORTS TO HARDEN THE DISTRIBUTION SYSTEM AND TO IMPROVE RESTORATION OF SERVICE AFTER A MAJOR OUTAGE

Q. Earlier you mentioned work AmerenUE has undertaken in an effort to harden its distribution system and to improve restoration of service after a major outage event. Can you elaborate?

A Again, when our customers voiced their concerns, one that we heard repeatedly was that they expect us to restore service in as short amount of time as possible after an interruption Under normal circumstances, we are able to meet that expectation However, major storms impose longer outages upon our customers Unfortunately, it has become clear that both the frequency and severity of major storms in our service territory have increased in recent years As one weather expert noted, "Whatever the reason, it is clear that the severe weather in Missouri and Illinois has become much more frequent and much more severe in the past three years than it was 10 years ago " *Detailed Study of Severe Weather Occurrences in Missouri and Illinois and the Severe Weather Trends in Frequency* *and Intensity Over the Past 12 Years*, Forensic Weather Consultants, December 31, 2006 [3] We believe, as borne out by both Commission Staff and third party evaluations, we have done a good job with respect to storm preparedness and response and we continue to aggressively explore measures that can further improve both our storm preparation and response

For example, after every major storm, AmerenUE conducts an internal debriefing process to identify areas where improvement can be made The Company undertook that process after the 2006 storms and implemented changes based upon that effort In 2007, the Company went a step further and hired the most qualified consulting firm that specializes in electric system reliability studies that was available to provide the Company with an independent analysis of AmerenUE's storm response practices The firm retained, KEMA, focuses on providing business and technical consulting, inspections and measurement, testing and certification to electric utilities In its 75 years in the utility business, KEMA has provided energy consulting and technology implementation expertise to some 500 utilities in 70 countries around the world AmerenUE believes KEMA was uniquely suited to review the Company's storm preparedness and restoration practices, as they had the ability to link a utility's operational needs with customer expectations, regulatory requirements, financial objects and other stakeholder goals Additional information about this well-qualified firm can be found at kema com

KEMA's charge was to perform a complete review of three areas AmerenUE's sub-transmission and distribution system, the Company's design and

[3] Forensic Weather Consultants (FWC) was retained to conduct a study of the number and severity of "significant weather events" that have occurred in Missouri and Illinois in recent years compared to a similar period 10 years earlier

maintenance plans, and its emergency restoration efforts after severe storms KEMA spent a great deal of time with AmerenUE personnel and made several presentations to the Commission Staff and to other interested parties In November of 2007, KEMA issued a 197 page report which detailed the results of its investigation and suggested 37 recommendations to improve AmerenUE's restoration efforts KEMA's report is attached to my direct testimony as Schedule RJM-E1 Generally, KEMA found that AmerenUE performed well after each of the major storms in 2006 and that although the Company's restoration plan was not designed for the magnitude of storm damage that it faced, the plan did provide a robust framework for a well-executed restoration response

Q. What types of recommendations where included in the report from KEMA?

A KEMA's 37 recommendations were varied, including recommendations to better manage the process of providing restoration time information to its customers, to adopt a corporate communications strategy, to develop an initial damage assessment methodology and to continue building a working relationship with the State Emergency Operations Center, just to name a few

Q. Will AmerenUE implement KEMA's recommendations?

A All of KEMA's recommendations are currently being reviewed Many of the recommendations are being adopted Further, as the report points out, many of the recommendations were already in the process of being implemented by the Company prior to the issuance of the report Others require further evaluation so that AmerenUE can determine how to best put the recommendation in place For example, one recommendation was to conduct a test scenario of storm call volumes into our customer service department

AmerenUE has determined that this test may be more difficult than originally anticipated because of the number of different AT&T Central Office switches in the St Louis region This recommendation is still being reviewed so that the Company can determine how to carry out the test scenario in a manner that best approximates what occurs during an actual, widespread outage event

V. CUSTOMER COMMUNICATION EFFORTS

Q. Please elaborate on your earlier statement that AmerenUE customers need more information about the Company's investments in its electric system, including through the Power On Program.

A AmerenUE is faced with a situation where it needs, more than ever, to clearly communicate with its customers so that customers can be informed about the investments it is making in its electric distribution system and the other steps it is taking to improve reliability and to foster environmental stewardship This type of communication is not only important to the Company, but to the Commission and other stakeholders who are directly affected by the investments the Company must make to maintain and improve system reliability, to deliver the power its customers need, and to comply with an increasingly stringent set of environmental mandates As discussed in the direct testimonies of AmerenUE President and CEO Thomas R Voss and AmerenUE witness Kenneth Gordon Ph D, the fact is that utilities, including AmerenUE, are facing rapidly rising costs which will affect rates now and in the coming years Among those costs are the kinds of investments included in Project Power On Informing customers about these critical investments in our system is absolutely essential if we expect customers to accept the rate increase necessary to fund these improvements

The need to better communicate with customers in these areas has also been communicated to us by our customers, and is borne out by a JD Power and Associates report According to that report, there is inherent value for any public utility to have a robust customer contact program According to the March, 2007, J D Power and Associates E Source Residential Focus Report

> J D Power and Associates' most recent model for electric utility residential customer satisfaction show the rising importance of effective communications Last year, for the first time, its residential customer satisfaction model included a specific component on communications, which accounted for about 15 percent of a utility's overall residential customer satisfaction score – more than billing/payment options or customer service

Recent history demonstrates that we cannot rely on traditional methods of communication – a line on a customer's bill or a press release doesn't sufficiently convey the needed information to many of our customers Thus we have undertaken a substantial customer communication effort which uses television, radio and billboards as well as detailed mailings to communicate to our customers our efforts to improve system reliability and to be good environmental stewards, including through Project Power On

The amount we are spending, approximately $5 million, is modest compared to the advertising costs of most businesses, which typically spend at least 3 to 4 percent of their gross revenues on advertising and other marketing Mass market advertising is necessary to ensure our customers in the 57 counties we serve across Missouri know how we are investing in distribution system infrastructure to improve reliability, and so that customers understand the costs associated with those improvements Mass market advertising provides a context for each customer so that when we come to the doorstep of a homeowner or business to explain a project or to request the ability to trim or remove off-easement vegetation, the homeowner or business owner understands the reasons behind these efforts and the expenditures associated with them, which in large measure are embodied in Project Power On This basic understanding will help gain customer acceptance for needed improvements, more aggressive vegetation management, and more inspections, and the costs and rate impacts associated with them The same principles apply to the need to communicate the substantial cost impacts involved in complying with new and more stringent environmental regulations, which are costs over which neither the Company nor the Commission has any control

Q. Aren't these communications really just a form of advertising designed to improve the Company's public image?

A No That would be an inaccurate characterization of this communication effort These communications contain information that is necessary and important to our customers, as noted earlier These direct mail letters, general print and electronic advertisements explain what projects are being conducted and why they are being conducted A general rule of thumb for communication is that an individual must hear a message at least three times before the message actually registers with that person The use of a range of tools—direct mail, print and electronic advertising and media contact helps the Company get those messages to its customers so that they understand the reasons for Project Power On and have a greater awareness of how the project will improve system reliability

In this day and age, customers expect to be informed as to what is going on and what the Company's plans are for the future They are concerned about the reliability of their electric service and demand information on how that reliability is being improved We attempt to communicate with our customers in numerous ways For example, we do a mailing to all customers at least once per year and can do special mailings when appropriate We make information available on our website, Ameren com However, we know that some customers don't read the mailings and not all of our customers have the time or ability to access our website We do not believe there is a single manner of communication that will allow us to reach every customer Given that fact, we would be remiss to not use a multitude of mechanisms to communicate this important information to our customers The advertising we've done in the past year has provided us with a tool that is valuable to the Company, but even more so to our customers

Q. Has the Company made changes or improvements to Ameren.com for the purpose of providing more up-to-date information to AmerenUE customers?

A. Absolutely As part of our internal debriefing from the public hearings held when the Commission investigated AmerenUE's response to the 2006 summer storms, AmerenUE has redesigned a portion of its website to allow customers to access information about their specific outages This information was available previously, but only to customers who had set up an account with a password This proved to be inconvenient for many of our customers Now customers can log onto our system using their phone numbers, and they are able to see the status of their service, although they will still need to create an account to access additional account information, such as billing information

Additionally, we have divided the maps on Ameren com by state and have added greater levels of detail, allowing our customers to look at outages by zip code We have also added alert messages on the outage maps and have integrated those alert messages with the application that our call-takers utilize so that they can easily refer to these alert messages while talking with our customers This allows our customer contact center to provide the most accurate and up-to-date information

There are additional website improvements scheduled to take effect in 2008, including providing information regarding specific reliability improvements that will impact customer service based on the distribution circuit that serves that customer Typical projects that would be displayed include planned or in-progress tree trimming, line maintenance, line upgrades, and undergrounding work on a customer's circuit We are also looking at how we can allow customers to enter outage calls, street light outages and wire down reports through our website This will likely be a map-based entry of the information in order to show the customer existing orders and prevent the creation of duplicate orders for the same problem

Q. Does this conclude your direct testimony?

A Yes, it does

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company	)	
d/b/a AmerenUE for Authority to File	)	
Tariffs Increasing Rates for Electric	)	Case No ER-2008-____
Service Provided to Customers in the	)	
Company's Missouri Service Area	)	

AFFIDAVIT OF RICHARD J. MARK

STATE OF MISSOURI)
) **ss**
CITY OF ST. LOUIS)

Richard J Mark, being first duly sworn on his oath, states:

1 My name is Richard J Mark I work in the City of St Louis, Missouri, and I am employed by AmerenUE as Senior Vice President of Missouri Energy Delivery

2 Attached hereto and made a part hereof for all purposes is my Direct Testimony on behalf of Union Electric Company d/b/a AmerenUE consisting of 19 pages, Attachment A and Schedule RJM-E1, all of which have been prepared in written form for introduction into evidence in the above-referenced docket

3 I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct

Richard J. Mark

Subscribed and sworn to before me this 1st day of April, 2008

Notary Public

My commission expires

DEBRA K PATTERSON
NOTARY PUBLIC NOTARY SEAL
State of Missouri
St Louis County
My Commission Expires Oct 31 2008
Commission # 04482292

EXECUTIVE SUMMARY

Richard Mark

Senior Vice President of Missouri Energy Delivery for Union Electric Company d/b/a AmerenUE

* * * * * * * * * *

AmerenUE has made important operational changes that will positively impact its customers. The Company has renewed efforts to improve both the reliability of its service to customers and its ability to restore power in a timely manner when it is interrupted. These efforts include a direct response to every customer-specific complaint expressed at local public hearings held in the Commission's storm investigation docket (Case No. EO-2007-0037) and in the Company's last rate proceeding (Case No. ER-2007-0002), organizational changes to improve identification and correction of areas where reliability improvements can be made, implementation of the Commission's recently adopted Infrastructure Inspection and Vegetation Management Rules, and the initiation of various reliability improvement programs, including Project Power On.

We are listening to our customers' concerns and working to respond to their needs. Historically, the Company has been focused on being a low-cost provider of electricity to its customers, as evidenced by the fact that AmerenUE's rates are among the lowest in the nation. It is now apparent that while our customers still expect us to provide electric service at a reasonable cost, the reliability of our electric service occupies an increasingly important role in our customers' satisfaction. We have taken on the challenge of improving the reliability of our electric service and are in the midst of implementing several programs to enable us to achieve that goal.

Throughout 2007, the Company held more than 525 meetings with individuals, community leaders, neighborhood associations, senior citizen centers, legislators and business owners to receive input on their concerns and to discuss how those concerns could be addressed We are using that information to focus our efforts on improving reliability as promptly and cost-effectively as possible

Organizationally, the Company has made several changes We have restructured our Corporate Communications Department and set up a designated group to analyze customer information in order to identify and communicate improvement opportunities The goal is to review and analyze various sources of customer input to allow the Company to better recognize and respond to the concerns of our customers

The Company created a Reliability Improvement Department within AmerenUE This places the responsibility for and oversight of our reliability projects in one area, which will enable a more consistent and effective approach to implementing reliability projects We believe this will help to promote real reliability improvement for our customers

AmerenUE has implemented several projects designed to help the Company improve the reliability of its system, including its most significant system investment program, called Project Power On (described in detail in my testimony) Beyond Project Power On, AmerenUE contracted with a consulting firm, KEMA, to obtain an independent, expert opinion on how the Company could harden its electric system to minimize service interruptions and to identify ways to improve system restoration after major storms

AmerenUE is faced with a situation where it needs, more than ever, to clearly communicate with its customers so that its customers can be informed about the investment it is making in its electric distribution system and the other steps it is taking to improve reliability and to foster environmental stewardship

Recent history demonstrates that we cannot rely on traditional methods of communication – a line on a customer's bill or a press release doesn't sufficiently convey the needed information to many of our customers Thus we have undertaken a large customer communication effort which uses television, radio and billboards as well as detailed mailings to communicate to our customers our efforts to improve system reliability and to be good environmental stewards, including through Project Power On

AmerenUE has redesigned a portion of its website to allow customers to access information about their specific outages This information was available previously, but only to customers who had set up an account with a password This proved to be inconvenient for many of our customers Now customers can log onto our system using their phone numbers, and they are able to see the status of their service, although they will still need to create an account to access additional account information, such as billing information There are additional website improvements scheduled to take effect in 2008

FINAL

AmerenUE
Storm Adequacy Review

AmerenUE
St. Louis, Missouri

KEMA Project AMSV.0001

Executive Summary

In July and December of 2006 AmerenUE's Missouri service territory experienced severe weather inflicting the most extensive damage to the electric sub-transmission and distribution infrastructure in the company's history Severe July winds, from windstorms two days apart originating at right angles to each other, created the largest restoration effort ever performed by AmerenUE In December AmerenUE's customers were assaulted with an extreme ice storm, again leading to protracted restoration efforts These storms caused widespread damage to trees and power lines resulting in power outages confined to an area comprised of six districts encompassing the greater St Louis area Over 650,000 and 270,000 AmerenUE electric customers lost power during the July and December events respectively

In response to these storms, AmerenUE quickly ramped up from its normal field complement of 800 AmerenUE line personnel and contractors to 3800 and 4400 electric line crews, tree crews, and electric service crews for July and December respectively, in addition to numerous corporate personnel, to support the restoration efforts The rapid response by AmerenUE's management to secure additional resources from contractor companies and other utilities was a significant factor in the company's ability to fully restore the system in ten and eight days respectively, especially considering there was no advance warning for the July storm and little warning for the December storm

The magnitude of the supporting logistics, generally invisible to the average customer, was the equivalent of bringing the population of a small town into the area and providing all necessary logistical services, food service, lodging, parking, vehicle support and security, and personal needs to accommodate the population In addition, the operational logistics for field work such as materials, equipment and supervision are extensive and far exceed requirements in normal operating periods These restorations were a massive effort by any standard In overall review of the effort put forth by AmerenUE, KEMA concluded that

> ***AmerenUE, its employees, and contractors performed very well restoring power after these record-breaking 2006 storms. AmerenUE's restoration plan, while not designed to address the magnitude of the storm damage and the overwhelming volume of restoration activities, did provide a sufficiently robust framework for an effectively executed restoration response. AmerenUE is found to be a company dedicated to continuous improvement and management demonstrated by its dedication and commitment to this principle by adopting a series of initiatives in the areas of system design, maintenance, and emergency restoration planning and execution.***

This review focused on three areas, sub-transmission and distribution (T&D), design and maintenance (including an infrastructure review based on a forensic study of the system resilience as response to the storms) and the emergency restoration plan's implementation during these severe storms In summary, KEMA found the following

- While AmerenUE's non-storm reliability indices have been relatively constant in recent years, its overall daily reliability has been trending slightly downward during the same period due to a marked increase in severe weather activity,

- AmerenUE's design standards are consistent with good engineering standards for the typical wind and weather conditions found in the mid-west,

- While AmerenUE's average age of the T&D pole inventory in the six districts affected by the 2006 major storms is approximately 35 years, it is within the norms for the industry in the mid-west,

- AmerenUE's pole inspection and vegetation management practices were consistent with industry practices Programs, primarily due to a 2003 budget cut, were sporadic prior to these catastrophic events and have been significantly upgraded since 2004,
  - Much of the 2006 storm damage would not have been prevented by these programs,
  - Since the 2006 major storms, AmerenUE has introduced an extensive overall inspection program encompassing a solid interlaced scheme of vegetation management (including addressing out of easement tree removal), sub-transmission and distribution circuit inspections and pole inspections,

- AmerenUE's emergency restoration plan and elements of information processes were designed for the more moderate storms typically experienced, therefore, AmerenUE was limited in their ability to scale up the technology solutions to storms of this size, and

- AmerenUE's reaction to the storms was immediate and appropriate given the management tools present at the time

It is also KEMA's opinion that AmerenUE could have managed the process of providing restoration time information to its customers in a better fashion The magnitude of these storms and AmerenUE's lack of experience with these large storms resulted in customers not receiving timely, actionable and valuable information

Based on KEMA's specific conclusions, coupled with knowledge of leading industry practices in the area of system design, maintenance and outage management, KEMA has identified the following 37 opportunities for AmerenUE to improve overall T&D system resilience to storms and the storm restoration efforts to both minimize the level of damage and shorten the overall restoration time The recommendations have been grouped into the following three categories

- Continue with AmerenUE identified improvements,
- Modify existing processes and systems to better address severe storms, and
- Develop new processes and systems to support Levels III and IV restoration efforts

Continue with AmerenUE's already identified improvements AmerenUE has already established a need for these 12 improvements and has incorporated them into current budgets The numbers in parentheses (4 4 1) represents the recommendation number and section in the report

- Continue emphasis on the vegetation management program to achieve the committed schedule by the 4th quarter of 2008 and to implement the program enhancements Address the out of easement tree removal issues and review total budget periodically with the anticipation of the growing tree canopy (3 4 1)

  <u>AmerenUE response to 3.4.1</u> – **AmerenUE is committed to achieving the desired cycle lengths (four-year "urban" and six-year "rural") by the end of 2008 according to previous arrangements made with the Public Service Commission, and AmerenUE is currently on target to satisfy this goal. Additional vegetation program enhancements have been and will continue to be implemented on an even broader scale as cycle lengths are obtained. Current budgets for vegetation management associated with Project Power On are roughly double what they've been in recent years, and these figures are reviewed each year in the interest of improving service reliability in the most cost-effective manner.**

- Continue the revised pole inspection at the targeted inspection rate The pole inspection planning, record keeping, analysis and auditing functions should be improved (3 4 2)

  <u>AmerenUE response to 3.4.2</u> – **AmerenUE plans to continue inspections of the entire Missouri wood pole plant at the targeted rate of once every twelve years. Inspection planning and record keeping are currently done within the newly developed Circuit and Device Inspection System (CDIS) database. The database is linked to the pole plant record in the AM/FM system, thus providing the recommended functionality. Planned enhancements for 2008 include standard**

Schedule RJM-E1-4

reporting functions as well as enhanced access to the data for analysis purposes. With regard to the auditing recommendation, CDIS now tracks completion of the pole replacement work through DOJM, AmerenUE's work management system. Results are monitored by AmerenUE management on a monthly basis.

- Complete and distribute the automated pole loading calculation tool currently in development in the standards department (4 4 1)

  AmerenUE response to 4.4.1 – **The automated pole loading calculation program has been in development in the Standards Department for approximately two years and is scheduled to be released for AmerenUE internal use by the Missouri divisions and distribution planning departments in early 2008.**

- Continue the evaluation of the enhanced vegetation management program and apply the same approach to pole inspection and distribution line equipment programs (5 4 2)

  AmerenUE response to 5 4.2 – **Both the vegetation management program as well as pole inspection and distribution line equipment programs will be evaluated on an annual basis for cost effectiveness. A Users' Group has also been established for purposes of evaluating the effectiveness of the pole and line equipment inspection programs, consisting of field construction and engineering personnel, as well as other subject matter experts. The group meets monthly to review program status and evaluate potential program modifications and improvements, in order to provide the necessary information in the most efficient manner. Among the enhancements introduced thus far are the automation of inspection data delivery and construction job creation by both AmerenUE and its inspection contractor.**

- Continue with AmerenUE's plan to deploy additional weather recording sites and develop improved forecasting of potential damage capability (8 4 1)

  AmerenUE response to 8.4.1 – **AmerenUE is currently working with St Louis University to install 50 weather stations around Missouri. These weather stations will be strategically placed to enable AmerenUE to track, and therefore more accurately forecast, impending weather events as they approach the St Louis metropolitan area. A number of the weather stations will be installed in and around the metropolitan area to assist AmerenUE with initial damage assessments after a storm has hit. All 50 weather stations should be installed by early Spring 2008 and St Louis University should have the system up and receiving data by the end of April 2008.**

- Continue with AmerenUE's practice for notifying, mobilizing, and managing foreign and mutual aid resources (8 4 2)

 AmerenUE response to 8.4.2 – **It is AmerenUE's full intent to continue with the practice of notifying, mobilizing and managing foreign and mutual aid resources when the need arises. AmerenUE further intends to continuously monitor, evaluate, and revise its methods of doing so.**

- Expand the use of AmerenUE's leading practice of using Public Safety Advisors and Cut-and-Clear crews, permitting Field Checkers to focus on damage assessment while simultaneously ensuring the public is safeguarded from electric hazards (9 4 2)

 AmerenUE response to 9.4.2 – **The use of Public Safety Advisors and Cut-and-Clear Crews has become critical during storm restoration efforts to ensure public safety. AmerenUE will continue to evaluate the expansion of these two roles**

- Expand the number and use of Mobile Command Centers during Level III and IV events (10 4 4)

 AmerenUE response to 10.4.4 – **AmerenUE is currently performing a needs assessment to determine the optimum number of Mobile Command Centers required during Level III and Level IV events. One unit is currently in service and a second is on the drawing board.**

- Continue nurturing the strong working relationship AmerenUE already has with the Missouri Department of Transportation, the State Emergency Operations Center and local emergency operations centers (10 4 5)

 AmerenUE response to 10.4.5 – **AmerenUE will continue to build and expand upon the relationships it currently enjoys with the Missouri Department of Transportation, the State Emergency Management Agency, and other local EOCs.**

- Continue with the practice of issuing information cards to foreign and mutual aid crews, as part of the overall orientation package, to streamline the interface with the Distribution Dispatch Office for clearance taking and ensure that the process is formalized in the Electric Emergency Restoration Plan (EERP) (10 4 6)

 AmerenUE response to 10.4 6 – **AmerenUE will continue the practice of issuing information cards to foreign and mutual aid crews as part of its overall orientation package. In addition, AmerenUE will continue to review the orientation package**

and presentation (at least on an annual basis) for subject content and process updates.

- Continue with the 24-hour coverage practice for vegetation restoration activities, where 20% of the tree crews work through the night on an as-needed basis (10 4 8)

  AmerenUE response to 10.4.8 **– AmerenUE will continue to provide the appropriate shift coverage with Vegetation Management personnel based upon the unique requirements of each restoration effort.**

- Complete the review of the loss of customer call situations (12 4 1)

  AmerenUE response to 12.4.1 **– This recommendation has a number of constituent parts. Per the more detailed discussion in the text, Ameren's IT function and the business lines will work together to determine all the in-bound communication stakeholders and their needs. The anticipated call volumes will be estimated based on the ultimate criteria for the various storm levels. Ameren already has design information from AT&T and Stericycle (the in-bound high volume outage call vendor) on their respective call volume capabilities. However, the test scenario discussed in the recommendation may be more difficult than anticipated and unattainable. This is due to AT&T having 27 different local Central Office switches in the St. Louis area. Realistically, Ameren would have to make the phone calls in each of the local regions covered by these switches, and access to each of the 27 local Central Office switches may not be possible. A test scenario can be conducted utilizing the AT&T 800 service for AmerenUE by calling the local AT&T number for AmerenUE from a centralized location. Ameren will need to further investigate and fully define these types of scenarios. Once these definitions are in place, Ameren is willing to work with the vendors to complete the testing and evaluate the results.**

AmerenUE's current processes and structures are adequate for Levels I and II restoration efforts, but need to be modified to support the restoration efforts of Levels III and IV The following 15 modifications will enable existing systems, processes and structures to better support the more severe events

- Make use of detailed pole loading analyses done for foreign attachment applications by cataloging the loading data by circuit, location or other identifier The assembled information may then be used as a data sample in future studies of loading, pole condition, failure analysis, etc (4 4 3)

AmerenUE response to 4.4.3 – **AmerenUE will evaluate the usefulness of utilizing the information from existing pole loading analyses for studies internal to AmerenUE.**

- Develop and maintain current knowledge of technological developments in pole and conductor materials and designs (4 4 4)

- *AmerenUE response to 4.4.4* – **Ameren's Standards Department is charged with keeping abreast of the industry's technological developments in pole and conductor materials and designs and considers this part of its daily mission. This department has studied various composite materials associated with distribution facilities as well alternate design configurations. Among the more recent changes made in Ameren construction standards have been the introduction of cambered poles, fiberglass crossarms for distribution voltages, and armless construction configurations for subtransmission voltages. As other opportunities present themselves that make economic sense to pursue, Ameren Standards will give them due consideration.**

- Redefine the existing storm level classifications to include at least one additional level (7 4 1)

  AmerenUE response to 7 4.1 – **AmerenUE plans to add a Level IV storm definition to its EERP. The initial recommendation is that Level IV would be declared when greater than 200 feeders are locked out or when greater than 200,000 customers are without power, or both. This recommendation is still being evaluated and may be adjusted.**

- Integrate all subordinate emergency plans into the master EERP (7 4 2)

  AmerenUE response to 7.4.2 – **AmerenUE has recently created and filled a new position – Superintendent of Emergency Planning. It will be this person's job to continually monitor and revise the EERP and work with all of the AmerenUE Divisions to ensure the subordinate plans are in line with the master EERP. Integration of all subordinate emergency plans into the master EERP, per this recommendation, will be a part of the process. This project will be started in the first quarter of 2008.**

- Expand Section Six of the EERP to include the development of self-administered work islands during Level III and IV storms (7 4 4)

<u>AmerenUE response to 7.4.4</u> – **The expansion of Section Six of the EERP is a priority for AmerenUE. Development of self-administered work islands will be considered as a part of that expansion.**

- Define the process and enhance the communications between AmerenUE's Emergency Operations Center (EOC), Resource Management and the Divisions relating to resource volume and arrival times to assist Divisions in improving efficient crew dispatching (10 4 2)

<u>AmerenUE response to 10.4.2</u> – **Timely communication with regard to resource volume and arrival times is crucial during the initial stages of a storm restoration effort. AmerenUE will define the communication process between the EOC, Resource Management and the Divisions as it relates to incoming resources and their estimated arrival times. AmerenUE will continue to review this process definition (at least on an annual basis) for possible communication enhancements between all parties. AmerenUE's existing plans to upgrade to V3.2 of Resources on Demand, its storm resource tracking software, will also have an impact on this enhancement.**

- Refine the certified functional agent program to secure more employee participation (10 4 7)

<u>AmerenUE response to 10 4.7</u> – **AmerenUE is evaluating the certified functional agent program to determine additional training needs. This includes, but is not limited to, adding more employees to the list and determining annual training requirements to ensure certified employees maintain their degrees of competency.**

- Evaluate the AMI (Advanced Metering Infrastructure) system ability to support large scale restoration events (11 4 3)

<u>AmerenUE response to 11.4 3</u> – **AmerenUE's AMI service provider, Cellnet Technologies, and Ameren's IT Operations Department have both made changes to monitor the outage-related AMI functions on a consistent basis. Cellnet has tuned various parameters in the application. Together, AmerenUE and Cellnet are studying a number of software options given the limitations inherent in the current AMI technology. They expect to have design specifications finalized by the end of 1Q08.**

- Develop a process to deliver AmerenUE's restoration information and estimates directly to customers in a form under AmerenUE's control (13 4 2)

<u>AmerenUE response to 13.4.2</u> – **The purchase of radio time and newspaper ad space in the interest of delivering "custom" AmerenUE messages to the public is something that has been done before, albeit on a limited scale. The potential for negative slants to be integrated into the media/press coverage of severe weather events does make the prospect of customizing messages for the public and delivering them directly a more attractive strategy than it's been in the past. AmerenUE will seriously consider using these kinds of controlled information outlets more consistently.**

- Develop a critical facility list and define responsibilities and expected outcomes (13 4 3)

<u>AmerenUE response to 13 4.3</u> – **A critical facility list has been developed and covers all of AmerenUE's operating territory. The initial definition of what constitutes a "critical facility" has been determined and facilities that fall within that definition have had their accounts coded to include them on the list. Effective 12/19/07, customers with "critical" SIC codes appear on various screens within AmerenUE's Outage Analysis System (OAS). Responsibility for maintenance and control of the list is currently being defined.**

- Develop and perform a realistic test for EMPRV (14 4 1)

<u>AmerenUE response to 14.4.1</u> – **Since the 2006 storms, EMPRV's interfaces have been replaced by faster interfaces and workflows to Oracle Purchasing, and AmerenUE's removed the temporary interface to MMIS, the old materials management system. In early 2008, AmerenUE will be moving to a faster server infrastructure, which balances CPU usage during peak times. In addition to monitoring normal performance, AmerenUE plans to hold special post-storm meetings to address process, application, and workflow issues for purposes of achieving continuous improvement in this area.**

- Develop an implementation plan for Resources on Demand (3 0) to support the logistics function and all contractors and mutual aid crews (15 4 1)

<u>AmerenUE response to 15.4 1</u> – **Version 3.2 of Resources on Demand is currently being configured with AmerenUE information and should be ready for implementation at the start of 2008. Training on the upgrade is tentatively scheduled for mid-January of 2008.**

- Develop a restoration communications process that uses the EOC informational dashboard and twice daily conference calls to obtain and provide timely and consistent information to all external communications stakeholders (13 4 1)

  AmerenUE response to 13.4.1 **– The manner in which AmerenUE deals with the restoration of storm-related outages has fallen under far greater scrutiny in recent years. In light of this, AmerenUE is in agreement that a more standardized method of communication with both internal and external stakeholders during these types of events is necessary. AmerenUE Corporate Communications will work to identify those stakeholders and their respective needs and collaborate with EOC personnel on the development of informational "templates" that can be used to transfer information from the EOC to those stakeholders during severe weather events.**

- Refine and formally adopt a Corporate Communications Strategy (13 4 4)

  AmerenUE response to 13.4.4 **– Communication with the customer and public engagement in general have become very important for AmerenUE over the last couple of years. And while many new branding and communication initiatives are afoot, there is no centrally documented Corporate Communications Strategy binding these activities together. AmerenUE is currently developing such a strategy**

- Continue enhancing the outage determination business logic in the Outage Analysis System (OAS) to improve the estimation of Expected Restoration Times and resource requirements during Level III and Level IV restorations (11 4 1)

  AmerenUE response to 11.4.1 **– This recommendation has a number of constituent parts. In response to the more detailed discussion in the text, the issue of multiple damage points downstream from a protective device is related to the OAS analysis engine and how it "groups" outages, as well as to the use of its partial restoration capability. AmerenUE will have to organize a team of business experts to discuss enhancements to the analysis engine before any changes can be implemented in OAS. Regarding counts of damaged assets, OAS's OA6C screen was designed and implemented to capture the detailed construction needs on a specific order, though it is not often used. An AmerenUE team will have to convene to review this existing screen and determine policy and requirements for its expanded use. Regarding OAS support of a "quick damage assessment process," another team would have to be formed to understand what information (other than what comes in from the OAS call) can be collected and entered in order for an algorithm or process to determine**

Schedule RJM-E1-11

a high level damage assessment. In the mean time, an update ERT process was put into place in the last year to improve ERT accuracy and customer communication. Given this, AmerenUE will continue to use the new ERT process and monitor customer and media feedback regarding its effectiveness.

The following 10 enhancements will help ensure that AmerenUE's T&D system is significantly robust to minimize future damage, and that future restoration efforts support the reasonable return of all AmerenUE customers in the shortest time possible

- Develop, design, and implement an initial damage assessment methodology to be conducted during the first six hours of the event that provides the appropriate determination of the storm classification, estimated required restoration resources, and initial restoration time estimates appropriate for public communication (9 4 1)

  AmerenUE response to 9.4.1 – **Initial damage assessment is probably one of the most critical aspects of storm restoration. The EERP addresses this issue and lays the groundwork for development, design, and implementation. The next step is, within the framework of the subordinate emergency plans, to establish how the assessment is implemented at the division level. The Superintendent of Emergency Planning will be working with the Missouri divisions to review and revise their storm plans in 2008. This item will part of that review.**

- Adopt a "Restoration Work Island" approach under Level III and IV emergency conditions (10 4 3)

  AmerenUE response to 10.4.3 – **AmerenUE has used the "Restoration Work Island" approach in the past in isolated instances, with a good degree of success. AmerenUE will continue to research and evaluate this approach as a storm restoration practice under particular emergency conditions.**

- Use the 800 network in front of Customer Service System/IVRU (Integrated Voice Response Unit) to enhance call-taking capacity and information capabilities (12 4 2)

  AmerenUE response to 12.4.2 – **This recommendation would require that all AmerenUE calls would need to be converted to 800-service. The local numbers would need to be eliminated, which would take several years due to the local numbers needing to be removed from the phone book, internet, and customers' speed dial lists. Ameren will need to investigate if a unique message can be played to each individual customer based upon each customer's Automated Number Identification (ANI). Ultimately, AmerenUE will need further clarification from**

Schedule RJM-E1-12

KEMA on this suggested recommendation before any degree of commitment can be made.

- Modify the OAS data structure to capture outage root cause and affected components better, supporting post-storm infrastructure analysis or create a dedicated forensic database (3 4 3)

  AmerenUE response to 3.4.3 **– AmerenUE is willing to investigate this further in terms of how the necessary data would be captured, who would enter it, and how it would be extracted for analysis. Preliminarily, a team (perhaps including Construction Standards personnel) would need to identify what criteria and associated data should be required for supporting a forensic analysis. Then a determination can be made as to how to best capture the information and where it should be entered. AmerenUE will plan for establishing the criteria and data requirements in 2008 and implementing a solution thereafter.**

- Institute a formal Forensic Analysis process to run concurrently with damage assessment (7 4 3)

  AmerenUE response to 7.4.3 **– The development of a formal forensic analysis procedure that is integrated into the damage assessment phase of storm restoration activity is currently being evaluated.**

- Develop design standards and guidelines related to NESC construction grades (B or C) and to specific applications in the service territory (4 4 2)

  AmerenUE response to 4.4.2 **– In early 2007 AmerenUE made a decision to "early adopt" the 2007 version of the National Electric Safety Code (NESC), that is, before the State of Missouri endorsed it as its version of choice. The Ameren Standards Department is currently working to incorporate all provisions of the code into its next revision of the Construction Standards, to be released in early 2008. In the mean time, AmerenUE incorporated the NESC's new "extreme ice loading" criteria into its replacement and build-out strategy for all 34kV and 69kV construction as of March 2007, which exceeds the code's original intent. The Standards Department continues to study expanded applications of B-grade construction in those instances where reliability stands to improve and it makes economic sense.**

- Develop a statistical analysis methodology to ensure that maintenance is optimal for different classes of line equipment (5 4 1)

AmerenUE response to 5.4.1 **– AmerenUE will analyze the data returning from the circuit and device inspections to determine optimal maintenance policies. AmerenUE expects to complete the first study in 2008 and will refresh the analysis on an annual basis. In addition, AmerenUE will utilize an existing proprietary methodology, developed in conjunction with another consulting firm, to analyze equipment life cycles for optimum replacement policies.**

- Enhance the internal informational dashboard displaying current and historical information during the progression of the storm that includes customer outage and restoration resource levels (10 4 1)

AmerenUE response to 10.4.1 **– AmerenUE currently has an informational dashboard that provides information as the storm restoration progresses. Enhancements to the dashboard are being evaluated.**

- Evaluate the benefits and risks of providing temporary repairs to customers' weather head equipment under emergency conditions (10 4 9)

AmerenUE response to 10 4.9 **– There are many issues surrounding this recommendation that will have an effect outside the realm of AmerenUE. Further evaluation and study will be required in this area.**

- Integrate the CellNet system into the restoration verification process during Level III and IV events to the extent of the current AMI technology's capabilities (11 4 2)

AmerenUE response to 11.4.2 **– AmerenUE and its AMI vendor, Cellnet Technologies, have been investigating the capabilities and limitations inherent in the AMI technology. Together they are defining software specifications that could potentially improve restoration verification functions during larger scale severe weather events.**

It should be noted that many of these activities have already been started by AmerenUE as part of their continuous improvement program Consistent with the EERP, the company completed a series of post-event debriefings From these debriefings, a number of actions and recommendations were developed to enhance the company's ability to respond to future events of a similar nature and impact Many of the resulting action items have been completed at the time of publication, while others are still a work in progress

This report is an evaluation of the AmerenUE's storm restoration response to the 2006 major storms The report details a number of conclusions reached by KEMA during the review These conclusions have been shared with AmerenUE personnel and the ensuing recommendations designed to address the identified opportunities have been developed jointly The detailed findings, conclusions and recommendations constitute the body of this report

Table of Contents

Executive Summary		- 1 -
1	Introduction	1-1
	1 1 Background	1-1
	1 2 Situation	1-1
2	Project Approach and Methodology	2-1
3	Project Area – Infrastructure Review	3-1
	3 1 Data and Analysis	3-1
	3 2 AmerenUE and Comparative Data	3-5
	3 3 Conclusions	3-35
	3 4 Recommendations	3-39
4	Project Area – Engineering Standards	4-1
	4 1 Engineering Data and Analysis	4-1
	4 2 Review of Design Standards and Practices	4-5
	4 3 Conclusions	4-7
	4 4 Recommendations	4-9
5	Project Area – Maintenance	5-1
	5 1 Maintenance Program Overview	5-1
	5 2 AmerenUE and Comparative Data	5-4
	5 3 Conclusions	5-6
	5 4 Recommendations	5-8
6	Project Area – Emergency Restoration Plan	6-1
	6 1 Leading Practices in Emergency Restoration	6-1
7	Emergency Restoration – Annual Plan	7-1
	7 1 Industry Practices	7-1
	7 2 AmerenUE Practices	7-2
	7 3 Conclusions	7-3
	7 4 Recommendations	7-20
8	Emergency Restoration – Imminent Event Plan	8-1
	8 1 Industry Practices	8-1
	8 2 AmerenUE Practices	8-1
	8 3 Conclusions	8-2
	8 4 Recommendations	8-5
9	Emergency Restoration – Event Assessment	9-1
	9 1 Industry Practices	9-1
	9 2 AmerenUE Practices	9-2
	9 3 Conclusions	9-5
	9 4 Recommendations	9-12
10	Emergency Restoration – Execution	10-1
	10 1 Industry Practices	10-1
	10 2 AmerenUE Practices	10-2
	10 3 Conclusions	10-2
	10 4 Recommendations	10-16

Table of Contents

11 Emergency Restoration – Information Systems and Processes 11-1
11 2 AmerenUE Practices 11-4
11 3 Conclusions 11-8
11 4 Recommendations 11-15
12 Emergency Restoration – Customer Service 12-1
12 1 Industry Practices 12-1
12 2 AmerenUE Practices 12-2
12 3 Conclusions 12-3
12 4 Recommendations 12-5
13 Emergency Restoration – External Communications 13-1
13 1 Industry Practices 13-1
13 2 AmerenUE Practices 13-2
13 3 Conclusions 13-2
13 4 Recommendations 13-10
14 Supply Chain 14-1
14 1 Industry Practices 14-1
14 2 AmerenUE Practices 14-2
14 3 Conclusions 14-2
14 4 Recommendations 14-6
15 Support Logistics 15-1
15 1 Industry Practices 15-1
15 2 AmerenUE Practices 15-2
15 3 Conclusions 15-2
15 4 Recommendations 15-4
16 Appendices 16-1
16 1 List of Exhibits 16-1
16 2 Comparative Data of Line Design and Pole Loading 16-3

Exhibit 1-1 Severe Weather Trend 1-2
Exhibit 3-1 Annual number of sustained customer interruptions by cause code (for the six districts under investigation, including storms) 3-5
Exhibit 3-2 Total number of tree-related outages 2002-2006 for the six districts under investigation 3-6
Exhibit 3-3 Selected System Characteristics 3-7
Exhibit 3-4 Pole Density 3-8
Exhibit 3-5 Pole Class 3-9
Exhibit 3-6 Pole Class by District 3-10
Exhibit 3-7 Pole Height by District 3-11
Exhibit 3-8 Average Pole Height (ft) 3-12
Exhibit 3-9 Average Pole Age (yr) 3-13
Exhibit 3-10 Average Vegetation Density 3-14
Exhibit 3-11 Vegetation Density Weighted by Pole Density 3-15

Schedule RJM-E1-17

Table of Contents

Exhibit 3-12 Pole Inspection and Treatment Program results 3-16
Exhibit 3-13 Pole inspection and treatment results as a function of pole age (1999-2002 data) 3-18
Exhibit 3-14 Trend in Vegetation Management budget and spend 3-19
Exhibit 3-15 Benchmark data from the year 2000 3-19
Exhibit 3-16 STORM DAMAGE MAP Wednesday, July 19, 2006 M represents locations of microbursts and T signifies locations of tornado touchdowns 3-21
Exhibit 3-17 STORM DAMAGE MAP Friday, July 21, 2006 M represents locations of microbursts and T signifies locations of tornado touchdowns 3-22
Exhibit 3-18 July Storm Events 3-23
Exhibit 3-19 July Storm, Outage Summary by District 3-24
Exhibit 3-20 July Storm, Pole and conductor installation data from DOJM 3-25
Exhibit 3-21 July Storm, Root Cause by District 3-26
Exhibit 3-22 July Storm, Root Cause by District 3-27
Exhibit 3-23 July Storm, Root Components 3-28
Exhibit 3-24 July Storm, Vegetation Management related 3-29
Exhibit 3-25 MODIS Polar Orbiting Satellite Snowfall Detail 3-30
Exhibit 3-26 Snowfall Totals 3-31
Exhibit 3-27 December Storm, Outage Summary by District 3-32
Exhibit 3-28 December Storm, Pole and conductor installation from DOJM 3-32
Exhibit 3-29 December Storm, Root Cause by District 3-33
Exhibit 3-30 December Storm, Root Cause by District 3-34
Exhibit 3-31 December Storm, Root Components 3-35
Exhibit 4-1 Overhead Line Loading Districts (NESC Figure 250-1) 4-2
Exhibit 4-2 Basic Wind Speed Map (NESC Figure 250-2(B) 4-3
Exhibit 4-3 Combined Freezing Rand and Wind Zones (NESC Figure 250-3) 4-4
Exhibit 4-4 Grade C Pole Selection Chart from Distribution Construction Standards 4-6
Exhibit 5-1 Pole Inspection Program 5-2
Exhibit 5-2 Electric Circuit Inspection Program 5-3
Exhibit 5-3 AmerenUE's Interlaced Infrastructure Inspections 5-5
Exhibit 5-4 Vegetation Expenditures 2001 - 2007 5-5
Exhibit 6-1 Outage Management Process 6-2
Exhibit 7-1 Outage Management Process – Annual Plan 7-1
Exhibit 7-2 Determinants Applied to Emergency Definitions and Event Levels 7-5
Exhibit 7-3 Leading Practice for Storm Definition 7-6
Exhibit 7-4 Comparison of Divisional Emergency Response Plans 7-10
Exhibit 7-5 EERP Emergency Organization... 7-14
Exhibit 7-6 Depiction of both the EOC and Division Functions 7-15
Exhibit 8-1 Outage Management Process – Imminent Event Plan 8-1
Exhibit 8-2 July Windstorm Paths 8-3
Exhibit 9-1 Outage Management Process – Event Assessment 9-1
Exhibit 9-2 Field Damage Assessment Mobilization and Reporting 9-3
Exhibit 9-3 Door Tag Hangers 9-5

Schedule RJM-E1-18

Table of Contents

Exhibit 9-4	Example of Back-lot System Design	9-10
Exhibit 9-5	Outage Event Example	9-11
Exhibit 10-1	Outage Management Process - Execution	10-1
Exhibit 10-2	Order of Resource Acquisition and Mobilization Priority	10-5
Exhibit 10-3	Approximate Normal Daily Contract Resources	10-6
Exhibit 10-4	Mobile Command Center	10-8
Exhibit 10-5	St Louis Dispatch Office Shift Coverage During Normal Operations	10-12
Exhibit 11-1	Outage Management Process – Information Systems	11-1
Exhibit 11-2	Leading Practice Integrated Systems for Outage Management Processes	11-2
Exhibit 11-3	AmerenUE Call Center Technology and Workflow	11-5
Exhibit 11-4	Example 1 of AmerenUE's web based outage information	11-6
Exhibit 11-5	Example 2 of AmerenUE's web based outage information	11-7
Exhibit 12-1	AmerenUE Inbound Call Flow	12-2
Exhibit 12-2	Using the 800 network as Front-end during Emergencies	12-6
Exhibit 13-1	Outage Management Process – Communications	13-1
Exhibit 14-1	Outage Management Process – Supply Chain	14-1
Exhibit 14-2	Storm Trailer	14-4
Exhibit 14-3	Inside of a Storm Trailer	14-4
Exhibit 15-1	Outage Management Process – Support Logistics	15-1

1. Introduction

1.1 Background

In an effort to learn from the past to improve the future, the management of the Missouri Operations of Ameren Corporation engaged KEMA Inc to conduct a study of the adequacy of the company's ability to prepare for and respond to severe weather events The scope of this engagement included reviews of the company's emergency restoration plans and processes, evaluation of the system damage incurred during 2006 storms and review of company programs in the area of infrastructure design and maintenance This report details the methodology used by KEMA to collect and analyze information, the findings resulting from that analysis, the conclusions, and recommendations for actions that KEMA believes would generally contribute to improvement in the company's ability to manage severe weather events

Throughout this report, we refer to the Company, as "AmerenUE" and it should be noted that the review and work reported herewith involved only the Missouri operations of Ameren Corporation or AmerenUE All findings, conclusions, and recommendations reported apply to only to the Missouri operations of the company

1.2 Situation

The geographic area in which AmerenUE provides electric service is often subject to severe weather The weather can take the form of significant ice storms with menacing accumulation, tornadoes, lightning, and severe thunderstorms that can occur with little or no warning on any hot summer day The impact of severe weather on an electric transmission and distribution system can vary greatly from one occurrence to another The storm impact is dependent upon many variables, including such things as the specific geographic area affected, age and condition of the electric facilities, vegetation density and condition both inside and outside the utility easement, and electric system operating configuration at the time of the event In all cases however, AmerenUE, like many other electric utilities around the country, strives to ensure that electric service is maintained during weather events and when interruptions do occur, strives to restore service in the fastest possible time while maintaining safety of the electric system for the public and the workforce

In 2006, the central US, including Missouri and the AmerenUE territory, experienced many storms that were considered unusual and severe As illustrated in Exhibit 1-1, recent weather records show that severe weather is becoming more common in all parts of the US and what once was classified as an unusual event is becoming more commonplace. Damage to the utility infrastructure of communities is occurring at higher rates and many utility companies are performing in-depth evaluations of the condition of the electric infrastructure and its ability to withstand severe weather events. Specifically, the companies are asking if the infrastructure performed as expected given the age, condition, and other attributes of the system and considering the severity of the event in question.

This report examines the performance of the AmerenUE infrastructure during the windstorms of July 2006 and the ice storms of November-December 2006. At the request of AmerenUE, KEMA consultants have evaluated the distribution system infrastructure from the perspectives of age, physical condition, and maintenance practices. KEMA has also evaluated the design and construction standards of the company and the vegetation maintenance practices in place currently and over the years preceding these events. Finally, KEMA has evaluated the emergency restoration plans and procedures of AmerenUE and the execution of those plans during recent outage events due to severe weather.

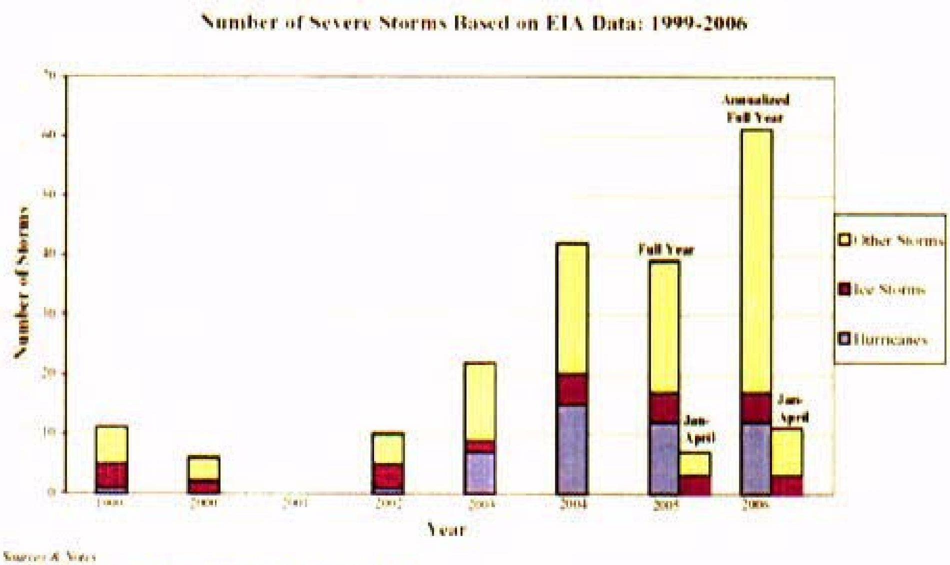


Exhibit 1-1: Severe Weather Trend

Schedule RJM-E1-21

The findings of the KEMA investigation indicate that AmerenUE does a credible job in all areas of design, construction, operation, and maintenance of the electric system AmerenUE's practices in these areas are consistent with industry standards and what is considered good utility practice However, KEMA also found that the vegetation management program and pole inspection programs prior to the 2006 storms were insufficient due to budget cuts in 2003 AmerenUE was still in the process of ramping up the pole inspection and vegetation management programs at the moment both programs were tested by severe weather events Apart from the budgeting issue, there are opportunities for improvement and KEMA has identified the areas that we believe can be improved for future outage prevention and restoration Overall, the AmerenUE system design, construction, operation, and maintenance indicate that the infrastructure is sound and is of the quality one would expect of a leading electric utility The improvements are primarily focused on a review and continuous improvement process (record keeping, analysis, business case development and feedback), aiming at maintaining the current system integrity and performance levels

Given this general assessment, why did AmerenUE customers experience extended electric service outages during storms such as the events of 2006? In summary, the weather experienced in the 2006 storms examined by KEMA was of severity and localized intensity that the utility infrastructure was not designed to withstand, nor would be expected to withstand, using industry accepted design and construction methods Furthermore, the expectation of an electric utility to build a system that would withstand such weather is questionable when considering the potential impact on rates and public concern over aesthetics of utility facilities in their community

In order to ensure that an electric system has adequate storm resilience, a utility must undertake an extensive analysis to quantify both the probability of certain weather conditions and the probability of the infrastructure to withstand those conditions over an expected facility life in excess of thirty years Add to this the changes in community development, community regulations on utility construction, growth of vegetation and impact of private landowners and public official's management of vegetation, and the variables to consider in building a storm-hardened system become quite numerous System hardening is not simply about putting in stronger poles or placing facilities underground It is about, as always in regulated utility environments, doing the best possible job with the resources available while maintaining a reasonable cost structure against good service reliability to meet the needs of consumers An infrastructure can be built that will withstand severe weather, but the cost is prohibitive to customers and regulators

When a significant storm occurs leaving hundreds of thousands of customers without service, there is an expectation by the customers, the Commission and the local and state governments that AmerenUE will work to restore service quickly This is a reasonable expectation, however, the time required to achieve the restoration of all customers could take days if not weeks depending on the severity of the damage AmerenUE, like other utilities, has a formal plan to manage the restoration efforts, which has been proven to work well in smaller storm events However, the 2006 storms were not normal, leaving over 650,000 customers in July and 270,000 customers in December without service for an extended period AmerenUE had never experienced storms of these magnitudes and had to adapt its proven plan to the demands created by these events

Realizing the magnitude, AmerenUE quickly began the process of obtaining additional resources from both contractors and mutual aid utility partners AmerenUE mobilized its own forces to begin the damage assessment, first response, and tree removal to permit the process of determining the extent of the damage as well as clearing the easements to allow line crews to begin the re-construction of the sub-transmission and distribution systems This initial activity brought together numerous resources to orchestrate all the preliminary activities to receive the additional resources and get them actively restoring the systems

In parallel, the Emergency Operations Center (EOC) began assembling the information to be given to senior management, government officials and the customers The core plan served AmerenUE well as it provided the basic blueprint for conducting these activities

AmerenUE had implemented a number of leading edge practices that smoothed the transition from normal to complex emergency operations

2. Project Approach and Methodology

KEMA approaches projects of this type with techniques and tools that support both the quantitative and qualitative analyses that are required for a full understanding of the operations and organizations under study Because much of the project involves analysis of data from various systems and reports, a number of data modeling and analysis techniques are employed The following outline presents that approach used by KEMA in the AmerenUE study

- Data collection
  - Request detailed information
  - Data interpretation and integration
- Interviews
  - Talk with key players in the areas of focus
  - Review and confirm the data collected
  - Seek information on issues identified in discussion
- Analysis/synthesis
  - All information reviewed, analyzed, integrated, etc
  - Identification of areas for further study
  - Preliminary findings and conclusions
- Follow-on information collection and verification
- Conclusions and recommendations

3. Project Area – Infrastructure Review

3.1 Data and Analysis

The infrastructure review is a forensic analysis of AmerenUE's distribution system focused on the product of two main events, the July 2006 severe thunderstorm and the December 2006 ice storm The July storm event is actually composed of two separate storm systems, the first occurring on July 19th and the second occurring on July 21st The storm paths of both systems were different, however, the type of storms, both characterized by unusually high wind speeds and tornados that occasionally accompany severe thunderstorms, were very similar and therefore considered as one event The July storms are therefore analyzed collectively The second event, the December storm event occurred on November 30th and continued through December 1st

Storms are complex systems and therefore inherently complex in defining severity Several standardized methodologies have been used to classify storms Two widely accepted methods employed here are 1) the general definition of a severe thunderstorm [1] and 2) the Saffir-Simpson Hurricane Scale

3.1.1 Definition of the July Storm Event

A severe thunderstorm produces hail at least three-quarters of an inch in diameter, has wind speeds of 58 miles per hour or higher, or produces a tornado About one in ten thunderstorms are classified as severe Some of the most severe thunderstorms occur when a single thunderstorm affects one location for an extended time Warm humid conditions are highly favorable for the development of thunderstorm systems

All of these factors were applied in the July storm event that was preceded by extreme heat, reached recorded wind speeds of 92 miles per hour in several locations and produced several tornados These wind speeds are comparative to the upper bound of a Category One Hurricane (wind speeds of 74-95 miles per hour) according to the Saffir-Simpson Hurricane Scale It is typical for the forces created by a Category One wind to cause damage to vegetation and unanchored structures

[1] http //www fema gov/hazard/thunderstorm

3.1.2 Definition of the December Storm Event

The December storm event is characterized by sleet, freezing rain and gusts of wind Frozen rain and sleet will accumulate to create a larger surface area, effectively increasing the force winds impose on affected structures The sheer weight of ice accumulations also plays a significant role in testing the structural integrity

Downed vegetation and structures as was frequent in both storm events (i e , poles, streetlights) will negatively impact the outage response time as normal transportation is obstructed thus hindering restoration efforts

These storm events will be evaluated in more detail in the sections preceding the forensic analyses of each event as their severity is crucial to determining what the normal expectations of anticipated damage are, and to provide key insights into explaining root causes of damage

3.1.3 Analysis Methodology

3.1.3.1 Data collected

The forensic analysis performed was primarily analytical (statistical) in nature and therefore data intensive and dependent The following is a summary of data received

- Outage Assessment System (OAS) Database – Provides outage records for storm and non-storm outage events (2001-2007)
- Pole Audit Database – Provides important pole attributes (i e install date, type, height, size and more) along with a location and pole tag for reference Also provides subjective information about vegetation density relative to a pole
- Pole Inspected and Treatment Database – Provides pole inspection and rejection rates and a pole tag for reference There is data containing 1999-2003 records and 2003-2007 records with different attributes, and different practices that apply
- Vegetation Management – Vegetation related spending along with circuit lengths, customer counts and years since last trim on a per feeder basis

- Customer Counts – Total approximated customer counts on a per circuit basis

- Distribution Operation Job Management system (DOJM) Summaries – Work management system that provides materials supplied per district

- AmerenUE Territory Maps – The maps support tying asset and storm information to the geography as defined by AmerenUE's service territory

- Historical Storm Data – Historical storm information plays a significant role in the analysis as primary root cause, exposing potentially latent deficiencies such as pole overloading, sporadic vegetation management, pole deterioration, etc The data consists of wind speeds at locations, storm paths and eyewitness expert accounts

3.1.3.2 Interviews

In addition to the electronic and hardcopy data received, interviews captured useful information for interpreting the data and provided instrumental insight into the underlying procedures and practices

3.1.3.3 Data Analysis

The data received served several important functions and was assessed and filtered accordingly Three lines of data gathering and analysis can be distinguished and provide the following information

1 Provide a baseline, which is the state of the system prior to the storms impact This is determined by what the system is comprised of (pole attributes and general circuit attributes – this can be defined as the exposure to the storm and exposure to vegetation), system conditions (e g pole inspection results, vegetation densities, etc) and methodologies and practices (e g pole inspection and vegetation management programs) held by the company leading up to the events This provides insight into why the system is in the current condition and may form the basis for recommendations for improvement and / or show what practices are noteworthy and have

helped in mitigating damages that the system has sustained during the storm events

2 Determine the severity of the storms that attacked AmerenUE's sub-transmission and distribution systems

3 Ascertain the level of damages sustained due to the storm events and how this damage has impacted customers The number of sustained (extended) outages per circuit primarily defined severity of damages Also, the number of locked out feeders, poles issued and conductor issued have been used as indicators

The extent of damage sustained determined which districts to investigate These districts are Berkeley, Dorsett, Geraldine, Jefferson, Mackenzie and St Charles (St Charles did not play as significant a role in outage events during the December storm event and is therefore omitted from the findings for that event) The combined area covered by these districts held the majority of the outages in both the July and December storm events KEMA compared the baseline with the damages sustained in order to determine vulnerabilities, system strengths and what role AmerenUE practices may have played Storm analysis results were also compared with each other where practical These comparisons were made primarily by descriptive statistics (numerical correlations) and visual interpretation of geographical mapping of key indicators

After a partial analysis, the results were then reviewed in a comprehensive fashion to generate and underwrite partial findings Some analysis results may trigger a certain line of additional analysis and collection of newly required data Conclusions based on these findings are drawn and used to generate recommendations aimed at mitigating future risks Such recommendations may span from decreasing the impact of equipment failure during comparable storm conditions, hardening the system or to improving relevant practices

3.2 AmerenUE and Comparative Data

3.2.1 Baseline information

The Outage Analysis System (OAS) tracks AmerenUE's system performance The data captured OAS provides insight into the daily system reliability metrics and outage causes and components involved Whereas the number of customers affected and outage duration is collected in an automated fashion, the quality of the failure data depends on the capability of the trouble crews or Field checkers to assess the failed component and cause of failure As the work ticket for restoration can only be closed out upon entry of such data the quantity of data is not in jeopardy However, the cause assessment is often a judgment call and the option to enter "UNKNOWN CAUSE" may skew realistic figures, especially during storm conditions Exhibit 3-1 below provides a summary of this data for the six districts under investigation, useful to interpret recent trends

Sum of CustomerInterruptions		Yr							
CauseCode	Description	2002	2003	2004	2005	2006	2007	Grand Total	% of Total
AA	AMR MRT AMEREN *	346	337	304	393	813	77	2 270	0 030%
AD	AMEREN DIG IN *	173	1	809	60	634	14	1 691	0 022%
AN	ANIMAL	12 841	30,759	26,906	33 684	33 560	8 228	145 978	1 907%
CE	CUSTOMERS EQUIP	2 268	3 434	1 990	2 155	1 963	680	12 490	0 163%
FI	FIRE NON AMEREN*	1 184	1 584	263	790	1 116	233	5 170	0 068%
LS	LOSS OF SUPPLY *	174	128	50	43	98	40	533	0 007%
LT	TRANSMISSION *	167	2 464	57	513	6 959	1	10 161	0 133%
OA	#N/A	6		5				11	0 000%
OE	OTHER/EXPLAIN *	18,167	32,937	62,857	45 103	94 353	10 596	264 013	3 448%
OL	OVERLOADED	17 144	25 409	2 214	19 600	6 663	2 366	73 396	0 959%
OM	OH MALFUNCTION	217 265	280 377	307 412	308 210	647 731	99 682	1 860 677	24 302%
OP	OPER ERROR	22 455	23 154	43 283	20 130	22 175	625	131 822	1 722%
PA	PREARRANGED	109 217	96 749	73 221	75 722	96 280	54 586	505 775	6 606%
PE	PUBLIC EXCAVATION *	4 178	2 666	2 179	2 637	5 481	386	17 527	0 229%
PU	PUBLIC NO VEHICLE *	9 437	12 445	14 158	9 090	15 380	5 286	65 796	0 859%
PV	PUBLIC VEHICLE *	36 969	61 691	35 522	56 488	39 392	28,774	258,836	3 381%
SM	SUB MALFUNCTION	52 092	70 385	64 796	60 867	67 605	6 592	322 337	4 210%
TB	TREE BROKE	107 492	182 715	273 780	236 708	593 574	171,153	1,565 422	20 446%
TC	TREE CONTACT	140 432	125 708	174 132	159 653	458 748	83 909	1 142 582	14 923%
TT	TREE TRIMMERS	548	1 449	865	863	9,293	1,945	14 963	0 195%
UM	UG MALFUNCTION	62 234	72 886	61 851	54 552	44 830	24,427	320 780	4 190%
UN	UNKNOWN CAUSE	67 955	112 085	162 787	142 299	386 191	62 903	934 220	12 202%
Grand Total		882 744	1 139 363	1 309 441	1 229 560	2 532 839	562 503	7 656 450	100 000%

Note The asterisk indicates that the cause code can be used for both electric and gas

Exhibit 3-1: Annual number of sustained customer interruptions by cause code (for the six districts under investigation, including storms)

Note The asterisk indicates that the cause code can be used for both electric and gas

- Exhibit 3-1Exhibit 3-1 2007 data only includes data through June

The data in this Exhibit 3-1 is the result before processing the raw OAS data with a proprietary algorithm This algorithm cleans up unlikely records like lightning as a root cause with a clear weather indication. [2] From this Exhibit it can be seen that Overhead Failures are the largest contributors to the total annual customer interruptions. The contribution of this cause trends up over the years 2002-2006. Furthermore, it can be seen that Trees, with a total contribution by Tree Broke and Tree Contact exceeding the contribution of Overhead Failure, trends up over these years as well. The increase of Tree Contact may possibly indicate insufficient budget and/or inadequate practices; however, the substantial contribution of broken trees indicates primarily the impact of wind. As such, these trends, increasing impact of Overhead Failure and both tree related causes to reliability, can be assigned to the increasing occurrence of storms (Exhibit 1-1). This has been confirmed by omitting the records pertaining to the known storm dates as major events. The trend in the total number of tree-related outages in the six districts under investigation is provided in Exhibit 3-2.

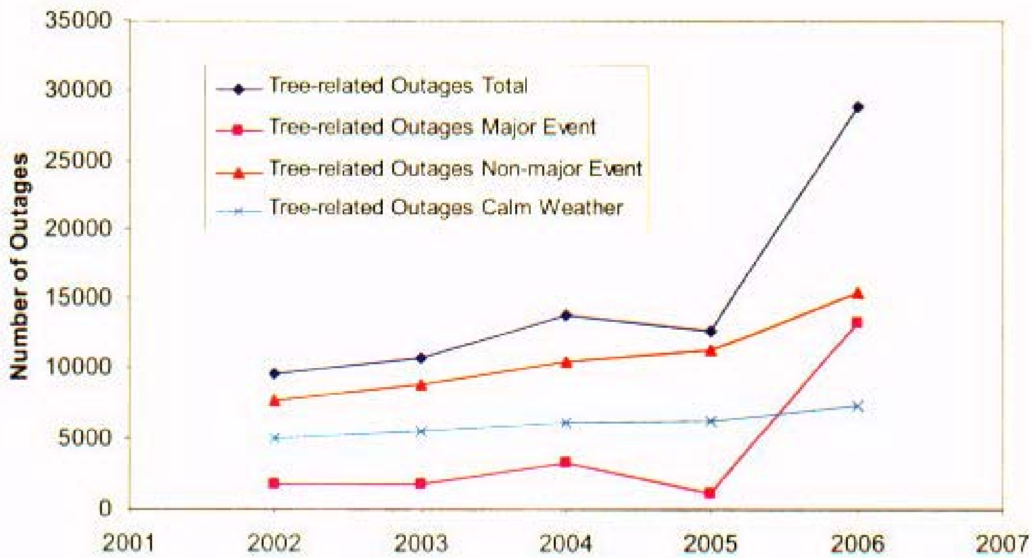


Exhibit 3-2: Total number of tree-related outages 2002-2006 for the six districts under investigation

- Note that while tree-related SAIFI is one of the vegetation management performance indices, the number of outages better represents the system performance under storm conditions for forensic analysis. Both indices can trend differently under the same conditions. This is supported by the fact that

[2] Due to the nature of some of the algorithms, the processed data has higher accuracy at the expense of lower granularity (e.g. no delineation between Tree Contact versus Tree Broke).

tree related SAIFI, with major events removed, is trending downward in recent years Specifically, KEMA noted the following

- 0 35 in 2005,
- 0 33 in 2006, and
- 0 23 year to date in 2007

- Note that the trend of tree-related outages during calm weather conditions is essentially flat

Analysis of the districts under investigation results in a similar finding that the number of outages trends up over the years with the exception of Jefferson It should be noted that Mackenzie has feeders that show 100% of the outages attributed to trees Geraldine and Berkeley have the highest outages due to trees in normal weather conditions

Storms affect areas to varying degrees or levels of severity Because maps are often one of the best tools to describe storm severity it is useful to define the system in terms of location as well Specifically, generated maps as well as various traditional Exhibits are used in this analysis to aid this visual approach The baseline findings are targeted at those districts where a majority (approximately 86%) of the storm related outages has occurred

The baseline system inventory shown in Exhibit 3-3 lists the relevant system attributes by district

	General		Conductor			
District	Feeders	Customers	OH (mi)	UG (mi)	Total (mi)	UG (%)
Berkeley	221	136,419	1,180 15	355 82	1,535 98	23 17%
Dorsett	148	99,677	1,030 33	550 22	1,580 55	34 81%
Geraldine	358	140,347	894 16	215 74	1,109 89	19 44%
Jefferson	103	88,033	2,493 52	565 33	3 058 85	18 48%
Mackenzie	294	192,779	1,257 73	513 47	1,771 20	28 99%
St Charles	56	58,794	551 32	471 36	1,022 67	46 09%
Total	1,180	716,049	7,407 21	2,671 94	10,079 14	26 51%

Exhibit 3-3: Selected System Characteristics

- Note there was a period of several months between the storm events, the statistics shown in this Exhibit are based on a snapshot of this information after the July storms and may have varied prior to the December storm

The Pole Audit Database provided pole locations. A pole density map has been created from the geographical pole data and is shown in Exhibit 3-4. Pole density is also useful as a proxy for customer density. Districts of Geraldine, Berkeley and Mackenzie all display high pole densities, as they have relatively more poles per area than other districts investigated. In case the storm intensity is consistent over the areas investigated, it can be expected that those districts would sustain more damage as there is more exposure (more components that can fail and more customers that can be affected).

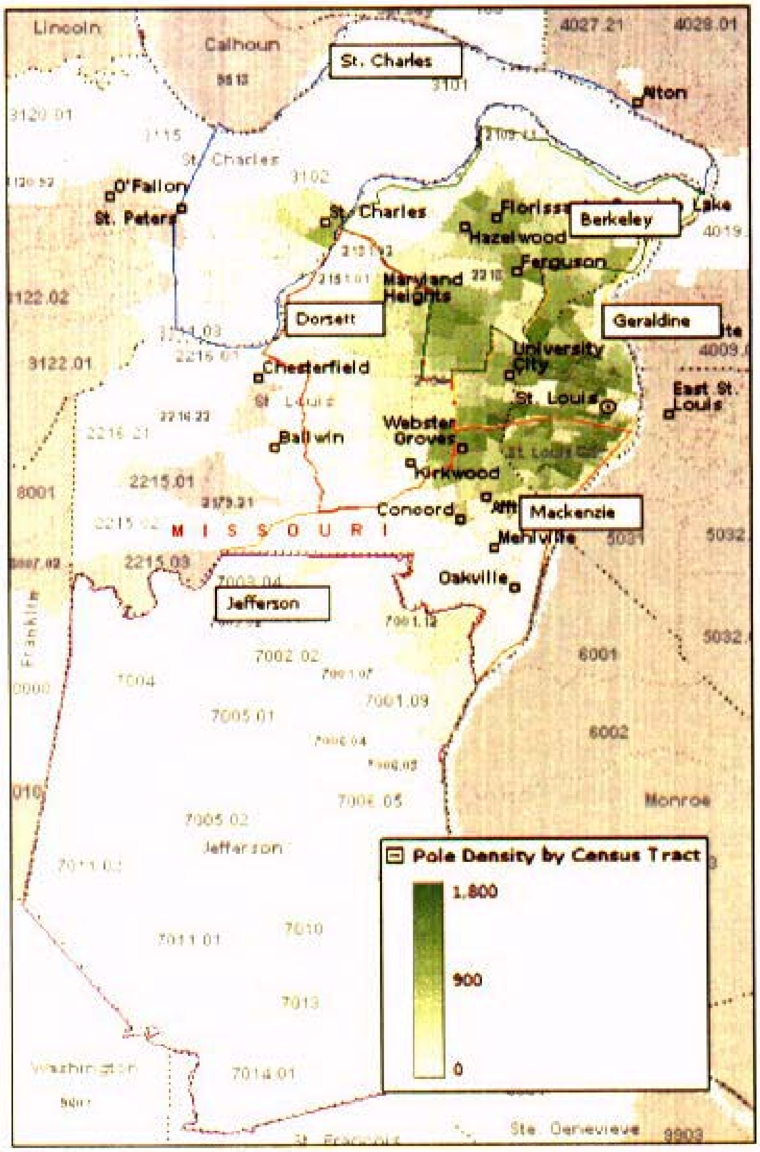


Exhibit 3-4: Pole Density

Schedule RJM-E1-32

(Poles/square mile, on a per census area basis)

The system consists of primarily wooden poles made of Southern Pine. In order to ascertain pole strength, a major factor to be determined is pole class; defining the pole diameter (a low pole class is thicker, therefore, generally stronger than a higher pole class). A map showing what locations appear to have stronger or weaker poles by averaging pole class by area, is shown in Exhibit 3-5.

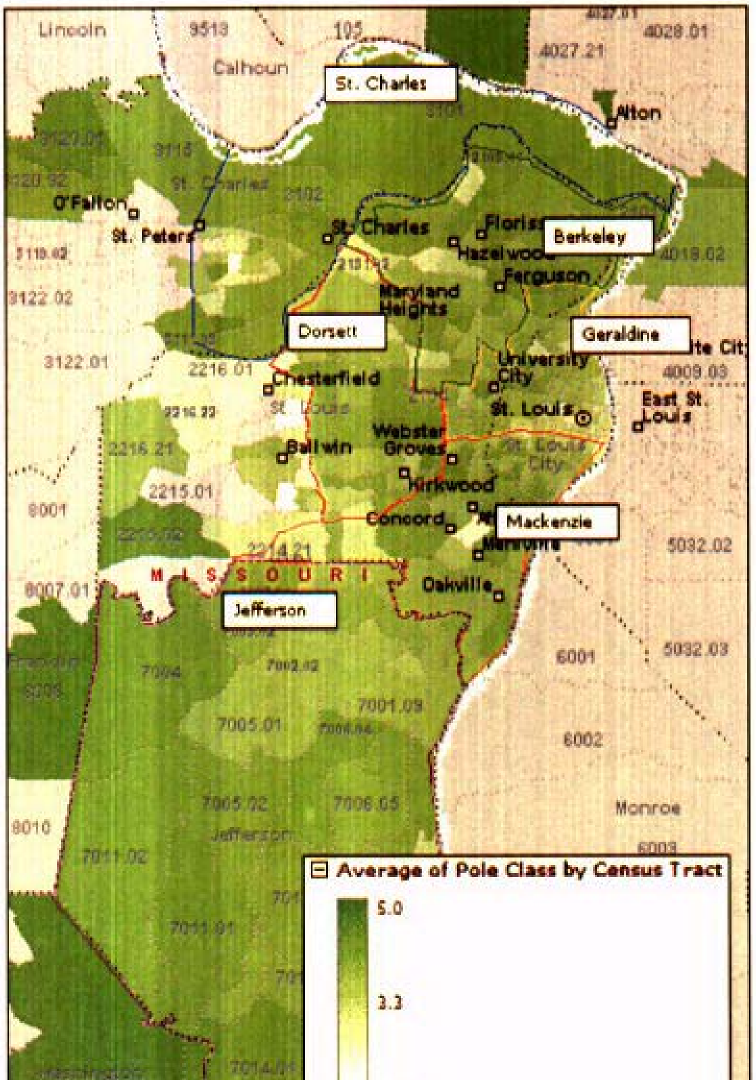


Exhibit 3-5: Pole Class

Exhibit 3-6 provides the average pole class by district. Note, that the distributions of pole classes are moderately consistent from district to district. Jefferson does have relatively more class 4 poles and less class 3 poles. The most common pole in use is a class 4 pole.

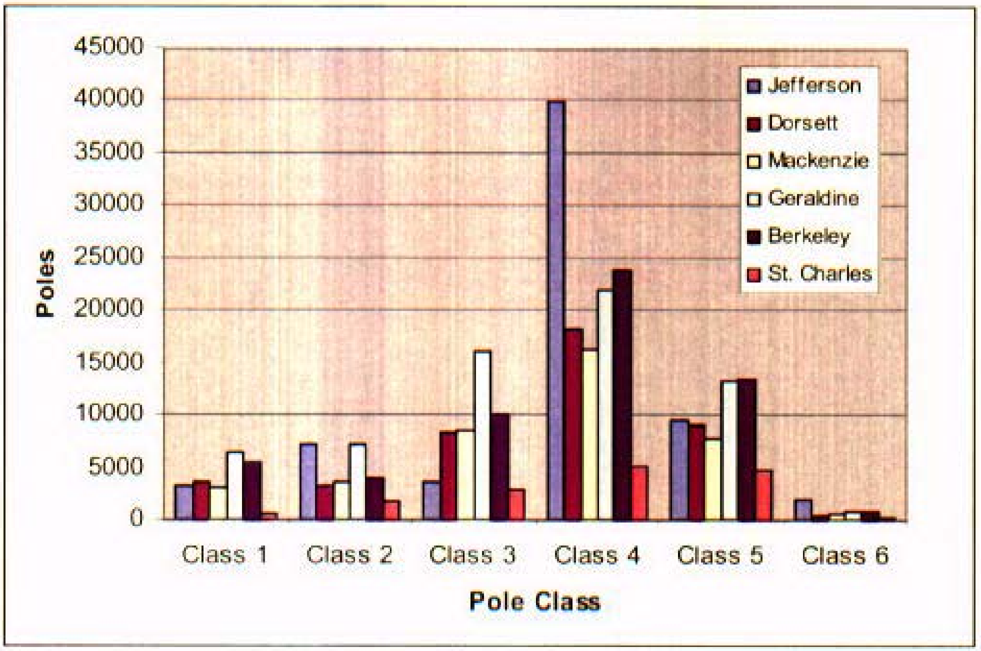


Exhibit 3-6: Pole Class by District

Pole height plays a significant role in the physics of a structural failure. Pole heights are broken down by district in order to determine if there are any apparent vulnerabilities. As shown in Exhibit 3-7, the pole heights vary little by district. The primary range of pole heights used is between 35 and 40 feet tall. The taller poles may have more surface area and therefore may experience higher torque at the potential breaking point (not always ground level) at the same wind speed.

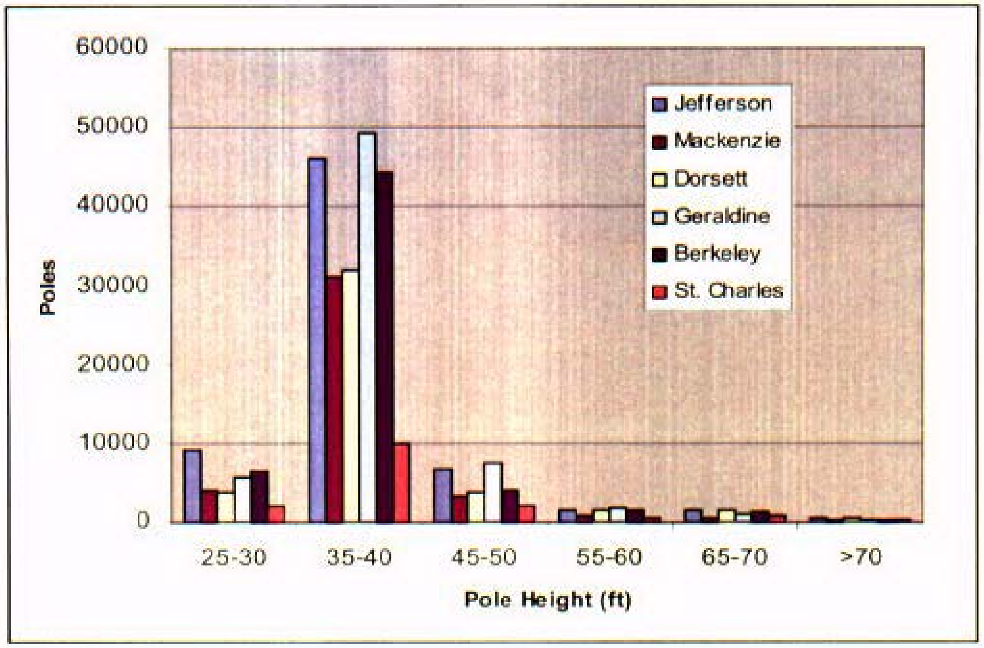


Exhibit 3-7: Pole Height by District

The average pole height as provided in Exhibit 3-7 is provided as a geographical map in Exhibit 3-8.

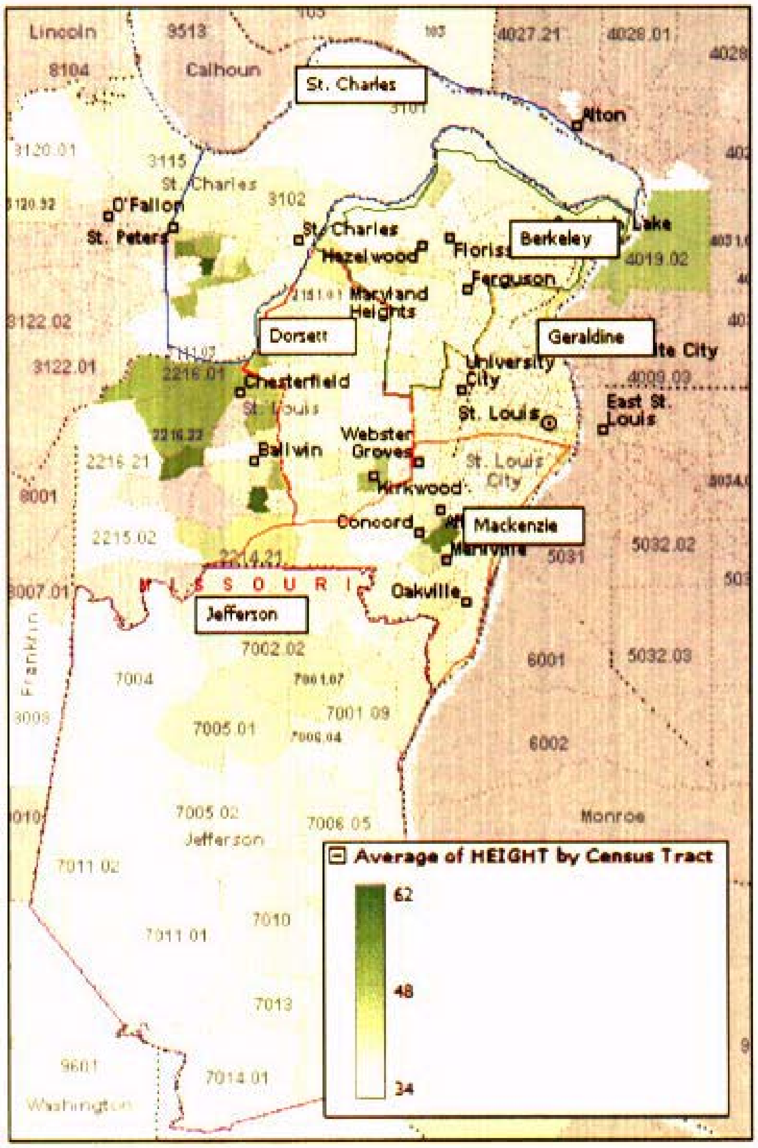


Exhibit 3-8: Average Pole Height (ft)

The areas with lower pole class (stronger poles) coincide with taller poles. This phenomenon exists in the St. Charles, Dorsett and Jefferson districts.

The average pole age tends to correlate positively with pole failure rates. As poles age, they potentially weaken and become more susceptible to the elements. It is therefore beneficial to determine the age of the poles (and later condition of the poles) in the areas affected by the storm. Exhibit 3-9 provides the results. St. Charles and Jefferson appear to have a relatively younger age distribution of poles, indicating that they, assuming all else is equal, should experience relatively less structural damage. The fact that Jefferson did have weaker poles on average may be negated by the fact that these poles were younger on average as well.

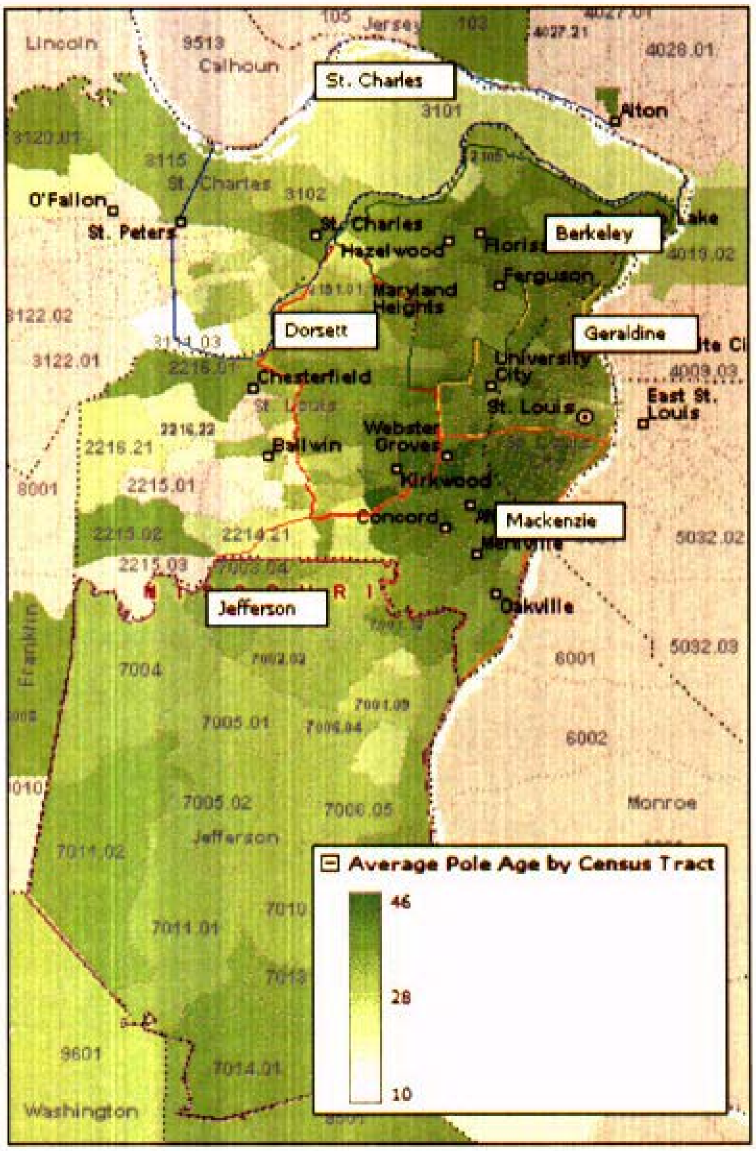


Exhibit 3-9: Average Pole Age (yr)

Depending on the region of interest, vegetation is often a significant factor in wind related storms. Nearby trees (both in and outside of the easement) may make contact with or fall on power lines or impact structures and lines in the

Schedule RJM-E1-37

form of debris (loosened branches) at high wind speeds. Vegetation density, as shown in Exhibit 3-10, is determined by a weighted average of the subjective vegetation assessments as per pole audit. This weighted average is divided by the square miles for the area of interest. The St. Charles district appears to have less vegetation relative to other districts; therefore, expected to experience less damage, assuming all other factors are equal.

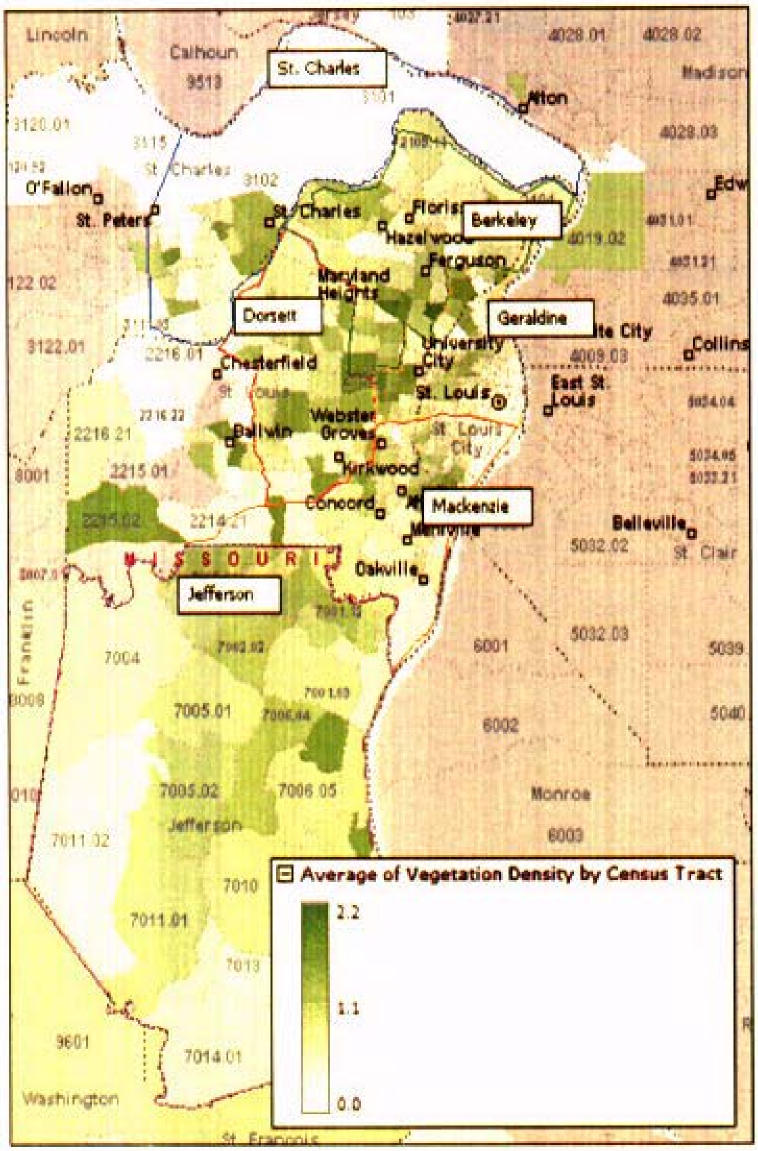


Exhibit 3-10: Average Vegetation Density

(Units are subjective, High = 3, Med = 2, Low = 1, None = 0, per pole averaged on a per census area basis)

In order to determine which areas are at risk for outages caused by vegetation it is important to capture the amount of vegetation and the amount of customers in the areas of interest. Vegetation densities are weighted by pole densities (as a proxy for customer density), as displayed in Exhibit 3-11. Because Berkeley, Geraldine, Mackenzie and to an extent Dorsett are densely populated with trees and have high pole (customer) densities, it is expected that these areas are more susceptible to damage and (impact of) outages by trees.

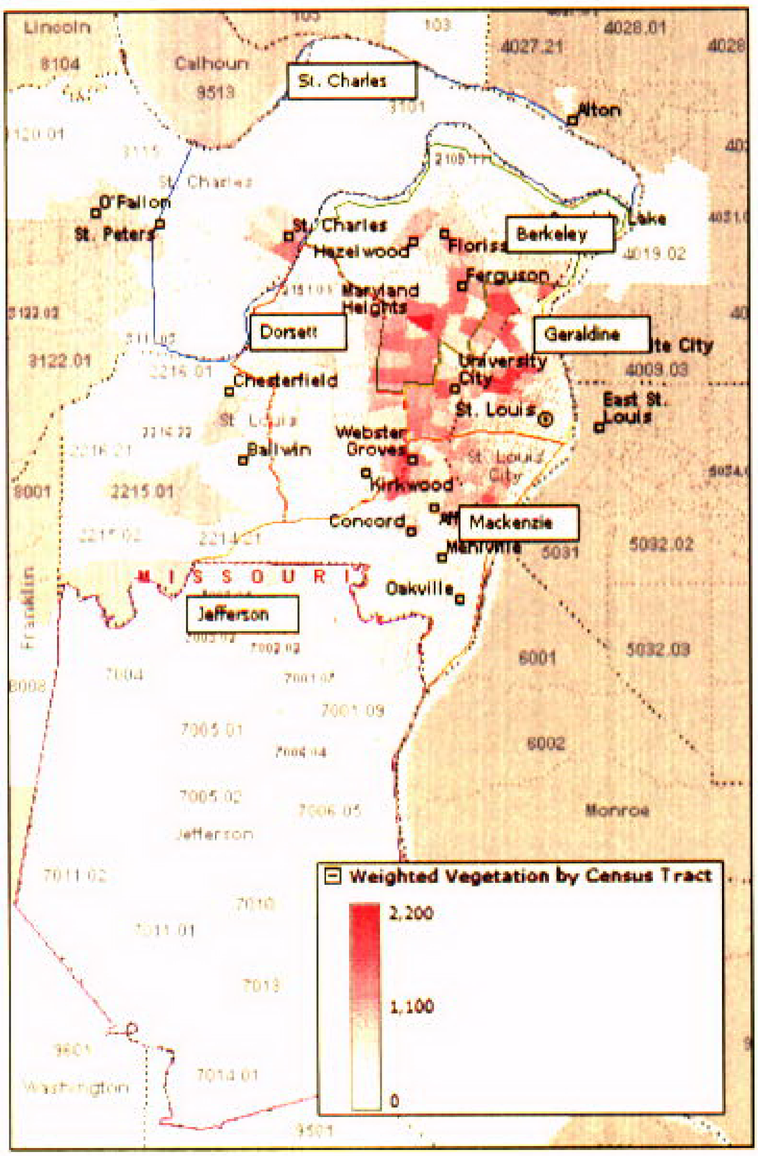


Exhibit 3-11: Vegetation Density Weighted by Pole Density

Units are subjective, the product of the Average Vegetation Density (see Exhibit 3-10) and poles/square mile (see Exhibit 3-4), on a per census area basis

To better understand the condition of the system leading up to the storm events, AmerenUE's pole inspection and treatment program and vegetation management program have been investigated

- From 1991 to 1997 AmerenUE performed pole inspections by maps at a rate of approximately 10% of the total sub-transmission and feeder backbone poles (200,000 poles) The selection of poles to inspect was largely based on its being a cyclical program No data was available from this period

- From 1997 to 2003 AmerenUE changed the program to a targeted selection and performed the inspections by circuit AmerenUE started with electronic data capturing in the year 1999

- In 2003 there was an apparent budget cut resulting in a negligible amount of pole inspections in the area under investigation

- From 2004 to 2007 Utilimap took over from Osmose and again reverted to a cyclical selection of poles Data up to 2006 was available but due to reporting differences, some of the analysis performed on the 1999-2002 could not be repeated for the 2004-2006 data Exhibit 3-12 provides the relevant data and analysis results

- Before 2003 auditing was conducted on a part-time basis while after 2003 two full-time AmerenUE employees were dedicated to that function

	General		Pole inspections 1999-2002					Pole inspections 2004-2006			
District	Poles	Avg Age (2007)	Inspections	% of Total	% Reject	% Decay	Avg Age	Inspections	% of Total	% Reject	Avg Age
Berkeley	58,099	35 80	6,780	11 67%	6 15%	18 22%	28 53	2,528	4 35%	3 24%	32 52
Dorsett	42,785	35 56	7,224	16 88%	4 11%	18 30%	23 97	906	2 12%	1 32%	29 42
Geraldine	65,674	35 95	6,674	10 16%	9 21%	20 77%	30 16	2,559	3 90%	3 79%	33 80
Jefferson	66 309	31 92	4,186	6 31%	2 72%	16 91%	26 41	1 205	1 82%	4 81%	26 42
Mackenzie	39,940	39 62	5,723	14 33%	5 21%	15 20%	29 31	4,993	12 50%	3 81%	36 26
St Charles	15,590	31 77	1,615	10 36%	4 52%	10 77%	22 75	808	5 18%	5 57%	34 14
Total	288 397		32 202					12,999			
Average	48,066	35 10	5,367	11 62%	5 32%	16 70%	26 85	2,167	4 98%	3 76%	32 10

Exhibit 3-12: Pole Inspection and Treatment Program results

The average pole age in 2007 is 35 1 years in the six districts The average in the Midwest ranges from 33 to 36 years

The pole rejection rates (poles that did not pass inspections as a function of total poles inspected) before and after the program changed are different With the targeted approach the average reject rate was higher (5 32%) than the cyclical approach afterwards (3 76%) The average age of inspected poles was comparable [3] This indicates that the targeted poles must have been selected based on criticality (impact of failure) and perceived condition, independent of age

The inspection rate represents the average number of poles inspected annually as a function of the total number of poles in each respective district (percentage of total) This number needs adjustment over the time periods reported here (four years and three years, respectively) and a correction for the total number of poles versus poles inspected (the total number of poles include lateral poles) It is assumed that a ratio of three lateral poles to one sub-transmission and feeder backbone pole exists "Back-calculating" against this assumption results in inspection rates of 11% (1999-2002) and 6% (2004-2006) The inspection rate after the budget cut in 2003 is ramping up to the target level of 10% (being 8 5% in 2006)

As seen from Exhibit 3-12, there is a strong positive correlation between average pole age at inspection and the rejection and decay rates for the data between 1999 and 2002 The rates are higher at elevated average ages per district This is also true for the general trend per pole as can be seen from Exhibit 3-13

[3] Important to note here is the difference between the average age now (2007) and the average age at inspection It is impossible to reconstruct the average age of the entire population at inspection but it can be approximated by adding the difference between now and then (i e the average age has gone up by 1 year a year as the number of poles added and replaced by pro-active programs, road widening projects or as a result of weather events is relatively small)

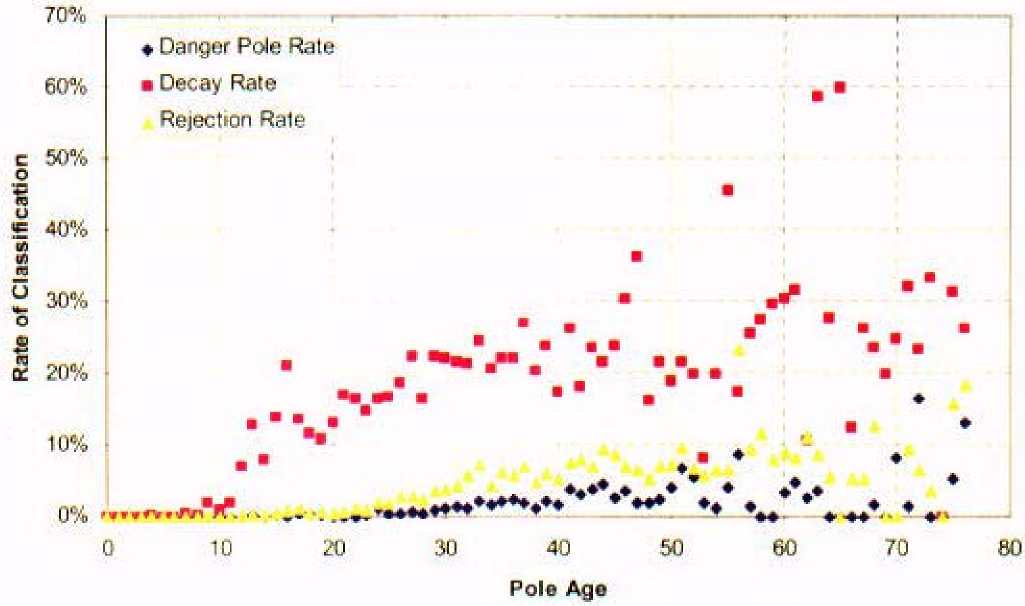


Exhibit 3-13: Pole inspection and treatment results as a function of pole age (1999-2002 data).

Evaluation of AmerenUE's vegetation management budget and spending results in the apparent absence of a storm reserve (refer to Exhibit 3-14). AmerenUE does not maintain reserves for any storm related spending as severe storms rarely occurred in the area. Prior to the 2006 July storm, AmerenUE had experienced only a maximum of 3.5 storm days. The restoration time target is less than 72 hours.

It can be observed that the budget is not fully used except for the most recent year (2006). This could lead to the interpretation that AmerenUE may withhold a storm reserve throughout the year within the business lines and consequently does not spend the full budget on cycle work. This coincides with the fact that cycle work backlog exists and was growing until 2005. However, the true interpretation of the under-spending has to do with resource unavailability, storm expenditures (including resources) and mutual aid. AmerenUE's vegetation management budget has been ramping up since 2004 (after a budget cut in 2003 that coincided with the budget cut related to the pole inspection program) and has reduced the growth of cycle work backlog since then but has been hampered by increasing storm related spending and a loss of available labor resources due to hurricane assistance as part of the mutual aid arrangements.

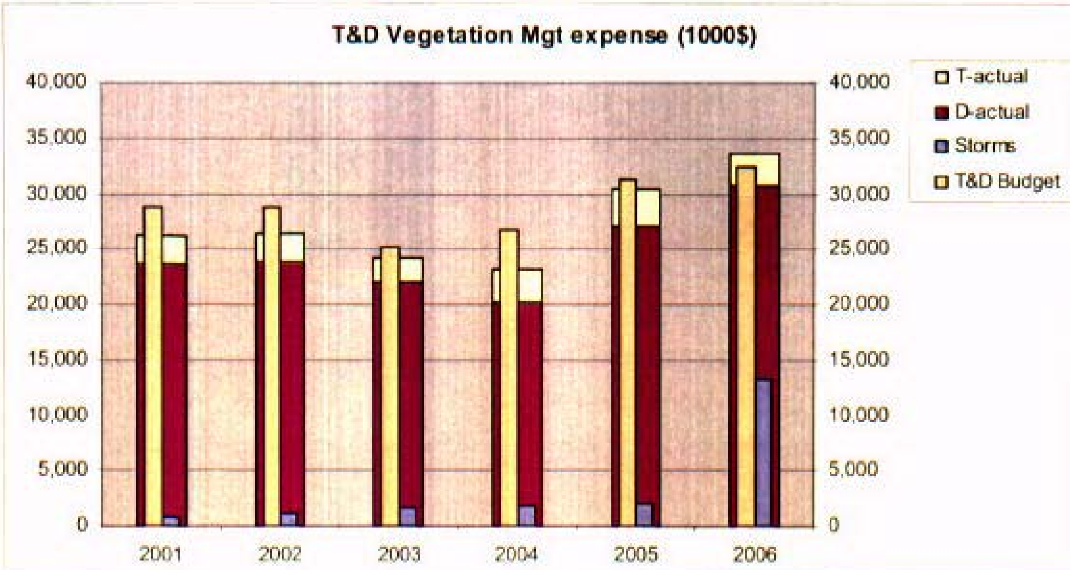


Exhibit 3-14: Trend in Vegetation Management budget and spend

The extremely high storm expense in 2006 is noted as well as the fact that, even with the high storm incidence that year, the company was still able to complete more cycle work than in previous years.

Further independent references indicated the data captured in Exhibit 3-15.

	Missouri	National Average
Urban trees per capita	21	17
Urban tree cover	30.60%	27.10%

Exhibit 3-15: Benchmark data from the year 2000 [4]

Another factor is that most of the urban areas have gained tree canopy. This situation was identified and quantified by a study performed by a local government agency [5] comparing the tree canopy in 1964/1965 with that in 1996. Saint Louis county gained more than 30% new canopy area, retained 13% of the total area and lost less than 5%, resulting in a net gain of 25%.

[4] From: "Connecting people with ECO systems in the 21st Century; an assessment of our nation's urban forests".
[5] From: "Urban Choice Coalition"

From these two references it can be concluded that vegetation management spending requires more attention with respect to trees in the urban areas under review and that funding for cycle work may need to increase along with growing vegetation density

3.2.2 July Storm Event

3.2.2.1 July Storm Event Severity

A deadly heat wave swept across the United States during the third week of July 2006 Each afternoon temperatures topped out near or above the century mark with heat indices reaching above 115° F in some locations In all, 22 deaths in 10 states were blamed on the excessive heat during that week

19 July 2006 Round One of Severe Weather

On July 19th, after reaching a high temperature of 100 degrees, a cluster of thunderstorms, also known as a mesoscale convective system, formed across Northern Illinois and propagated southwest across West Central Illinois and Eastern Missouri The outflow boundary and the thunderstorm complex produced straight-line winds and downbursts that created widespread wind damage from Central Illinois across the St Louis Metropolitan Area and into the Eastern Ozarks The damage sustained in the St Louis Metropolitan Area was consistent with wind speeds between 70 and 80 mph Areas of damage across Illinois suggested that wind speeds could have approached 90 mph Two tornado tracks were also uncovered across Southwest Illinois near the towns of Bunker Hill and Edwardsville Over 500,000 customers lost power, and thus no air conditioning

A State of Emergency was declared for the St Louis Area, and the Governor called in the National Guard to help with heat evacuations and clean-up efforts from the severe thunderstorms The temperature rose near 100 degrees once again on Thursday and heat index values were as high as 115 degrees in the affected region

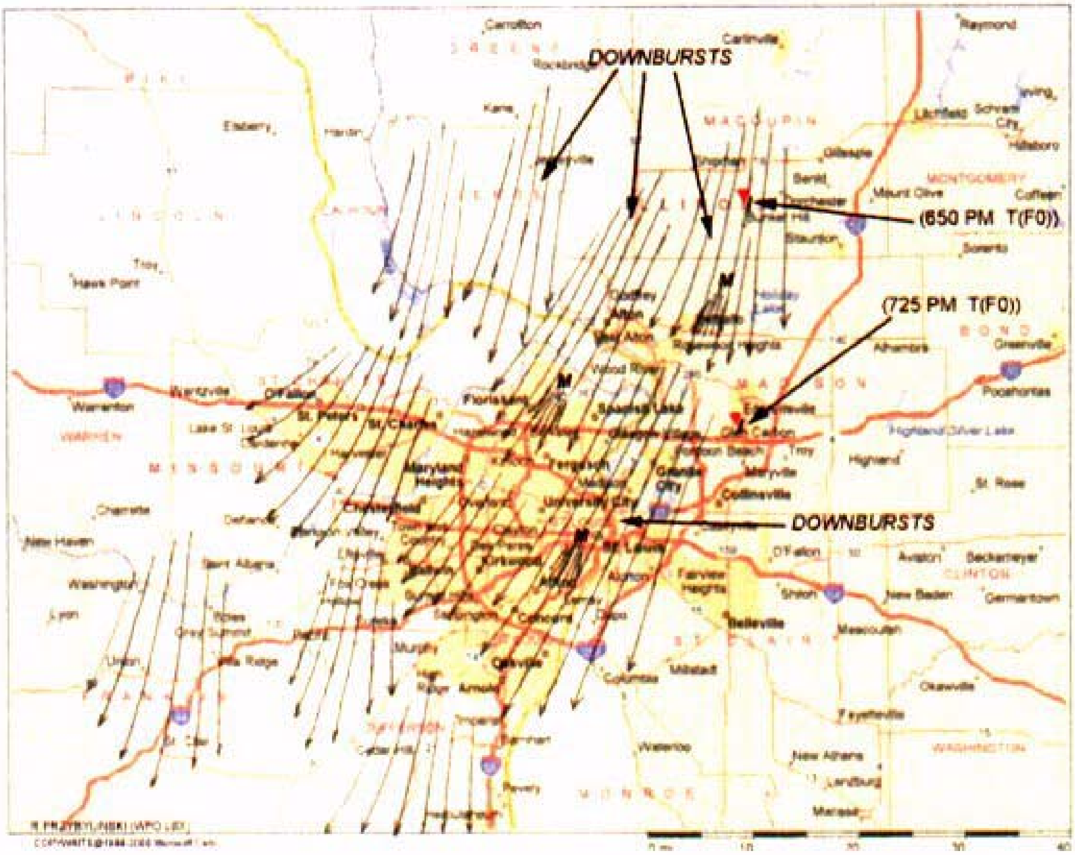


Exhibit 3-16: STORM DAMAGE MAP: Wednesday, July 19, 2006. M represents locations of microbursts and T signifies locations of tornado touchdowns.

21 July 2006: Round Two of Severe Weather

Another complex of severe thunderstorms formed across Central Missouri during the morning of July 21st on the trailing end of an outflow boundary from overnight convection across Southern Iowa and Northern Missouri. This cluster of thunderstorms formed into a bow echo as they pushed across the St. Louis Metropolitan Area producing another swath of wind damage from Central Missouri to Central Illinois. To the north of the apex of the bow a strong circulation produced several tornadoes. This led to many additional power outages and complicated clean up efforts from the July 19th storm damage. Some people who had just gotten their power back from the previous storm suddenly found themselves in the dark once again. The number of customer outages once again rose above 500,000.

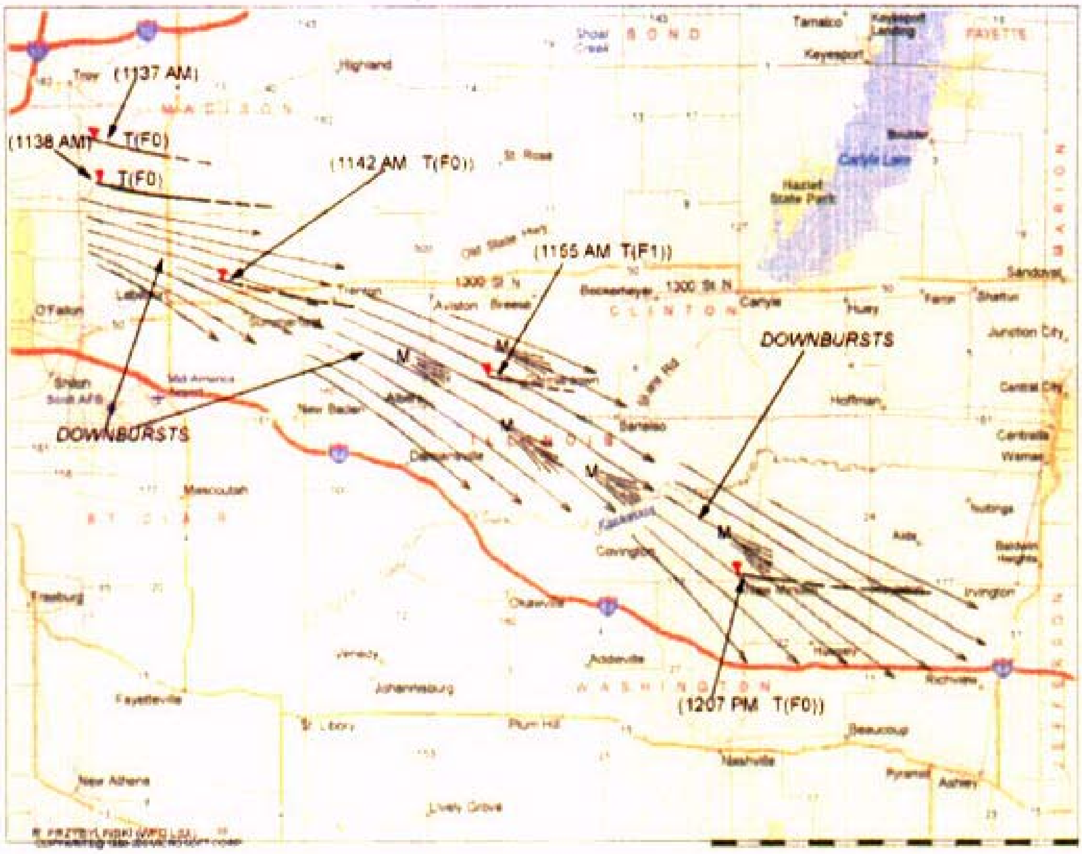


Exhibit 3-17: STORM DAMAGE MAP: Friday, July 21, 2006. M represents locations of microbursts and T signifies locations of tornado touchdowns.

The storm's summary along with local storm reports that contain measured wind speed in miles per hour along with latitude and longitude to define the location, reference Exhibit 3-18. Larger circles indicate higher wind speeds. The green storm path and associated wind speeds relate to the July 19th storm, the orange is the July 21st event. In the area of review we see higher reported wind speeds in Berkeley, on the edge of Dorsett and Jefferson. Downbursts, denoted by red and purple arrows for the July 19th and 21st storms respectively, were experienced in small areas within the Berkeley and Mackenzie districts. Note, that this graph only represents recorded wind speeds. The number of locations is limited by the lack of additional weather stations and trained spotters. Most likely, there are other areas affected by high wind speeds that went unrecorded.

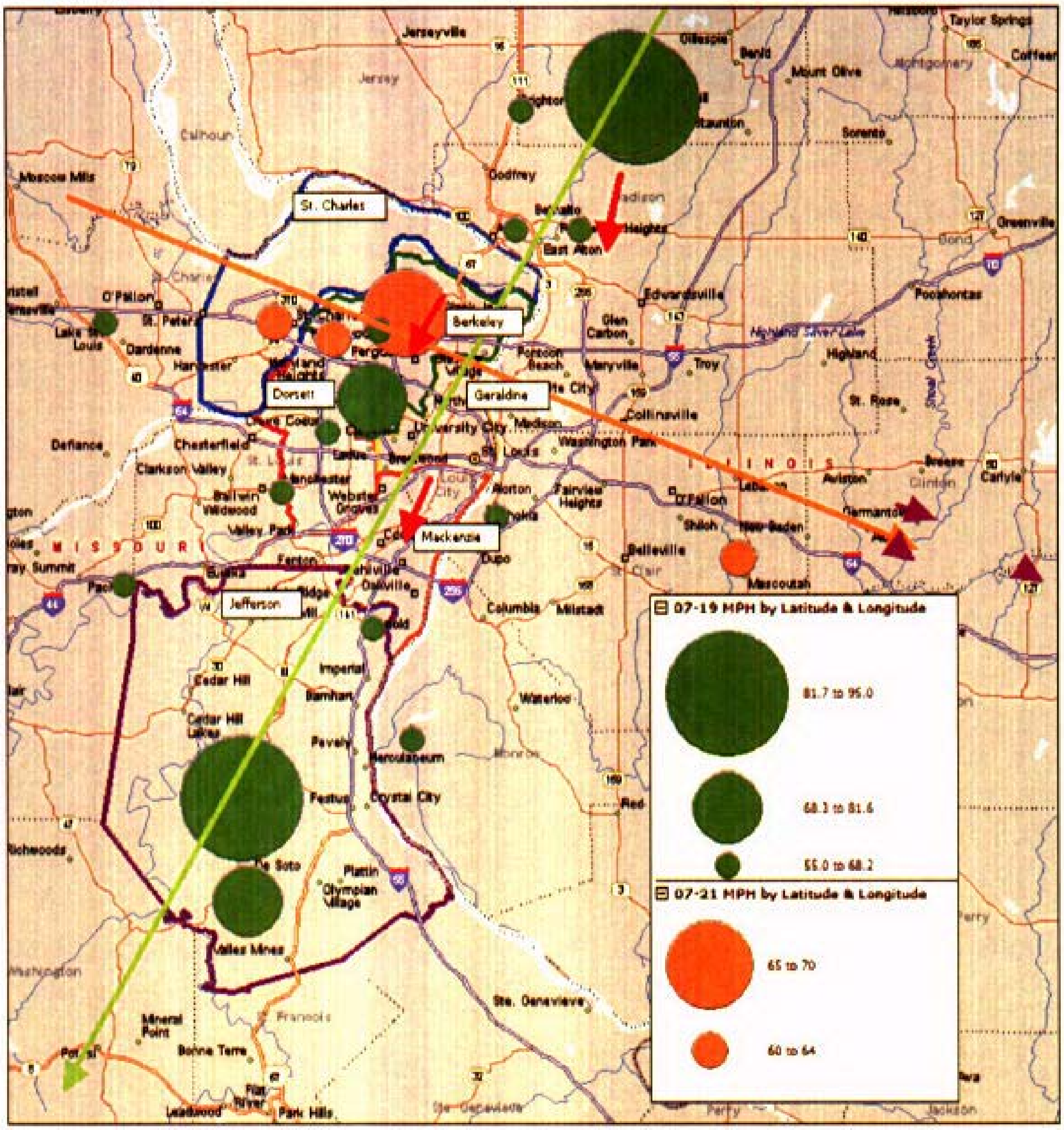


Exhibit 3-18: July Storm Events

3.2.2.2 July Storm Outages

The areas reviewed sustained a large number of outages Exhibit 3-19 provides a summary of these outages per district The outage data, coming from the OAS, per incident (components involved and corresponding root cause) is summarized on a per feeder basis Subsequent analysis focused on a per feeder basis, with the aggregated results summarized to the district level

	General		Lockout Statistics			
District	Feeders	Customers	Feeders	% Lockout	Customers	Outage Events
Berkeley	221	136,419	164	74 21%	118,326	3,123
Dorsett	148	99,677	58	39 19%	36,648	676
Geraldine	358	140,347	163	45 53%	87,625	2,309
Jefferson	103	88,033	27	26 21%	24,522	380
Mackenzie	294	192,779	120	40 82%	93,014	1,686
St Charles	56	58,794	26	46 43%	24,636	444
Total	1,180	716,049	558	47 29%	384,771	8,618

Exhibit 3-19: July Storm, Outage Summary by District

Berkeley experienced the highest percentage of feeders locked out during the storm (74%) The average among all the districts is approximately 47%

The number of poles and miles of conductor issued during the storm represent the number of failed poles and downed conductor As part of the forensic analysis these two data points provide a glimpse of the pole and wire failure rates The failure rate for storms can be compared as a function of the area exposed (number of poles and circuit length) and wind speeds The results are compiled from AmerenUE's work and materials management system, abbreviated as DOJM, and presented in Exhibit 3-20

District	Poles Down	%	Conductor Down (mi)	%
Berkeley	55	0 09%	2 19	0 06%
Dorsett	20	0 05%	1 40	0 05%
Geraldine	78	0 12%	26 58	0 91%
Jefferson	20	0 03%	0 67	0 01%
Mackenzie	103	0 26%	5 72	0 15%
St Charles	14	0 09%	0 90	0 06%
Total	290	0 10%	37 46	0 18%

Exhibit 3-20: July Storm, Pole and conductor installation data from DOJM

The total number of poles issued and assumed to have failed is 290 and is relatively low From this Exhibit it appears that the highest pole failure rate occurred in Mackenzie and the highest wire failure rate was in Geraldine (although this may be because most of the conductor was issued and not necessarily used in Geraldine) The pole failure rate by district correlates positively with average pole age provided in Exhibit 3-12 (correlation factor 0 8) The total overall pole failure rate of 0 10% for this storm is comparable or lower than the failure rate expected based on the given wind speeds and KEMA's storm damage model which results in rates between 0 10% and 0 28%) Note this model only provides calibrated results for poles during windstorms Downbursts may have had additional local impact on increased pole failure rates, bringing the total average even lower and this indicating better system performance (in terms of storm resilience)

There are several approaches to define the root cause of the damage or failure resulting in a customer outage The root causes employed in this investigation are tree (further categorized by tree broken, tree contact, tree other and tree unknown), equipment (mechanical and/or electrical failure), and lightning, other and unknown as shown in Exhibit 3-21 Exhibit 3-22 provides a graphical summary of outage event root causes by district The size of each pie chart is relative to the number of outage events As implied by this Exhibit, the dominant root cause for the July storm is tree related, approximately an average of 62% (from Exhibit 3-21) Comparing these results with the vegetation density weighted by pole density, as provided in Exhibit 3-11, confirms what should be expected based on exposure Berkeley sustained the highest amount of tree related outages, approximately 67% and Jefferson experienced the least amount, approximately 44%

District	Tree Broke	Tree Contact	Tree Other	TREE (total)	Lightning	Equipment	Others	Unknown
Berkeley	27 70%	21 40%	17 80%	66 90%	1 44%	7 88%	3 97%	19 10%
Dorsett	22 20%	20 60%	11 90%	54 70%	2 51%	10 06%	10 21%	22 50%
Geraldine	20 20%	22 30%	18 50%	61 00%	3 59%	8 66%	2 04%	22 50%
Jefferson	11 80%	23 20%	8 90%	43 90%	4 47%	5 26%	7 11%	39 20%
Mackenzie	20 60%	19 60%	18 60%	58 80%	2 43%	10 02%	3 20%	25 10%
St Charles	25 10%	21 70%	9 40%	56 20%	1 80%	5 41%	3 38%	32 90%
Average	23 40%	21 60%	16 80%	61 80%	2 45%	8 44%	3 90%	23 00%

Exhibit 3-21: July Storm, Root Cause by District

- KEMA re-analyzed the data to identify the distinction between Tree Broke, Tree Contact and Tree Other These tree related root causes were deduced from root cause codes TB, TC and 'tree other', which refers to any other tree related code Tree total is a summation of all tree related root causes

- There is a substantial percentage of root causes, 23%, defined as unknown If unknowns were removed from the analysis, the average root causes for all districts would be approximately 81% tree, 3% lightning, 11% equipment and 5% others

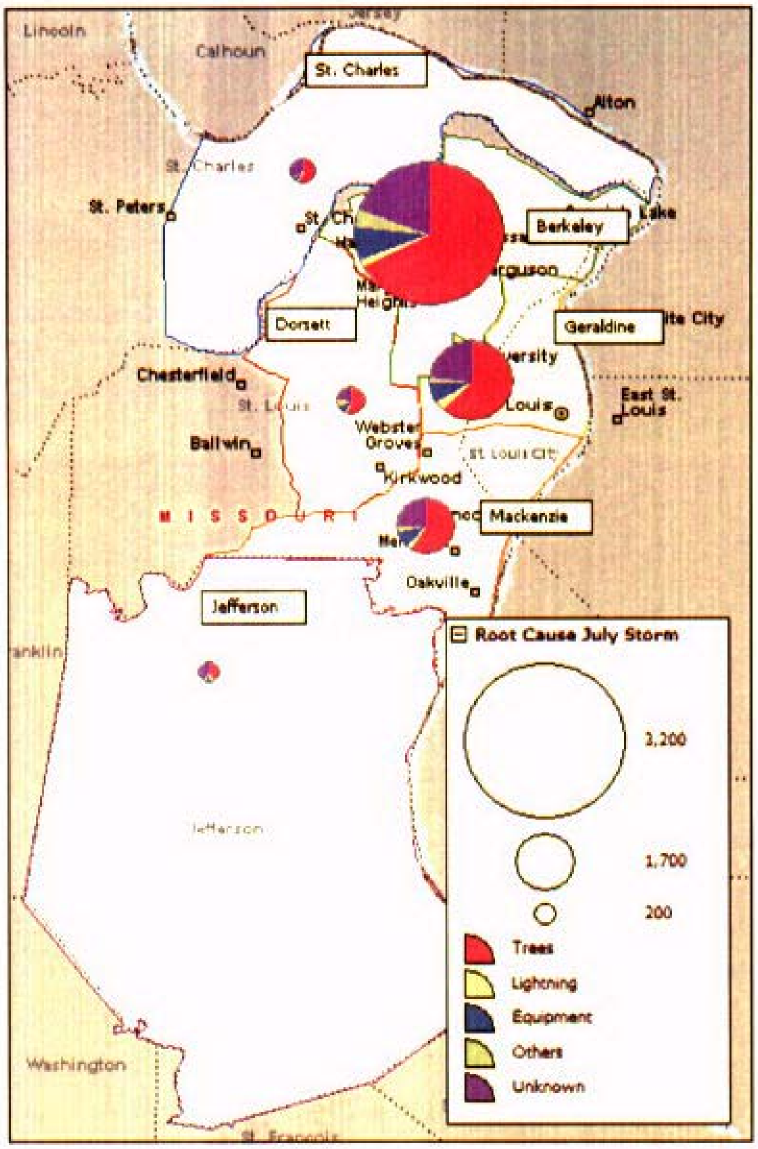


Exhibit 3-22: July Storm, Root Cause by District

(Number of outage events, on a district basis)

It is important to understand what components are affected due to the respective root causes. This may help define whether the damage was preventable or not, and to what extent. Damage was primarily to wire or equipment related (i.e. transformer). There appears to be little structural damage; minimal pole breakage due to wind only. As the recorded wind speeds did not exceed 92 mph, this indicates that pole overloading and/or pole deterioration did not play a role; however,

Schedule RJM-E1-51

this assessment has some uncertainty as the large group of unknown outage causes may contain pole breakages to a larger extent as it was reported within the equipment category Assuming that the total 11% equipment category (after correction for the unknown category) is comprised of a maximum of 4% pole breakages, this would yield a potential 4% improvement in case a 100% effective pole inspection and treatment program can be implemented and/or 100% adherence to pole loading calculations can be achieved at any time Therefore, there is no evidence of these being relevant root causes

The applied estimate of a maximum of 4% pole breakages within the equipment category can be verified against dedicated root component data in the OAS Exhibit 3-23 shows such data It can be seen that outages with structure as root component are limited by 2 19% of the total and 2 4% as an approximated maximum after correcting for the unknowns This further assumes that there are no pole related outages within the equipment category

District	Structures	Trees	Wire	Equipment	Unknown
Berkeley	2 31%	23 41%	33 46%	29 78%	11 05%
Dorsett	2 96%	27 66%	21 75%	39 94%	7 69%
Geraldine	2 08%	21 00%	33 78%	34 65%	8 49%
Jefferson	2 89%	26 32%	13 42%	33 95%	23 42%
Mackenzie	1 78%	22 72%	31 67%	35 29%	8 54%
St Charles	1 80%	21 62%	27 25%	38 96%	10 36%
Average	2 19%	23 00%	31 07%	33 62%	10 12%

Exhibit 3-23: July Storm, Root Components

- Note that root component "trees" is ambiguous and may imply a root cause rather than a system component

The next line of analysis relates the vegetation management program's results to the feeders that were locked out during the storm (as reported in Exhibit 3-19) The average period since last cycle trim for each feeder has been analyzed per district Also the average circuit length and spending per mile (over the period 2004-2006) has been analyzed related to the tripped feeders The results are provided in Exhibit 3-24

District	Avg Yrs Since Trim (Tripped Fdrs.)	Avg Yrs Since Trim (Non-tripped Fdrs)	Avg. OH (mi) (Tripped Fdrs.)	Avg. OH (mi) (Non-tripped Fdrs.)	Avg Trim $/OH mile (Tripped Fdrs)	Avg Trim $/OH mile (Non-tripped Fdrs)
Berkeley	3 25	2 19	6 14	2 82	$13,047	$9,448
Dorsett	3 20	2 42	8 55	6 54	$10,476	$10,488
Geraldine	3 39	2 77	3 70	1 63	$9,629	$6,724
Jefferson	2 80	2 49	25 36	23 95	$6,228	$5,960
Mackenzie	1 89	2 15	4 98	3 56	$8,453	$8,543
St Charles	2 23	2 47	11 68	8 25	$8,377	$5,594
Average	2 79	2 42	10 07	7 79	$9,368	$7,793

Exhibit 3-24: July Storm, Vegetation Management related

The average time between the last cycle trim and the July storm, 2 79 years (tripped feeders) and 2 42 years (feeders not tripped) show the presence of cycle work backlog The average time since last cycle trim in these urban areas is expected to be approximately two years plus a portion of the average time required to trim the feeders Based on a four year cycle, some feeders will have a period since last trim approaching four years while others were just trimmed On average this will result in two years The analysis further shows that the average time between the last cycle trim and the July storm for tripped feeders is higher than for feeders not tripped The difference is not much but it is present This may indicate the need for enhanced backlog reduction to revert to cycle work and/or the attention for danger trees during cycle work

The tripped feeders have on average longer circuit lengths than the non-tripped feeders that have less exposure to the impact of trees The application of mid-point reclosers to lengthy circuits, where not already available, may provide benefit under storm circumstances as well as daily reliability metrics

The average spend per circuit mile indicates vegetation density (and to a certain extent catching up with cycle work over this period) According to this indicator, the vegetation density is highest in Berkeley, Dorsett and Geraldine This corresponds well with the findings based on the pole audit data (related to vegetation density –

refer to Exhibit 3-10). Typically, the average vegetation management spending per circuit mile is higher for tripped feeders indicating that vegetation plays a dominant role as outage root cause.

Lastly, other data points, qualified as anecdotal information ('field observations'), have been collected for analysis: approximately 15% of the total trees were down after the storm (in particular areas) and 85% of the broken trees were out of easement.

3.2.3 December Storm Event

3.2.3.1 December Storm Event Severity

A very powerful early season winter storm produced significant amounts of snow and ice across large areas within the Midwest on November 30th and December 1st. Over a foot of snow fell from Oklahoma to southeastern Wisconsin and accumulations of sleet and freezing rain in excess of two inches were common across eastern Missouri and western Illinois. "The last winter weather event of this magnitude occurred on January 1st of 1999."[6]

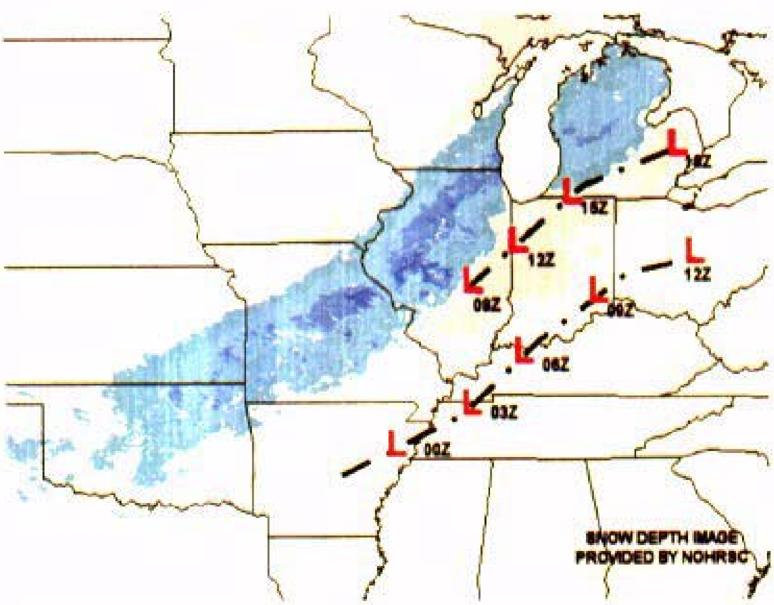


Exhibit 3-25: MODIS Polar Orbiting Satellite Snowfall Detail

[6] The quote was taken from the NOAA's write up regarding the severity of the of the December storm event. This is for a Midwest storm.
http://www.ncdc.noaa.gov/oa/climate/extremes/1999/january/blizzard99.html

The precipitation changed over to all-snow during the evening hours of November 30th over central and northeast Missouri as well as west central Illinois. A band of very heavy snow set up over this region with several reports of "Thundersnow" [7] received. Exhibit 3-18 below provides a map with the storm's total sleet and snowfall with the most significant ice accumulation area outlined with the blue dash line.

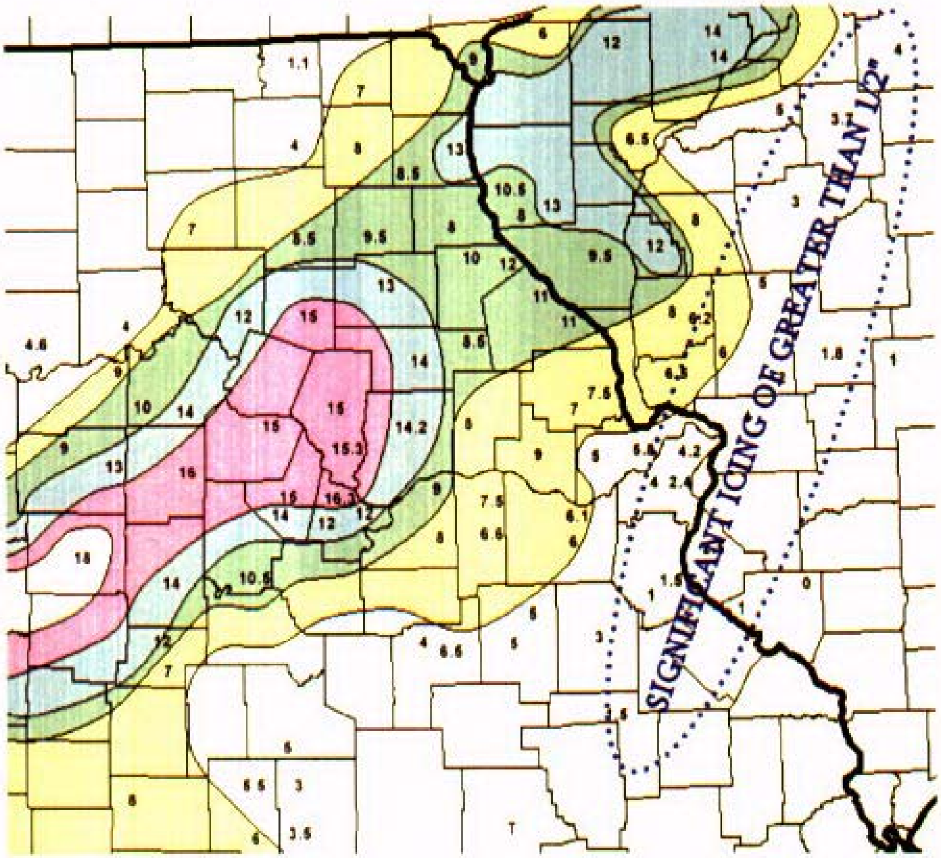


Exhibit 3-26: Snowfall Totals

There is no official wind speed data available for this storm for detailed analysis. However, it can be stated that the impact of wind is amplified by the increased surface area due to ice deposits on vegetation and system components. The combination of accumulated

[7] NOAA definition http://www.crh.noaa.gov/lsx/?n=11_30_06

ice on trees and power lines and gusty northwest winds produced widespread downed trees and power outages

3.2.3.2 December Storm Outages

The December storm event affected nearly the same area as the July storm event (the damage in St Charles district was not as substantial as compared to the July event and is omitted from the analysis) A summary of outages by district is given in Exhibit 3-27

	General		Lockout Statistics			
District	Feeders	Customers	Feeders	% Lockout	Customers	Outage Events
Berkeley	221	136419	91	41 18%	72,875	1,781
Dorsett	148	99677	28	18 92%	18,909	390
Geraldine	358	140347	78	21 79%	46,292	1,498
Jefferson	103	88033	48	46 60%	41,097	840
Mackenzie	294	192779	39	13 27%	34,577	602
Total	1124	657255	284	25 27%	213750	8618

Exhibit 3-27: December Storm, Outage Summary by District

During this storm, Jefferson experienced the highest percentage of feeders locked out, whereas this district showed the lowest corresponding percentage during the July storm The different nature of the storm provides the most straightforward explanation for this difference

District	Poles Down	%	Conductor Down (mi)	%
Berkeley	39	0 07%	59 56	1 70%
Dorsett	27	0 06%	2 89	0 09%
Geraldine	30	0 05%	16 74	0 57%
Jefferson	23	0 03%	1 26	0 02%
Mackenzie	84	0 21%	35 87	0 95%
Total	203	0 07%	116 32	0 59%

Exhibit 3-28: December Storm, Pole and conductor installation from DOJM

With the exception of the pole performance in Mackenzie, this storm could be characterized by the high failure rate of conductors (0 59% as opposed to 0 18% during the July storm) This is typical for snow and ice storms Whereas Jefferson had the highest feeder lock-out rate, Berkeley in fact experiences the highest conductor failure rate

The root causes are reported in the same fashion for a snowstorm as they would be for a severe thunderstorm i e there is no distinction for ice, snow etc This obviously limits the forensic analysis with respect to the analysis of root causes

As displayed in Exhibit 3-29, the dominant root cause for this event, similar to the July storm, was tree related with a substantial 60% A graphical summary of outage event root causes by district is shown in Exhibit 3-30 Note that the size of each pie chart is relative to the number of outage events

District	Tree Broke	Tree Contact	Tree Other	Tree (total)	Lightning	Equipment	Others	Unknown
Berkeley	25 66%	33 80%	9 38%	68 84%	0 56%	16 56%	1 24%	12 80%
Dorsett	20 51%	23 33%	6 67%	50 51%	1 79%	16 67%	2 05%	28 97%
Geraldine	29 77%	22 50%	12 15%	64 42%	0 33%	7 74%	1 07%	26 44%
Jefferson	9 17%	20 95%	24 64%	54 76%	2 86%	6 79%	3 93%	31 67%
Mackenzie	20 27%	19 44%	23 59%	63 29%	1 16%	16 61%	1 33%	17 61%
Average	21 08%	24 00%	15 28%	60 36%	1 34%	12 87%	1 92%	23 50%

Exhibit 3-29: December Storm, Root Cause by District

- Note that there is a substantial percentage, approximately 24%, of root causes defined as unknown If unknowns were removed from the analysis, the average root causes for all districts would be approximately 79% tree, 2% lightning, 17% equipment, 3% others

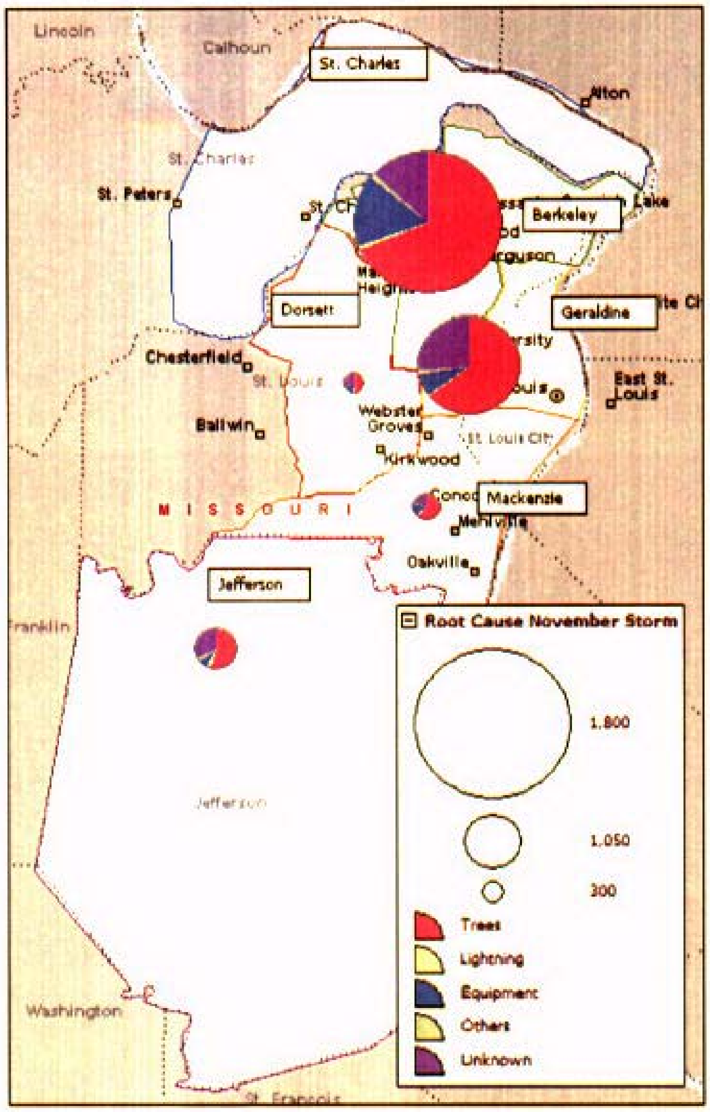


Exhibit 3-30: December Storm, Root Cause by District

(Number of outage events, on a district basis)

A list of general component categories and their associated percentage of outage events has been developed and is provided in Exhibit 3-31. As can be seen, wire and equipment were the dominant components affected by the December storm. Different from the July storm, the trees are not contributing much as root components, which, as discussed, is adequate as trees are not part of the system. Perhaps training of field crews has improved this from the unfavorable data collection situation during the July storms (unfortunately at the expense of increased percentage of unknowns) or it is because there are more outages related to blown fuses (root component) due to tree contact (snow on tree canopy as a root cause) The option tree as root component should be removed as input

District	Structures	Trees	Wire	Equipment	Unknown
Berkeley	6 06%	1 29%	20 10%	34 48%	38 07%
Dorsett	6 67%	2 82%	27 44%	43 85%	19 23%
Geraldine	4 61%	1 34%	21 09%	39 25%	33 71%
Jefferson	12 38%	1 90%	20 60%	36 43%	28 69%
Mackenzie	7 97%	2 49%	20 93%	33 06%	35 55%
Average	7 54%	1 97%	22 03%	37 41%	31 05%

Exhibit 3-31: December Storm, Root Components

3.3 Conclusions

This section reports the conclusions that can be drawn after reviewing the partial findings as reported in Section 3 2 The conclusions are presented according to how the infrastructure review was organized the general system reliability and programs leading up to the 2006 storms, the forensic investigation, followed by an integral assessment

It is important to know that while the OAS captures representative data, it does not provide 100% dependability as input depends on field calls often made under difficult circumstances based on best estimates

3.3.1 System reliability indicators are trending up as a result of recent storm activity.

AmerenUE's daily reliability indicators (i e the number of sustained customer outages) are trending up The root cause behind this observation is established as trees during storms, the daily non-storm indicators are essentially flat over the years The increase of severe storm events over recent years is the primary cause As contributing factors, it deserves recommendation to investigate the resilience of the system against these storms This investigation would focus on review of the vegetation management and pole inspection and treatment programs These programs leading up to the 2006 storms have been evaluated as part of the infrastructure review

General Programs

3.3.2 Prior to the 2006 storms, AmerenUE's vegetation management program did not achieve all of its stated annual spending targets; however, much of the storm damage would not have been prevented by the vegetation program in place at the time.

A review of AmerenUE's vegetation management budget and spending indicates the absence of a storm reserve AmerenUE does not maintain reserves for any storm related spending as severe storms rarely occur in the area

AmerenUE's vegetation management budget has been ramping up since 2004 (after a budget cut in 2003) and has reduced the growth of cycle work backlog since then but has been hampered by increasing storm related efforts and spending The observed under-spending for cycle T&D work has to do with resource unavailability, storm expenditures (including resources) and providing aid to other storm stricken mutual aid utility partners That said, since 2004, all storm-normalized SAIFI targets and "Line miles" trim goals have been met

3.3.3 AmerenUE's pole inspection program missed its annual inspection rate target as a result of budget cuts and changes to the program, however, this did not contribute much to the level of storm damage.

This program saw a change before and after 2003 Before 2003 AmerenUE had applied a targeted (pole, area or circuit selection) approach based on criticality and perceived condition The inspection rate was approximately 11% yielding an average reject rate of 5 32% There was a budget cut in 2003, coinciding with budget cut in vegetation management spending After 2003, AmerenUE applied a cyclical approach to selection The inspection rate is ramping up to the targeted 10% with an average reject rate of 3 76% The program has an audit function, staffed by AmerenUE employees, focusing on adequate application of AmerenUE's reject standards While the number of auditors has increased with the change in program, the auditing does not focus on completion of pole replacement work orders

General Forensic

The majority (86%) of the total outages in both the July and December storms occurred in six districts with significant overlap from all storms in a small area The likelihood of this happening is small (it never happened before in documented history) and has resulted in multiple, extended outage events for a high number of customers The affected areas have a high vegetation density, a high pole density and high customer density

Forensic

Vegetation related

The number of outages correlate with vegetation density and time since last trimmed The shorter the period since last trimmed, the smaller the chance of a feeder being locked-out during the storms This applies to both storms

Tree related outages were the root cause for approximately 81% of the outages in the July storm These root causes break down into 30% tree broke, 29% tree contact and 22% tree other Reportedly, 85% of the broken trees originated out-of-easement This emphasizes the importance of addressing this issue going forward (while anticipating more storms) The fact that the number of outages correlated positively with time since last trimmed and that this established 29% of the outages, emphasizes the importance of the ongoing cycle trim work backlog reduction It must be noted that cycle trim work, even being on schedule, will only have a limited effect reducing this percentage during storms

Pole related

The pole failure rate during the July storm was established at 0 10% This rate was consistent with KEMA's model forecast for similar storms The pole failure rate per district correlates positively with age (with a factor 0 8) As such, the Mackenzie District was vulnerable with the highest average pole age of 39 6 years It is important to keep in the mind that a significant amount of outages do not involve poles as a root component Only 290 poles were issued (and thus replaced) in the six affected districts From the available data it is unknown what type of poles failed For post-storm infrastructure analysis it is of interest to identify double circuit poles, feeder versus lateral poles (although most of the issued poles were class 4 and thus the non-inspected lateral poles) and, for instance, poles that were evaluated below design loading strength (<0 4% out of 51,000 evaluated poles between 2003 and 2007, refer to Section 4 3 3)

Equipment caused outages were the root cause for approximately 11% of the outages during the July storm Assuming that 4% of this total of 11% is related to pole breakages (with potential root causes being wind only, design overloading or pole decay), this assumed 4% is then the maximum potential for improvement of pole loading evaluations and inspection programs This number reduces to a maximum of 2 4% when considering the root component data

Conductor related

The December storm yielded root outage causes 79% tree, 2% lightning, 17% equipment, 3% others Whereas the pole failure rate was relatively low, the conductor failure rate during the December storm was 0 59%, mostly in Berkeley district This is expected for an ice storm, however, there are no calibrated models for snow and ice storms to verify the conductor failure rate Tree related outages positively correlated with conductor failure rates during this storm, although weakly Most of the damage would come from ice depositions directly onto the conductor that subsequently snaps due to excessive wind loading or onto tree branches touching or breaking off into the conductors Due to the outage reporting nature, not fit for forensic purposes, it is not straightforward to distinguish these two in order to steer improvement toward vegetation management or pole loading analyses

Integral Assessment

The statistical and forensic analysis based on the available data does not infer any major deficits that contributed negatively to the system performance during the investigated storms

The July storms can be characterized by relatively low equipment failure rates but a large coverage of area with dense vegetation and customers, resulting in outages of about half of the AmerenUE feeders in the affected area From a restoration perspective, the extent of the outage can be explained by inaccessible terrain (due to the many broken trees) and the large area

Potential contributing factors

The first July storm came from an unusual direction (NE-SW as opposed to the usual direction NW-SE) potentially taking out or loosening trees that had been hardened against storms in the usual direction The second July storm, in the usual direction, then likely has taken out more trees than expected for the same wind speeds

The first July storm may have taken out primarily feeders tangential to the storm, the second July storm did the same adding up to more feeders than expected based on just wind speeds (as opposed to also including wind direction)

The December storm can be characterized by extensive conductor failure due to a combination of wind and ice loading

3.3.4 The forensic analysis could have been more informative had AmerenUE had a formal forensic process in place to gather the critical data.

AmerenUE could in general improve on data gathering, analysis and feedback of findings into planning functions related to vegetation management and pole inspection and treatment programs Both post-storm forensic analyses and analysis of day-to-day operations would potentially improve by increased visibility into the integral state of the system to justify future spending (e g spending versus system improvement, where to spend the next dollar?) This would require a consolidation of pole, conductor and (potentially new) vegetation inventory data, inspection and maintenance programs (including the new distribution line equipment), their results and related spending

For forensic analysis purposes, the OAS data could be more concise and for instance differentiate causes and components in an unambiguous fashion Still, this would not distinguish specific equipment such as multiple-circuit poles, multiple events (cascading) and evaluation of design overload There should be a dedicated forensic data collection methodology in place such as now mandatory in Florida This would prove useful in anticipating actual increase in severe storm events, as the recent trend seems to indicate

3.4 Recommendations

3.4.1 Continue with AmerenUE's enhanced vegetation management program.

Continue with the ongoing vegetation management to achieve the committed schedule the 4th quarter of 2008 - analysis points out that feeders affected by the storm were on average trimmed longer ago than non-affected feeders It is important to start with the feeder three-phase backbone circuits

Continue with the ongoing enhanced programs that, among others, address the issue of out of easement tree removal – analysis points out that 30% of the outages were caused by broken trees from which reportedly 85% were out of easement Consider creating a tree inventory (e g danger tree locations, hazard tree locations, growth rates by species in AmerenUE's GIS)

As the vegetation in the greater St Louis area is denser than the national average for urban areas and the tree canopy is actually growing, it is recommended to periodically review the vegetation management budget in light of the growing tree canopy

3.4.2 Continue the revised pole inspection at the targeted inspection rate. The pole inspection planning, record keeping, analysis and auditing functions should be improved.

Continue the revised pole inspection and treatment program at the targeted inspection rate [8] The pole inspection planning, record keeping and analysis should be improved The improved planning must be supported by a consolidated pole inventory (with, amongst others, the ability to locate each pole, obtain the corresponding pole attributes, inspection and treatment history and feeder number) Inspection and treatment results should be readily available within AmerenUE They should be tied to the pole inventory and potentially tied to a (new) pole loading calculation database Geographic and trend analysis results should feed back into pole maintenance planning and budgeting, potentially, to targeted system hardening measures Lastly, while the current program does indeed contain an audit function focused on adequate application of AmerenUE's pole reject standards, it should also ensure the completion of pole replacement work orders

3.4.3 Modify OAS data structure to capture outage root cause and affected components better, supporting post-storm infrastructure analysis.

Introduce modifications to the OAS and train crews correspondingly Eliminate inconsistencies and improve data entry, separating affected equipment from causes adequately Introduce 'Wind-only' as a root cause and remove "Trees" as a root component, and make the other necessary modifications to provide for

[8] It must be noted that a recent program change will include the inspection of lateral poles as well The targeted inspection rate with this inclusion will also change, from 10% to 8 33%, corresponding to a 12-year cycle The combination of these changes will most likely result in higher pole reject rates and thus increased replace, treat or reinforce spending

reporting that removal of a tree is necessary for the restoration of an outage Consider verification of tree related outages (potentially with the tree inventory)

Consider a dedicated post-storm forensic data collection and analysis methodology, including a data template, database and dispatch procedure During such forensic data collection details like lateral versus feeder, multiple-circuit pole or other important attributes can be captured for analysis Create and train dedicated 'forensic' teams for post-storm data collection to be performed in parallel with the storm restoration process Ensure ability to combine the forensic data with materials issued during the storm, pole loading calculation results and the pole inspection database See recommendation 7 4 3 later in the report

4. Project Area – Engineering Standards

This project area focused on reviews of engineering practices and standards related to sub-transmission and distribution system integrity and strength The focus of the investigation was on the impact of the standards and practices on the infrastructure's ability to withstand storms of the type and magnitude experienced in 2006

4.1 Engineering Data and Analysis

KEMA reviewed AmerenUE's engineering standards to evaluate the standards used by the company in the area of distribution pole loading and strength calculations The KEMA analysis will provide a general review of the applicable sections of the National Electric Safety Code (NESC) and the requirements on distribution designs

Two primary documents house AmerenUE's engineering and construction standards

- Distribution Feeder Design, Article PS-30 Rev 1 – This is the introductory article of the Electrical Distribution Design Articles and provides the basic concepts, design philosophies, and engineering considerations for distribution line design at AmerenUE

- Distribution Construction Standards, May 2005 Edition – These standards apply to all AmerenUE operating companies and are the detailed construction standards used in the construction of new facilities as well as the rehabilitation or rebuilding of existing facilities These standards have been developed in conformance with all applicable national, state and local codes and meet the minimum standards of the NESC

Together, these documents provide designers, engineers, construction personnel and others with the necessary information to specify and build distribution facilities to meet company, customer and code requirements

4.1.1 Overview of NESC requirements

The governing safety standard for distribution pole strength is the NESC This code provides minimum design specifications to ensure public safety It is not intended to be a design manual, nor is it intended to address issues other than public safety A pole meeting the NESC requirements can be considered safe, but may or may not be the best solution from the perspective of economics or reliability

The NESC defines three different grades of safety requirements depending upon the public safety issues related to a particular installation These are termed Grade B, Grade C, and Grade N, with Grade B being the highest requirement In general, the NESC requires distribution structures to meet Grade C construction except when crossing railroad tracks or limited-access highways (these require Grade B construction)

According to the NESC, a structure must be able to withstand loading due to combined ice buildup and wind (the ice adds weight and increases surface area exposed to wind) For the purpose of determining the loading calculations for safety when considering wind and ice, the NESC has three primary rules Rule 250B addresses ice, Rule 250C addresses extreme wind, and Rule 250D addresses combined freezing rain/ice and wind loads

Rule 250B "Combined ice and wind district loading" divides the United States into three loading districts termed heavy, medium, and light (see Exhibit 4-1) Missouri is completely located within the heavy loading district These districts determine the loading criteria for overhead line designs with consideration for combined ice and wind loads

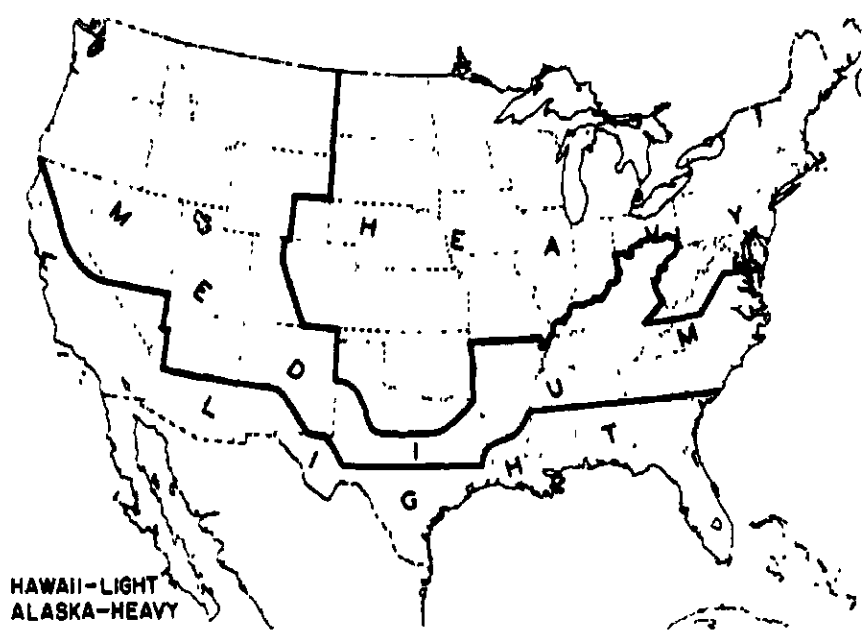
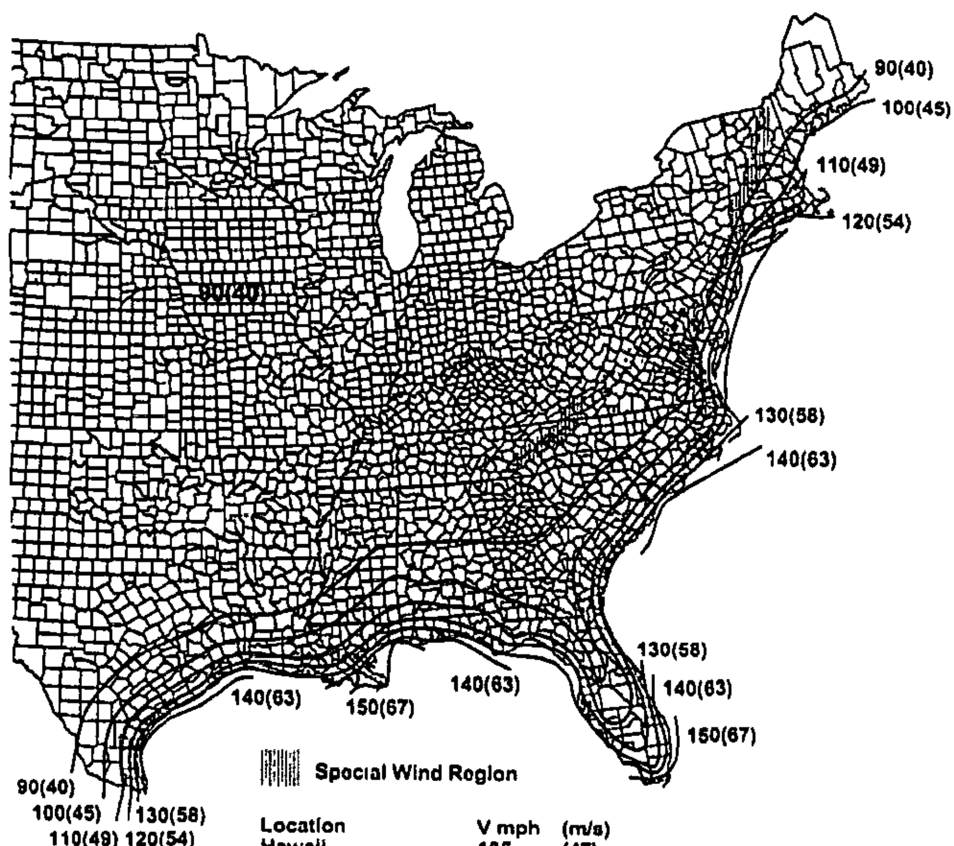


Exhibit 4-1: Overhead Line Loading Districts (NESC Figure 250-1)

Rule 250C "Extreme wind loading" provides extreme wind criteria to be considered in pole loading calculations The extreme wind speed criteria of the NESC changed in 2002, and are now based on three-second gust speeds (see Exhibit 4-2) as opposed to one minute sustained winds as defined in earlier editions of the Code It is important to note that only structures taller than 60 feet (18m) must meet these extreme wind criteria Most distribution structures are not in this category



Location	V mph	(m/s)
Hawaii	105	(47)
Puerto Rico	145	(65)
Guam	170	(76)
Virgin Islands	145	(65)
American Samoa	125	(56)

Notes:
1 Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10 m) above ground for Exposure C category
2 Linear interpolation between wind contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4 Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

Exhibit 4-2: Basic Wind Speed Map (NESC Figure 250-2(B)

Schedule RJM-E1-68

Rule 250D "Extreme ice with concurrent wind loading" was added in the 2007 edition of NESC This rule addresses concurrent ice and wind load due primarily to freezing rain conditions (see Exhibit 4-3) Like Rule 250C, this is an "extreme" condition rule and as such does not apply to structures less than 60 feet above ground or water level Again, most distribution structures do not come under this rule

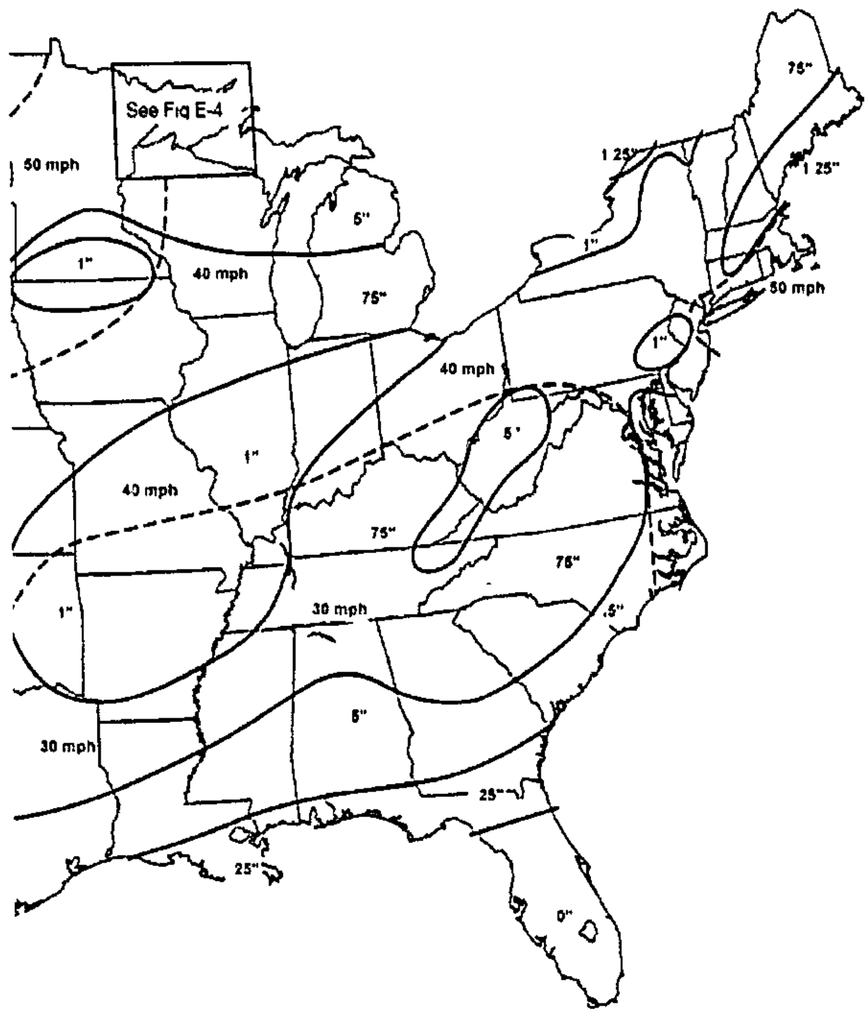


Exhibit 4-3: Combined Freezing Rand and Wind Zones (NESC Figure 250-3)

Summary of NESC Requirements for Distribution Poles in AmerenUE Service Territory

- Grade C construction is required for most distribution structures

- According to the NESC heavy loading district, distribution structures in Missouri must be designed for 0 5 inch radial ice buildup and 40 mph winds
- Extreme wind loading requirement for Missouri (for structures more than 60 feet high) is 90 miles per hour
- Extreme concurrent ice and wind for Missouri (for structures more than 60 feet high) is 1 0 inch radial ice and 40 mile per hour wind (Grade B) and 0 8 inch radial ice with 40 mph wind (Grade C)

4.2 Review of Design Standards and Practices

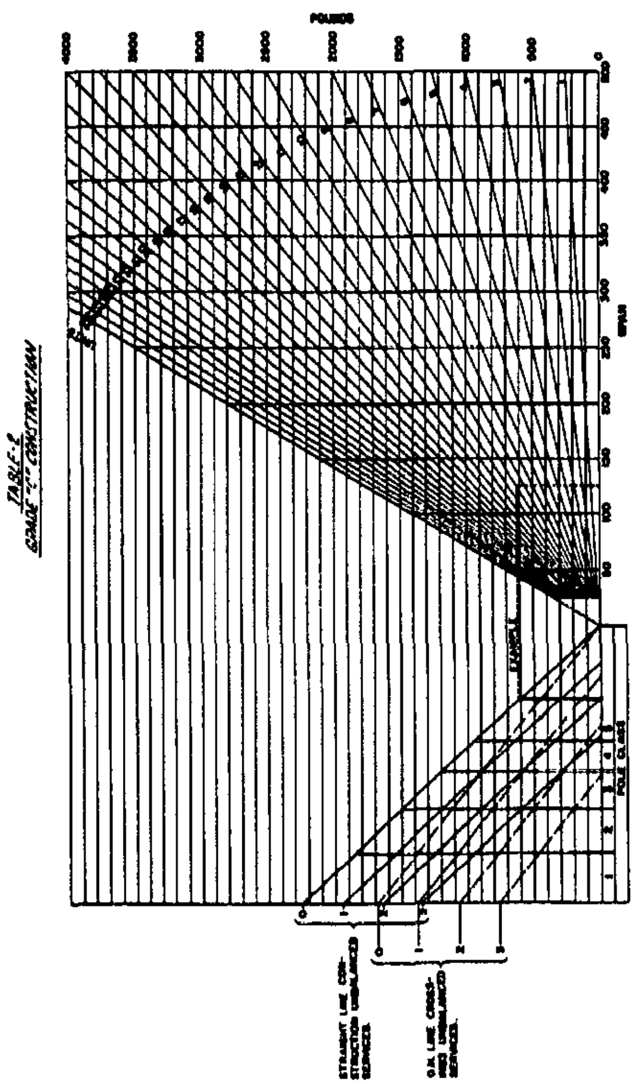
Standard distribution line design and construction at AmerenUE is based on Grade C requirements Grade B construction is also used, as required by the Code, for specific situations such as railroad crossing and limited access highway crossings

The Distribution Construction Standards manual defines the pole size to be used in a given construction situation The manual contains pole sizing charts, as illustrated in Exhibit 4-4 for all three grades of construction (B, C, N) as defined by NESC The manual also includes a table from the NESC which defines the minimum grade of construction required for specific conductor applications and voltage ratings

As mentioned earlier, structures of less than 60 feet above ground or water level are not required to meet the extreme wind or ice conditions specified in rules 250-C and 250-D of NESC In the greater St Louis area AmerenUE uses multiple circuit construction that carries both sub-transmission (34 5 kV) and distribution (4 and 12 kV) facilities This configuration often requires poles that exceed 60 feet and thereby requires that the structures be built to extreme wind and ice standards AmerenUE has recently implemented a standard minimum pole class for all construction of 34 5 and 69 kV facilities This new standard of using a minimum class 1 pole addresses the requirements of the 2007 NESC

POLES
Transverse Loading - Pole Class Selection

02 00 04 01
Sheet 4 of 9



DISTRIBUTION CONSTRUCTION STANDARDS

Ameren

ENG SAL
REV NO 0
REV DATE 09/20/94

Page 02- 15

Exhibit 4-4: Grade C Pole Selection Chart from Distribution Construction Standards

In normal work planning and design, the division engineering personnel are responsible for designing all extensions, upgrades, or replacements of distribution lines It is the responsibility of those personnel to adhere to company standards in line design and construction If situations are encountered that have unique or unusual requirements, the field personnel contact the engineering standards department for guidance and assistance in ensuring that appropriate design considerations are met In order to assist field personnel in calculations for line design the standards department is currently developing a design tool based on company standards and the 2007 edition of NESC It is anticipated that this tool will be distributed to the field by early 2008 for local use

In addition to electric facility design, a major consideration in pole loading is the addition of foreign utility attachments to the electric facility structures The use of power poles by telephone, CATV, broadband and other communications providers is common practice in the industry with those providers being given certain rights of access to electric facilities by the Federal Communications Commission The addition of communications cables to power poles can have a significant impact on total pole load, to the extent that safety margins are sometimes consumed or exceeded by the additional facilities

In order to ensure that poles are adequate for the addition of such cables, AmerenUE has in place an application process that communications companies follow to request attachment to poles This process includes detailed load analysis of the poles in question to ensure appropriate strength capacity is available If not available, the pole is typically changed to a larger size to accommodate the additional equipment AmerenUE uses a contract engineering firm to perform the loading analysis

4.3 Conclusions

4.3.1 KEMA analysis has found that AmerenUE has adequate standards in place to ensure that pole loading and line design meet the appropriate criteria as defined by NESC.

As the primary purpose of this study has been to evaluate AmerenUE's practices as they relate to severe storms and potential storm damage, our review has not found any indication of design standard or process deficiencies that might have contributed to the extent of damage experienced during severe weather in 2006 KEMA does believe, however, that improvement in the overall consistency of application of design standards can be made As stated earlier, an automated tool for line design calculations is in development and is anticipated to be available in early 2008 This tool will provide significant capability to improve overall consistency in application of design standards

4.3.2 Methodology for calculating design loading of poles is not well documented although tables and charts that are based on standard calculations are provided in the Distribution Construction Manual.

The standards organization is working on many fronts to reach a higher level of consistency across operating companies in design practices There is also an ongoing effort to bring more standardization to sizes of poles and conductors used in line construction as well as to the line configuration While KEMA does not believe that current levels of standardization or consistency in these areas are an issue for storm resiliency, we fully support the belief that improvement in these areas will ultimately benefit the overall reliability of the system under all conditions

KEMA has also surveyed a number of other utilities about practices of line design and pole loading Most notably, KEMA investigated the practices of other companies in grade of construction used, allowance and procedures for foreign attachments, and any specific design considerations made for potential severe weather impacts The details of this comparative data are provided in Section 16 2 of this document In summary, KEMA finds that AmerenUE's practices are generally consistent with those of other companies in the industry It is noted, however, that some companies of comparable size and geographic characteristics of AmerenUE, have adopted Grade B construction as a standard for all distribution facilities AmerenUE is currently evaluating the application of both Grades B and C construction throughout the system to determine the most beneficial standard for all AmerenUE companies

4.3.3 An appropriate procedure is in place to evaluate requests by others to attach to AmerenUE poles, including a detailed pole loading calculation.

KEMA has reviewed a sample of the loading calculations performed in response to foreign utility attachment requests This sample provided an opportunity to review the calculations being performed for consistency with NESC and AmerenUE standards Additionally, and more importantly, the sample provides a good data set on the current loading condition of AmerenUE facilities During the period from 2003 to the present, over 51,000 loading calculations were performed to assess the potential addition of communications facilities to existing poles These calculations showed that approximately 78% of the poles studied were found to be in compliance with company standards and NESC requirements

Schedule RJM-E1-73

for Grade C construction prior to the additional attachments being installed and capable of handling the additional load Stated another way, 22% of the poles studied were found in compliance with codes and standards at the time of review but required changes to be sufficient for the additional loading proposed Less than 0 4% was found to be below code specifications at the time of the loading study In KEMA's opinion, this is an excellent indicator of AmerenUE's dedication to NESC compliance and quality company standards in pole loading and design on an everyday basis

4.4 Recommendations

4.4.1 Complete and distribute the automated pole loading calculation tool currently in development in the standards department.

This tool provides field personnel with fast and convenient capability to analyze pole loading for new, replacement and existing structures Explanation and/or training on the tool, when distributed, should be tailored to cover the primary areas of concern in loading calculations and to develop consistent practices throughout the operating departments With the delivery of the automated design analysis tool, AmerenUE should also document the procedures to be followed in using the tool and the methods, algorithms and standards that are the basis of the tool

4.4.2 Develop design standards and guidelines related to NESC construction grades (B or C) and to specific applications in the service territory.

Current guidelines within AmerenUE call for Grade C construction except where Grade B is required by Code Some discussion is underway regarding consideration for Grade B as the standard AmerenUE should develop guidelines based on operational metrics that dictate construction grade, storm hardening and other special design considerations Operational metrics to be considered are such things as critical feeders, areas of historically significant storm damage, or other considerations that would warrant a more stringent design standard that would assist in achieving operational targets for reliability

4.4.3 Make use of detailed pole loading analyses done for foreign attachment applications by cataloging the loading data by circuit, location or other identifier. The assembled information may then be used as a data sample in future studies of loading, pole condition, forensic analysis, etc.

As earlier noted, over 51,000 detailed engineering studies have been performed in recent years as part of the foreign utility attachment process The data from these studies, in addition to determining requirements for the requested attachments, can also be used for further analysis of design strength, pole capacity, strength deterioration as function of age, application or location, as well as other considerations

4.4.4 Develop and maintain current knowledge of technological developments in pole and conductor materials and designs.

As in other fields, new technologies are impacting pole and conductor development and manufacture Distribution size poles manufactured from composite materials is a rapidly growing market due to the additional size and strength that can be gained without the additional weight of concrete or steel Similarly, composite conductors are being used widely for reconductoring applications in order to increase circuit capacity without having to upgrade poles or structures due to the weight added by increasing the size of standard conductors Further, changes and improvements in pole framing or other pole mounted equipment can reduce loading thereby increasing the structures ability to withstand severe weather

5. Project Area – Maintenance

KEMA has undertaken a review of the maintenance programs and processes in place at AmerenUE as they relate to storm preparedness and the ability of the infrastructure to withstand severe weather With a focus on the subtransmission and distribution systems, KEMA has reviewed the ongoing maintenance programs that are designed to ensure the reliable operation of that system in both normal and storm conditions Our analysis has covered three primary maintenance areas

- Pole inspection and maintenance,
- Vegetation maintenance and management, and
- Distribution line equipment maintenance

A general discussion of each area follows in this section with later sections addressing findings, conclusions, and recommendations

5.1 Maintenance Program Overview

5.1.1 Pole inspection and maintenance

AmerenUE has had a wood pole inspection and maintenance program in place for a number of years This program is consistent with those found throughout the industry and includes a company standard for inspection, treatment, reinforcement, and replacement AmerenUE's specifications for inspection and treatment of in-service wood poles are well documented and consistent with both NESC and ANSI guidelines which are the governing standards for pole strength and suitability for service

The AmerenUE program has undergone changes in recent years to expand and improve the program Prior to 2007 the program was directed toward subtransmission and feeder backbone poles (200,000 units) only, as described in Section 3 2 1 Beginning in 2007 the program was expanded to include all wood poles, regardless of application (adding another 700,000 lateral poles) In the new program all poles will be visually inspected at a minimum of once every four years and subject to a detailed, intrusive inspection once every twelve years Exhibit 5-1 illustrates the scope of the program and the changes that have occurred over time

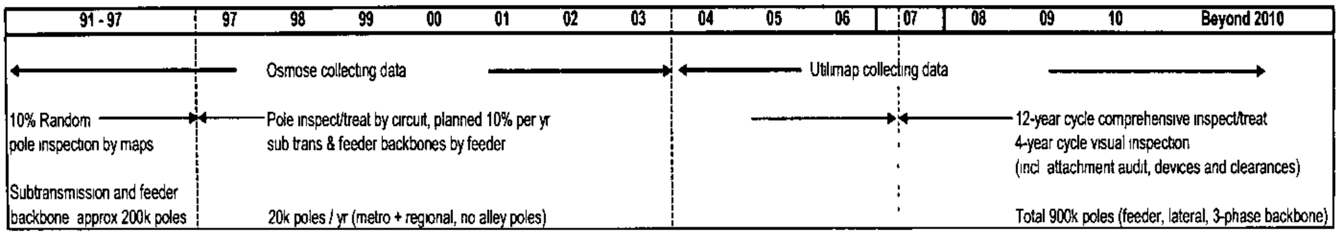


Exhibit 5-1: Pole Inspection Program

5.1.2 Vegetation maintenance and management

The subtransmission and distribution vegetation management program at AmerenUE is typical of programs found in most electric utility companies including the challenges most companies face in program funding, cycle schedules, and resource management In recent years AmerenUE has made (and continues) a concerted effort to put the vegetation program on a regular cycle trim schedule of four years for urban areas and six years for rural territories AmerenUE is currently on track to achieve its desired cycle schedules by the 4th quarter of 2008

The greater St Louis area is often called an "urban forest" because of the tree density of the region The high vegetation density as well as the density of electrical hardware in the same areas, as described in Section 3 2 1, creates challenges for the utility in both routine operations and maintenance and particularly in storm conditions High numbers of tree related outages are often experienced during stormy weather, often caused by trees outside of the utility trim zone and therefore, essentially out of the utility's area of influence or control AmerenUE is like other utilities throughout the country that are challenged to balance the need for vegetation maintenance for system reliability with the public desire for large and dense areas of vegetation for aesthetics

To balance the inherent conflicts between constituencies, AmerenUE has undertaken various programs aimed at finding a middle ground acceptable to most interested parties These programs include such things as danger tree identification and replacement efforts, conversion of overhead electric facilities to underground and joint efforts with municipalities on development and enforcement of ordinances

5.1.3 Distribution line equipment maintenance

As part of its efforts to improve system reliability and overall system integrity, AmerenUE has begun a structured distribution circuit inspection program The company has routinely performed inspections and maintenance on various components of the distribution system Pole inspections and vegetation maintenance previously discussed are two leading examples Additionally the company has performed routine maintenance on various other components of the system such as network protectors, switches, and similar equipment **Error! Reference source not found.** is reproduced from AmerenUE's "Policy for Electric Subtransmission and Distribution Circuit Inspections" and details the type and frequency of inspections in the program as well as the facilities included in the program The policy document also details the scope of the inspections performed on each type of equipment

Exhibit 5-2: Electric Circuit Inspection Program

5.2 AmerenUE and Comparative Data

5.2.1 Pole inspection program

Data from pole inspections prior to 2007 was presented and analyzed in Section 3 of this report, Infrastructure Forensic Analysis Further analysis of pole inspection reject rates, average ages at inspection and similar data is not presented in this section, however, KEMA's analysis of the program, execution and comparison to other programs in the industry is presented

With the change in the pole inspection program to include the entire pole population, AmerenUE has improved their program to the level of other comprehensive programs in the industry While detailed forensic data from the 2006 storms was not available, KEMA experience leads us to believe that if the data were available a higher pole failure rate would be found in specific segments of the pole population that have not been part of the pole inspection and treatment program in the past Specifically this refers to lateral or tap line poles or any other pole not included in the subtransmission and feeder backbone groups Findings at other companies lead us to this belief and to the expectation that pole reject rates will increase under the new program scope (as mentioned in the footnote 8)

Schedule RJM-E1-78

KEMA has found through industry surveys and engagements with other companies that pole inspection programs vary in cycle time but that those companies with active programs, on average, seek to achieve a ten-year inspection cycle AmerenUE's target of 12 years for detailed inspection and treatment is consistent with many other companies and when combined with a four-year visual inspection cycle and more frequent walk-by surveys, creates an aggressive inspection program that should be beneficial to reliability improvement and effective in maintaining pole integrity for storm duty as well as normal use Exhibit 5-3 provides the detail of the interlaced inspection programs that result in frequent opportunities to observe obvious pole defects

			2007												
Cycle Year	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12
Tree Trimming, Urban Feeders (inspection results reported in FODR)	X				X				X				X		
Visual Circuit Inspections (results reported in CDIS)			X				X				X				X
Pole and G/L Inspect & treat (results reported in CDIS)			X												X
Subtransmission Walk-by		X		X		X		X		X		X		X	

Exhibit 5-3: AmerenUE's Interlaced Infrastructure Inspections

5.2.2 Vegetation maintenance program

AmerenUE for several years has been working to overcome a vegetation maintenance backlog and to restore the program to on-cycle trimming. This effort has been the subject of discussion with the Missouri PSC and agreement and expectation is in place for vegetation maintenance to be on-cycle by the 4th quarter of 2008. Budget reductions in prior years have now been overcome with increasing funding and expenditure each year as the backlog reduction program progresses as well as enhancements to the basic maintenance program are introduced as pilot projects. Exhibit 5-4 shows the expenditures for the program from 2001 through 2006 with the projection for 2007.

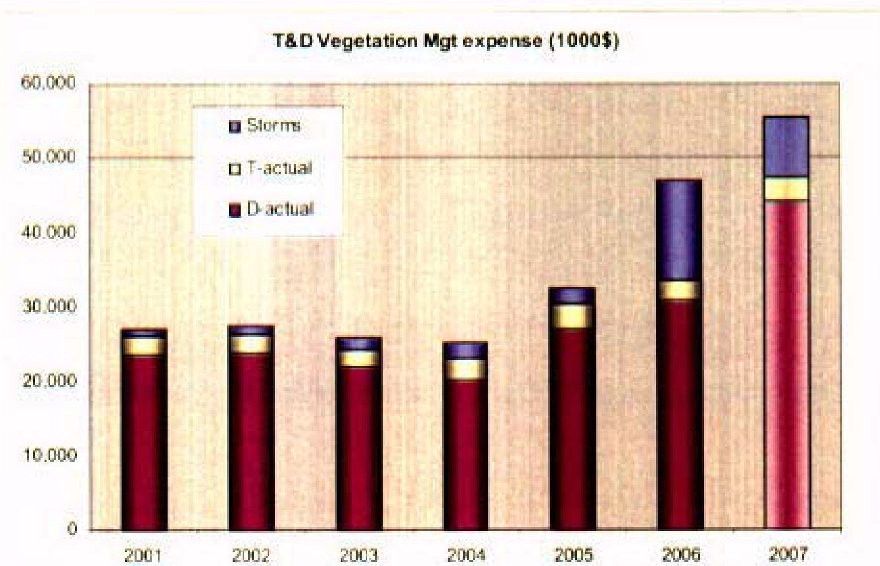


Exhibit 5-4: Vegetation Expenditures 2001 - 2007

Schedule RJM-E1-80

5.2.3 Distribution line equipment maintenance program

AmerenUE's Distribution Circuit Inspections program is in its first full year of implementation The lack of operational history for the program does not allow for analysis, however, KEMA notes that funding for the program elements is projected to be substantial, both for inspections and for anticipated repairs and equipment replacement

Dedicated inspection forms for transformers, regulators, capacitors, sectionalizers and reclosers have been reviewed by KEMA The form for Arresters, hard to assess in general, has not been received The forms are general in nature and have inventory data items such as presence of animal guards (yes/no) This would facilitate an as-found / as–left analysis to generate a work ticket intended to restore the original condition The forms do not yet have failure data fields such as predetermined failure mode, cause and effect fields to be filled out upon equipment failure Analysis of such data would identify additional relevant inspection parameters

The forms go hand-in-hand with an available training guideline document KEMA found these guidelines useful since they are compiled of many photographs with accompanying text The received version does not seem formalized in that the document lacks a company number, date, revision number, and approval history

5.3 Conclusions

5.3.1 Maintenance prior to 2007 has been consistent with industry practices (ramping up from under-funding), new programs going forward are better.

As outlined earlier in this section, the pole inspection, vegetation and distribution circuit inspection programs have all been enhanced, or newly created, in the last two years This increased emphasis on infrastructure maintenance is designed to improve system performance both in daily operations and in extreme weather or storm conditions The elements of the maintenance programs are consistent with industry practices and in some cases go well beyond what is typical for the industry

5.3.2 Vegetation management program is making good progress with increased funding to achieve desired cycles.

Reduction of the vegetation backlog has been a top priority for several years As shown in Exhibit 5-4, funding for the vegetation program has steadily increased since 2004 with a substantial increase in the 2007 budget The increased funding is necessary for both backlog reduction and for program enhancements that include more aggressive trim cycles for certain circuits and more aggressive actions to remove problem trees and expand rights-of-way The ultimate measure of success will be decreasing outages caused by trees in both storm and non-storm conditions A target for contribution of trees to reliability indices (i e tree-related SAIFI) has been established and will provide a quantifiable measure of success of the vegetation maintenance actions

5.3.3 Distribution line equipment inspection program will provide information to build a library of inspection, failure, and maintenance data.

As shown in Exhibit 5-2, distribution line equipment will be inspected at intervals ranging from one year for overhead and underground operating devices to twelve years for a comprehensive wood pole inspection The frequency of inspection and the number of devices included in the program will result in a large amount of data on condition and operations of line devices AmerenUE's current plan is to collect and maintain data on inspections performed, however, data on equipment failures is not currently collected or maintained KEMA believes that the equipment inspections and equipment failure or replacement information should be maintained as a library in order to analyze failure rates by class of equipment, age profiles, and various other information to be used in maintenance and replacement planning, including the evaluation of certain equipment types, makes and models The analysis also may identify additional relevant inspection parameters for inclusion into the inspection program

5.3.4 Programs include solid interlacing of pole, line equipment and vegetation inspection schedules, augmented by sub-transmission walk-bys.

As illustrated in Exhibit 5-3, AmerenUE has made a strong effort to integrate the various maintenance and inspection programs to provide maximum exposure of facilities and equipment to visual or more detailed inspections By purposefully staggering inspection cycles in each program, the company has created a plan in which circuits and poles are subject to visual inspections more frequently than the specific program for each particular class of equipment requires, while executing it at similar costs

5.4 Recommendations

5.4.1 Develop a statistical analysis methodology to ensure that equipment maintenance is optimal for different classes of line equipment.

As outlined in Section 5 3 3, the distribution circuit inspection program will produce data that can be used to evaluate equipment condition at various ages, duty cycles, locations (environments), etc The analysis of this information can provide valuable information on how to optimize the various equipment classes from the standpoint of design (historical performance), inspection, maintenance and replacements The analysis will also support more accurate budget forecasts for the related spending

5.4.2 Continue the evaluation of the enhanced vegetation management program and apply the same approach to pole inspection and distribution line equipment programs.

In line with the recommendations for pole and line equipment maintenance programs, KEMA would like to emphasize the importance of program evaluation In particular, the evaluation of the enhanced programs that are being executed as pilot programs to further determine when, where and to what extent to further implement these Targets for such evaluation have been established and the approach could be considered for application to the pole and distribution line equipment programs

6. Project Area – Emergency Restoration Plan

KEMA's focus in this section is to provide an assessment of the parts of the AmerenUE's Electric Emergency Restoration Plan (EERP) that have proven to be effective as currently structured and an assessment of those areas that can be improved to prepare AmerenUE for future events of the magnitude of the July and December Storms as well as for more effective response to storms of lesser consequence

6.1 Leading Practices in Emergency Restoration

6.1.1 Industry Practices

To provide a baseline for reviewing AmerenUE processes and capabilities, it is necessary to provide a summary level description of typical storm restoration activity For this purpose, KEMA has prepared a model of a storm restoration process that incorporates leading practices from the utility industry The model provides the reader with a basic understanding of how storm restoration is typically managed in a leading utility company and highlights the basic flow of information, the sequence of events in the field in assessing damage and the logistics of the restoration process As one would expect, many support activities facilitate the primary processes of system restoration and repair including management of information for both internal decision-making and public dissemination Both the primary processes and support activities as they existed in 2006 at AmerenUE are discussed throughout this report to provide an understanding of what works well and what could be improved Exhibit 6-1 shows our definition of the outage management process and is referenced throughout this report to demonstrate the specific area of the process being reviewed

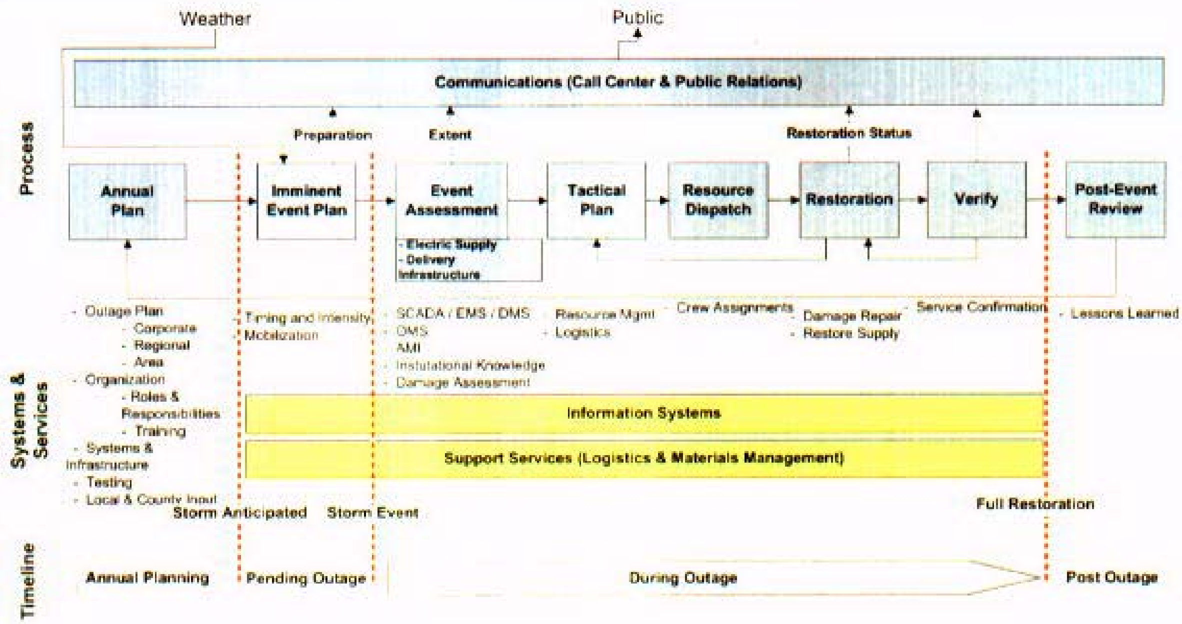


Exhibit 6-1: Outage Management Process

6.1.2 The Annual Plan

The leading restoration plans outline a utility's strategy and framework for managing all activities associated with a coordinated restoration effort after a significant storm, earthquake, or other natural disaster. Specifically, the plan defines:

- The high level strategy to prepare for and execute restoration activities,
- The personnel resources required to effectively conduct the restoration,
- The delegation of authority and responsibility for major elements of the storm restoration effort,
- The processes used to direct and manage the restoration efforts,
- The information tools required to process all the storm and restoration data into usable management information,
- The definition of storm strength and potential damage,
- The company's restoration strategic approach to a particular level of storm,

Schedule RJM-E1-85