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

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DIRECT TESTIMONY

OF

RICHARD J. MARK

CASE NO. ER-2008-____

I. INTRODUCTION

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. Undergrounding and Reliability Improvement

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. <u>Vegetation Management Program</u>

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 Service Provided to Customers in the Company's Missouri Service Area.	)))))	Case No. ER-2008-____

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
Richard J. Mark

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

Debra K. Patterson
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.

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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.***

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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)

  AmerenUE response to 3.4.1 **– 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)

  AmerenUE response to 3.4.2 **– 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**

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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.**

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- 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**

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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)

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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)

AmerenUE response to 7.4.4 **– 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)

  AmerenUE response to 10.4.2 **– 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)

  AmerenUE response to 10.4.7 **– 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)

  AmerenUE response to 11.4.3 **– 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)

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AmerenUE response to 13.4.2 **– 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)

AmerenUE response to 13.4.3 **– 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)

AmerenUE response to 14.4.1 **– 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)

AmerenUE response to 15.4.1 **– 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.**

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- 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**

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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**

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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.

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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.

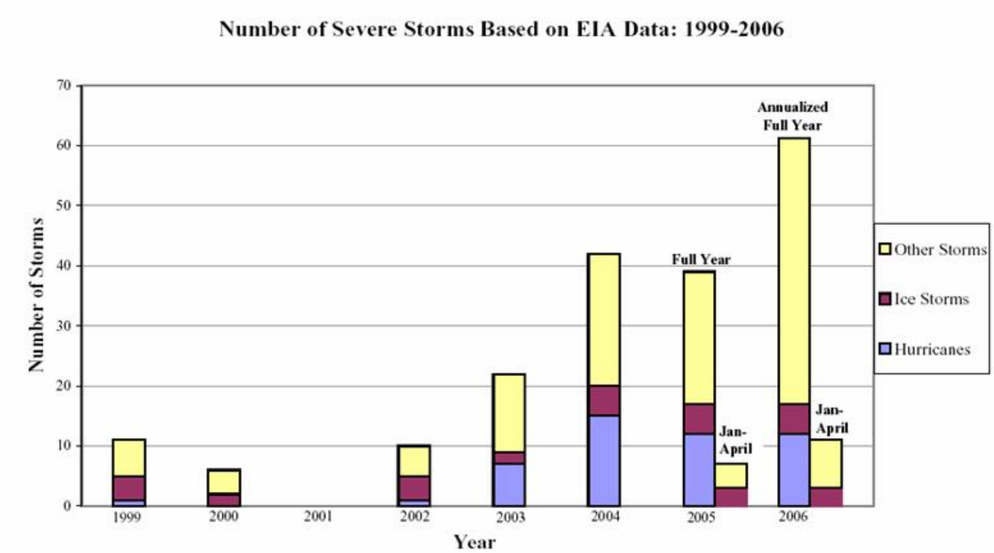
Throughout this report, we refer to the Company, as "AmerenUE" and it should be noted that the review and work reported herewith involved only the Missouri operations of Ameren Corporation or AmerenUE. All findings, conclusions, and recommendations reported apply to only to the Missouri operations of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



Sources & Notes:
US Energy Information Administration Monthly Report 1999-April 2006
2006 based on annualized value of 4/06 YTD data.
Severe storms defined as all storms with outage durations of more than one day, as reported by EIA.

Exhibit 1-1: Severe Weather Trend

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 19^{th} and the second occurring on July 21^{st}. 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 30^{th} and continued through December 1^{st}.

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.

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- 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.

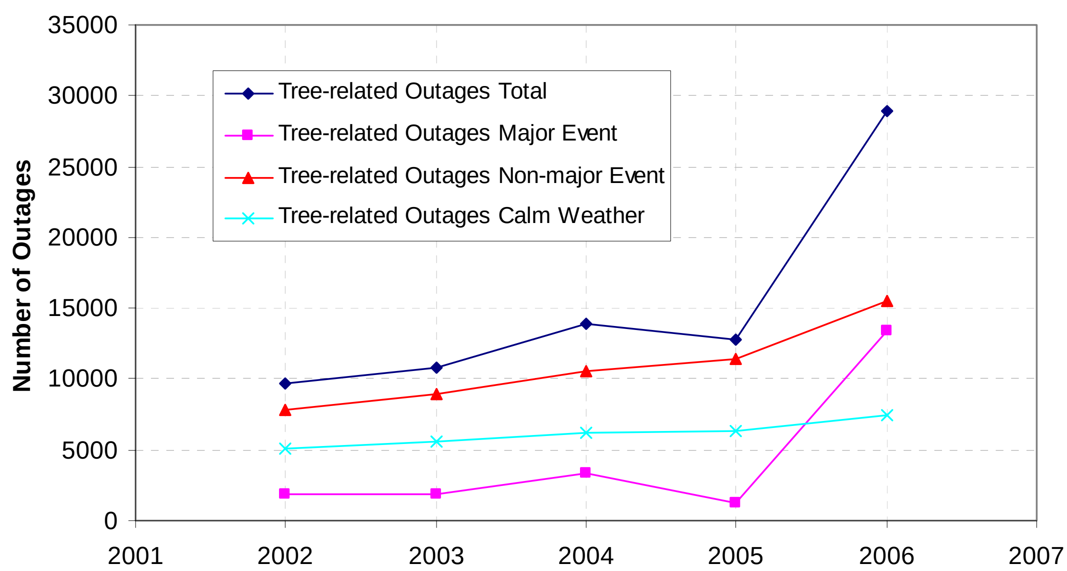

Exhibit 3-2: Total number of tree-related outages 2002-2006 for the six districts under investigation

- 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).

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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).

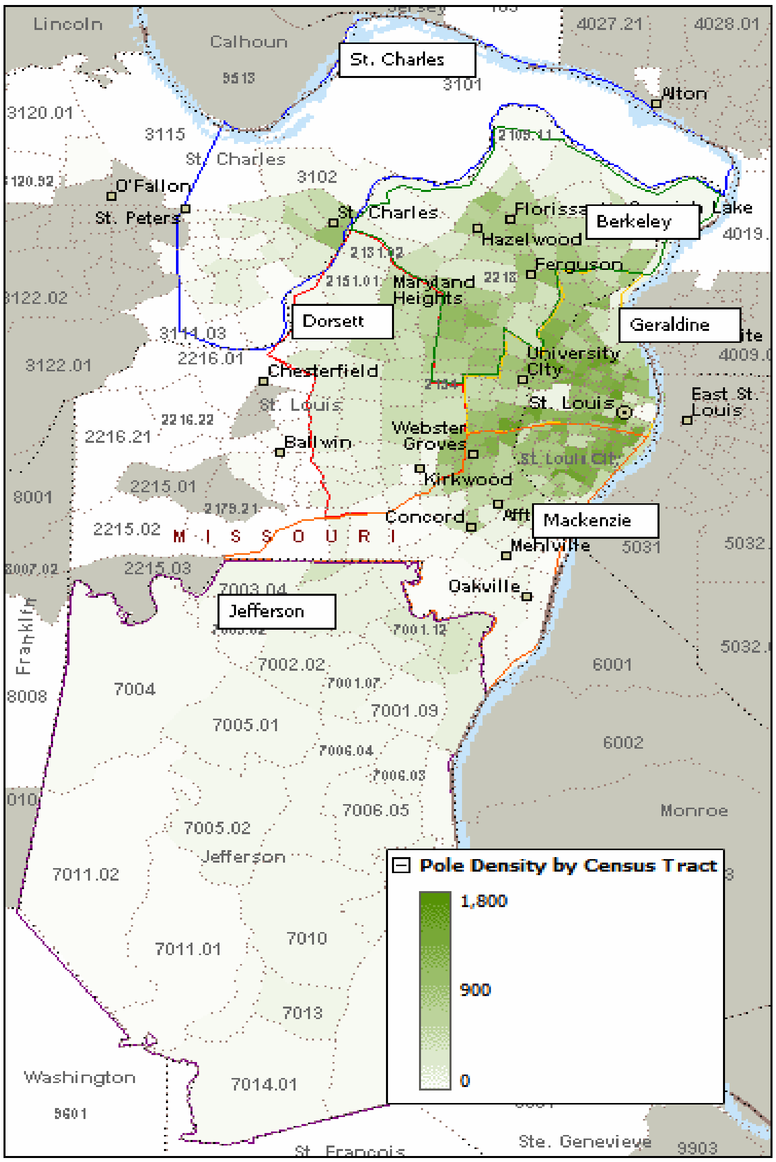

Exhibit 3-4: Pole Density

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(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.

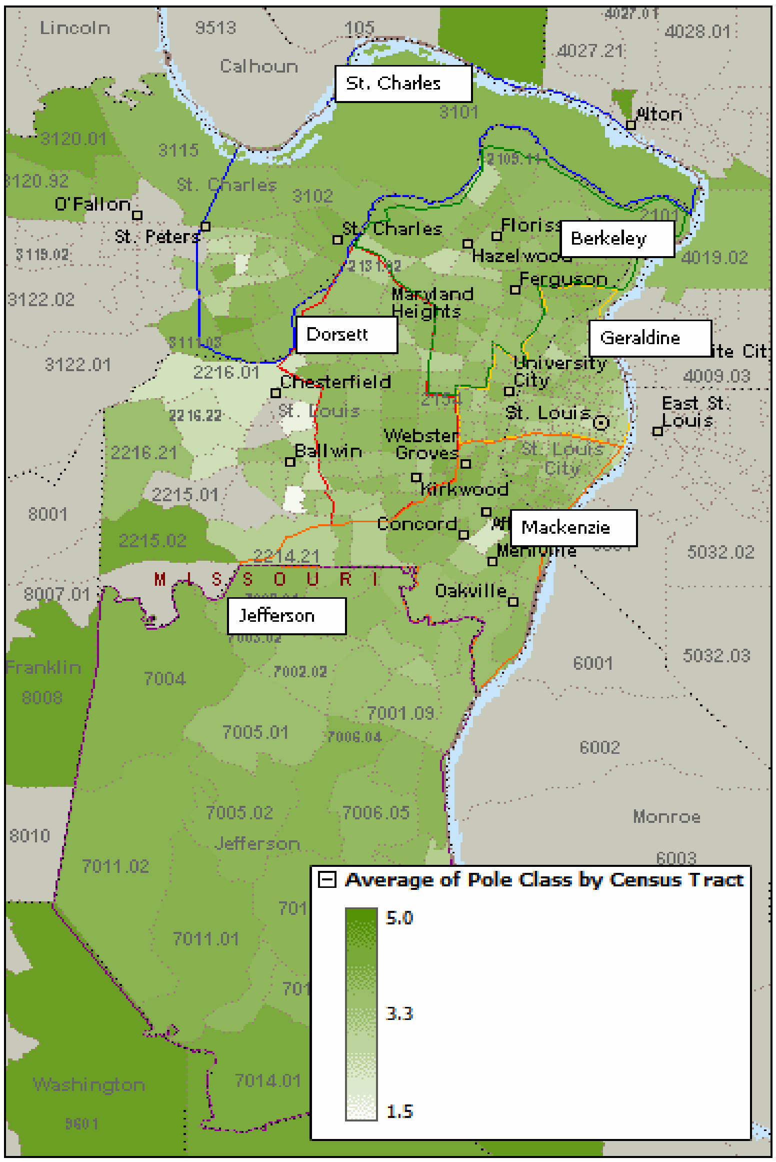

Exhibit 3-5: Pole Class

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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.

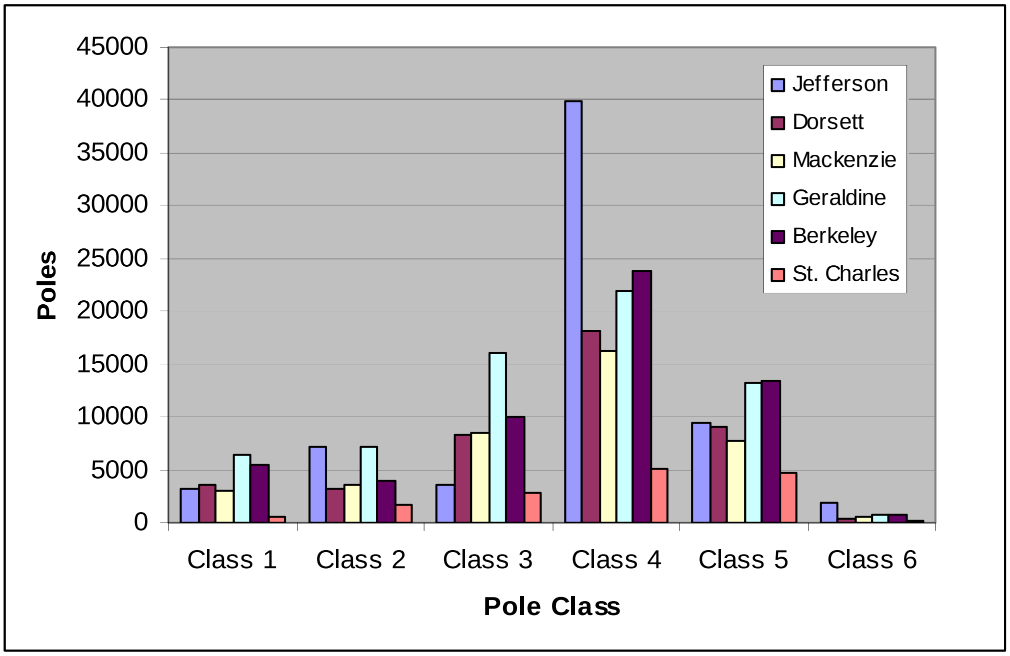

Exhibit 3-6: Pole Class by District

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.

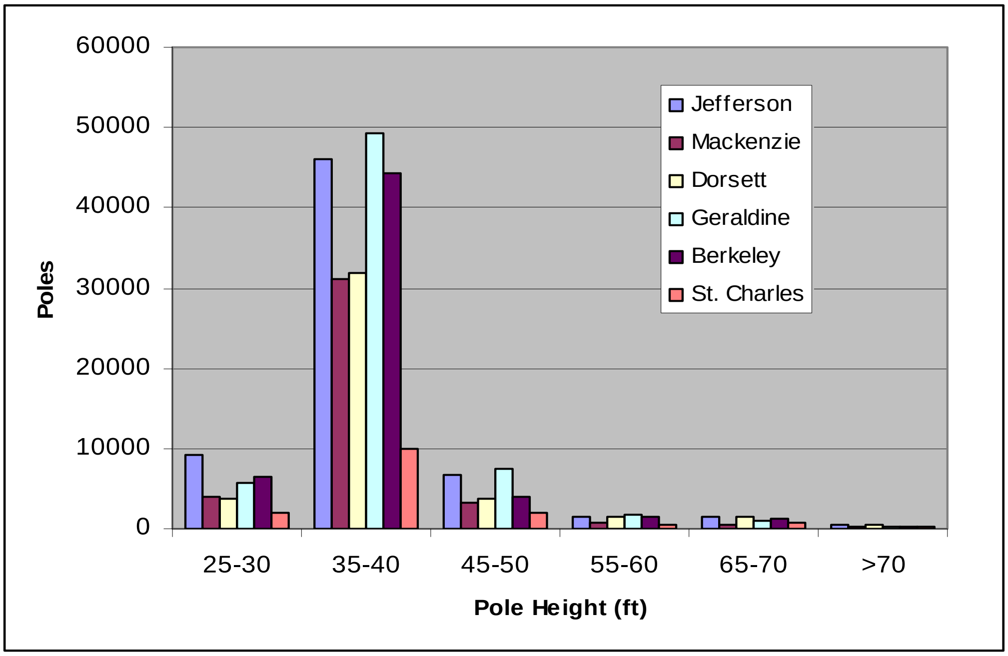

Exhibit 3-7: Pole Height by District

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

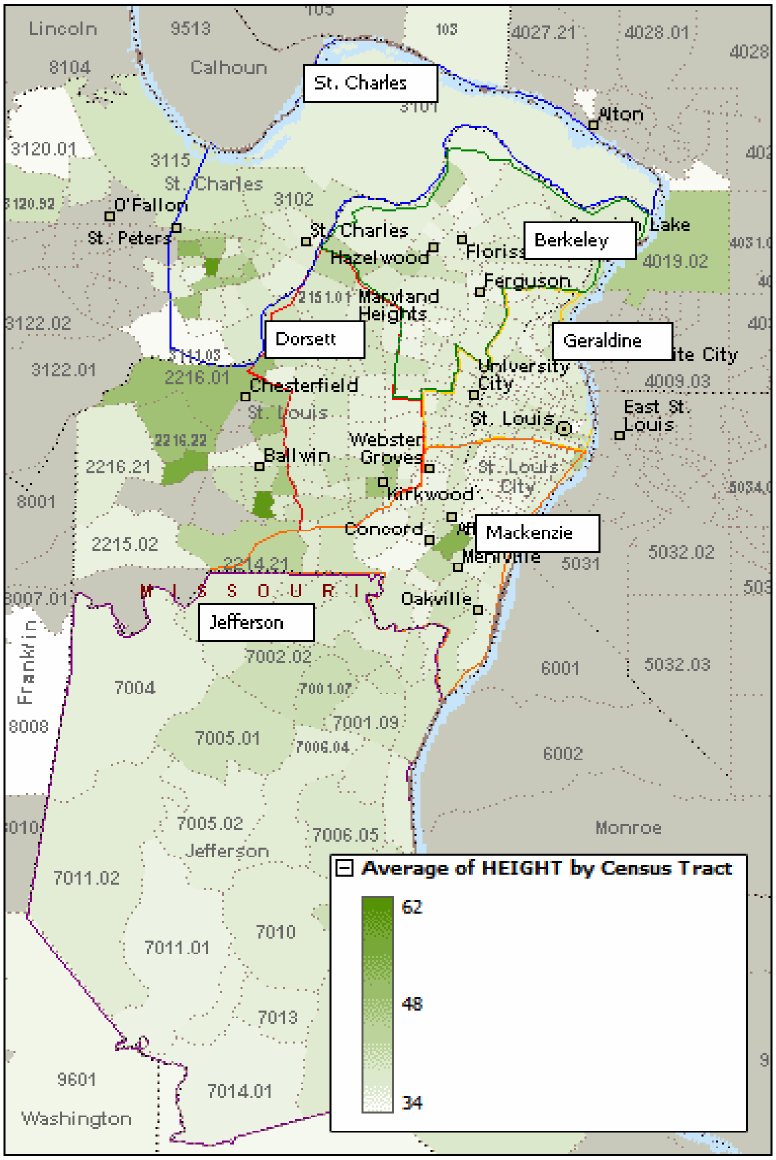

Exhibit 3-8: Average Pole Height (ft)

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

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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.

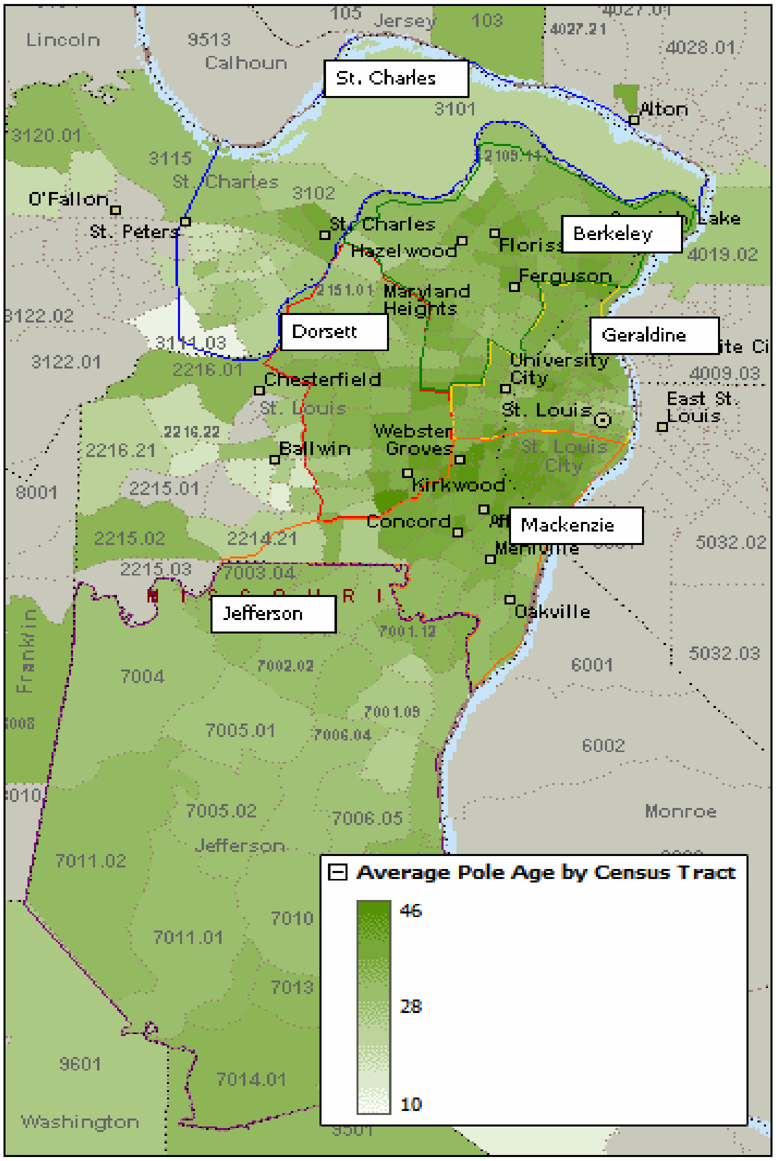

Exhibit 3-9: Average Pole Age (yr)

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 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.

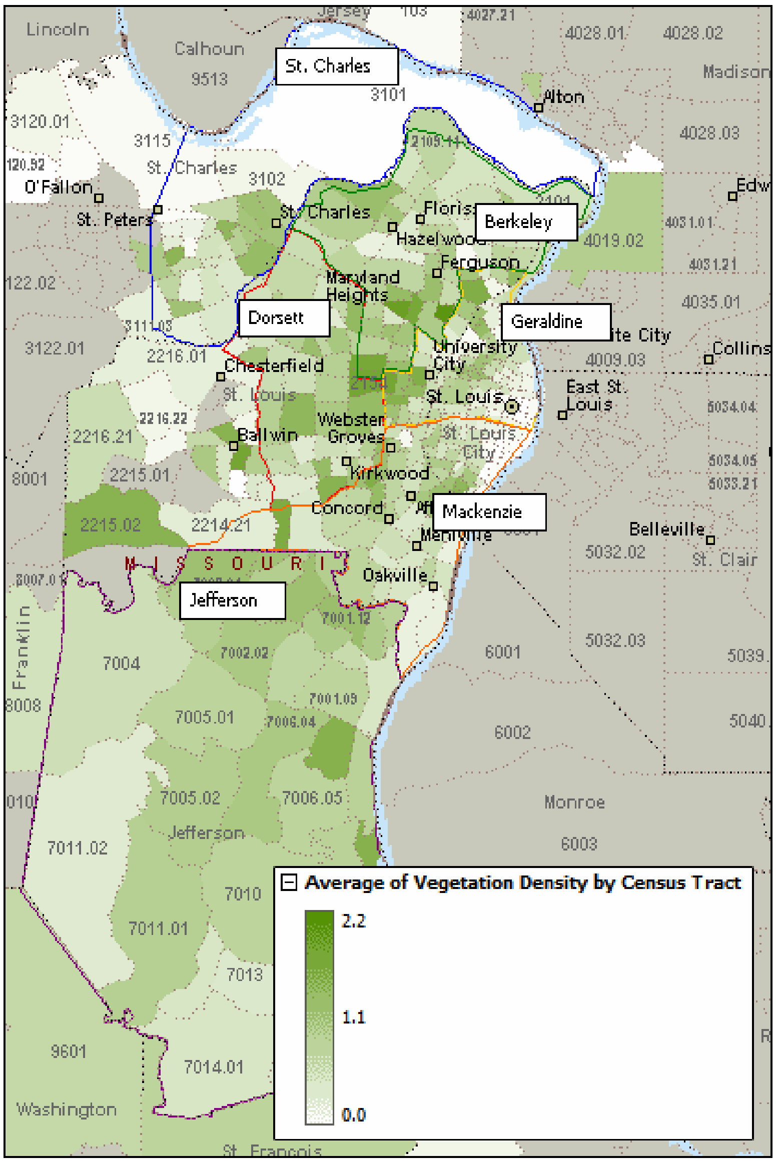

Exhibit 3-10: Average Vegetation Density

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

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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.

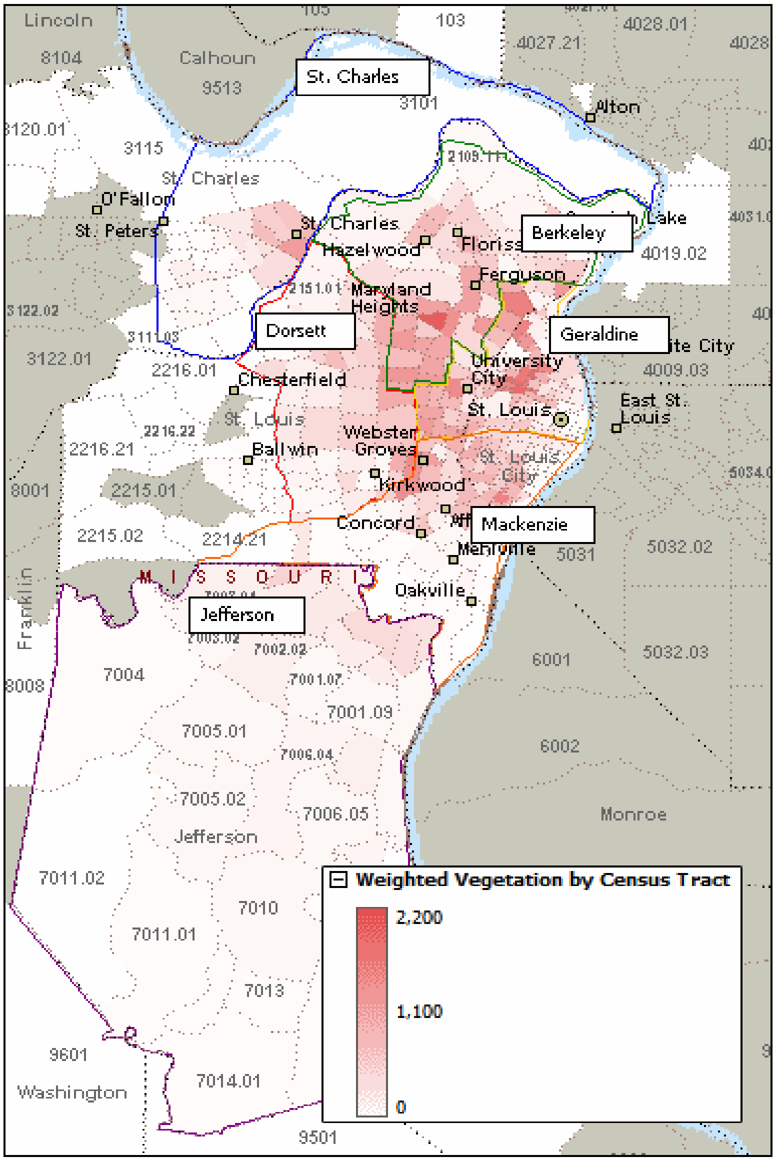

Exhibit 3-11: Vegetation Density Weighted by Pole Density

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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

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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).

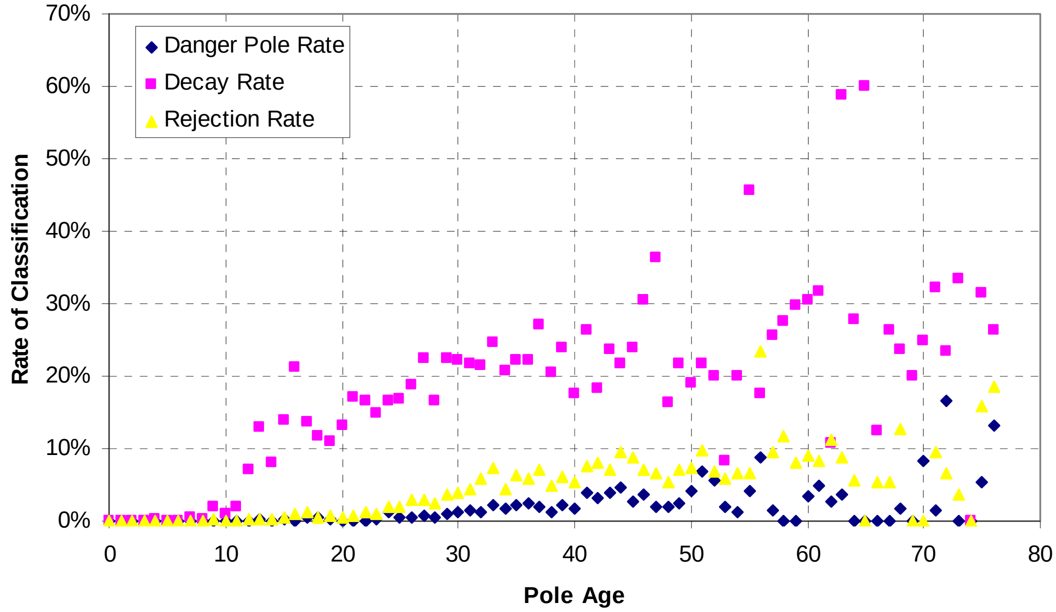

Exhibit 3-13: Pole inspection and treatment results as a function of pole age (1999-2002 data).

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.

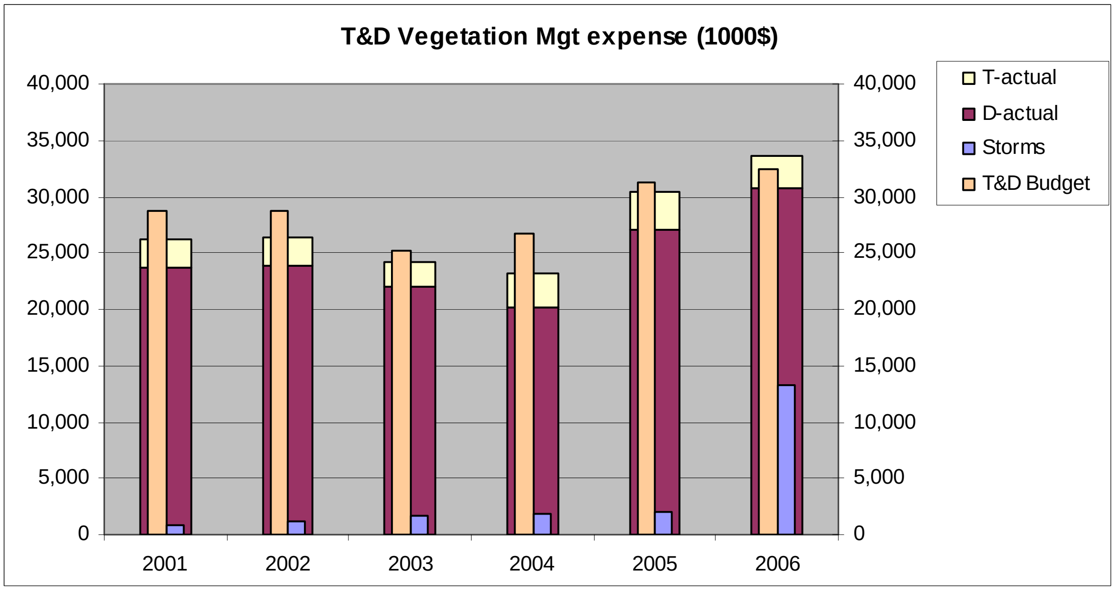

Exhibit 3-14: Trend in Vegetation Management budget and spend

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.

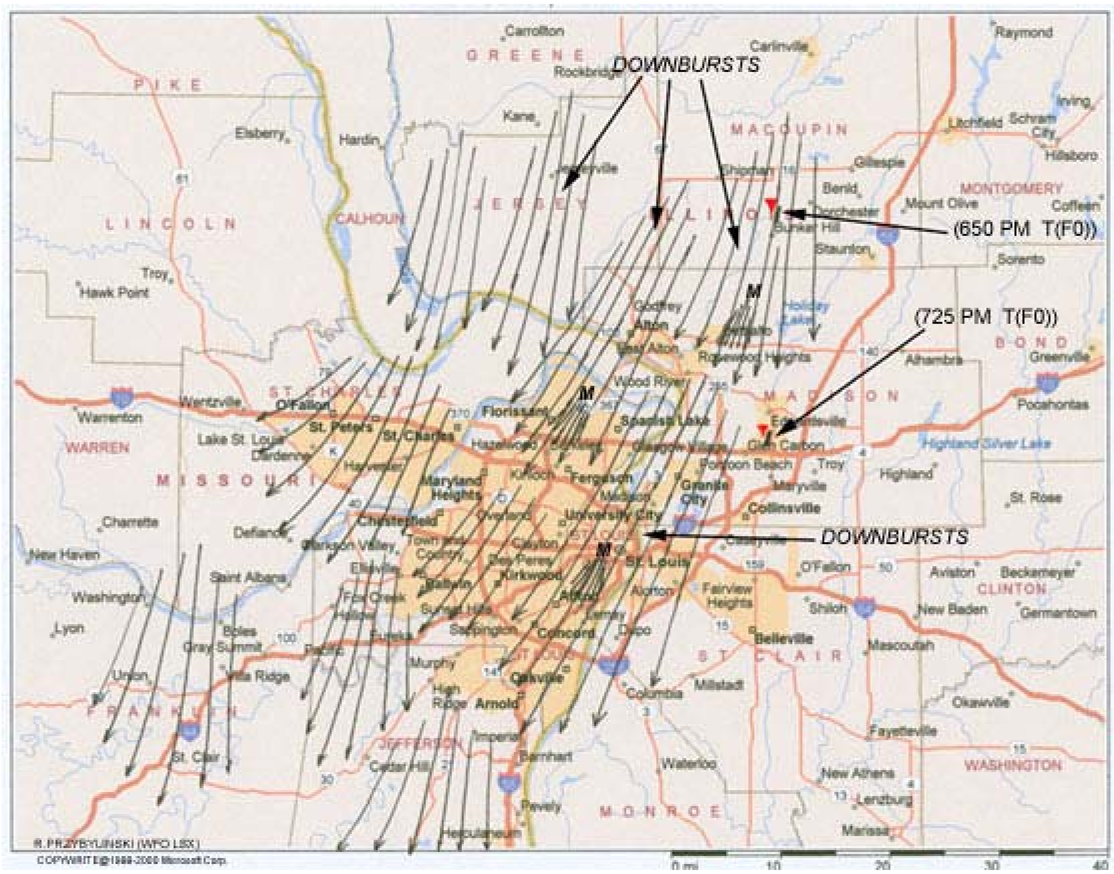

Exhibit 3-16: STORM DAMAGE MAP: Wednesday, July 19, 2006. M represents locations of microbursts and T signifies locations of tornado touchdowns.

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.

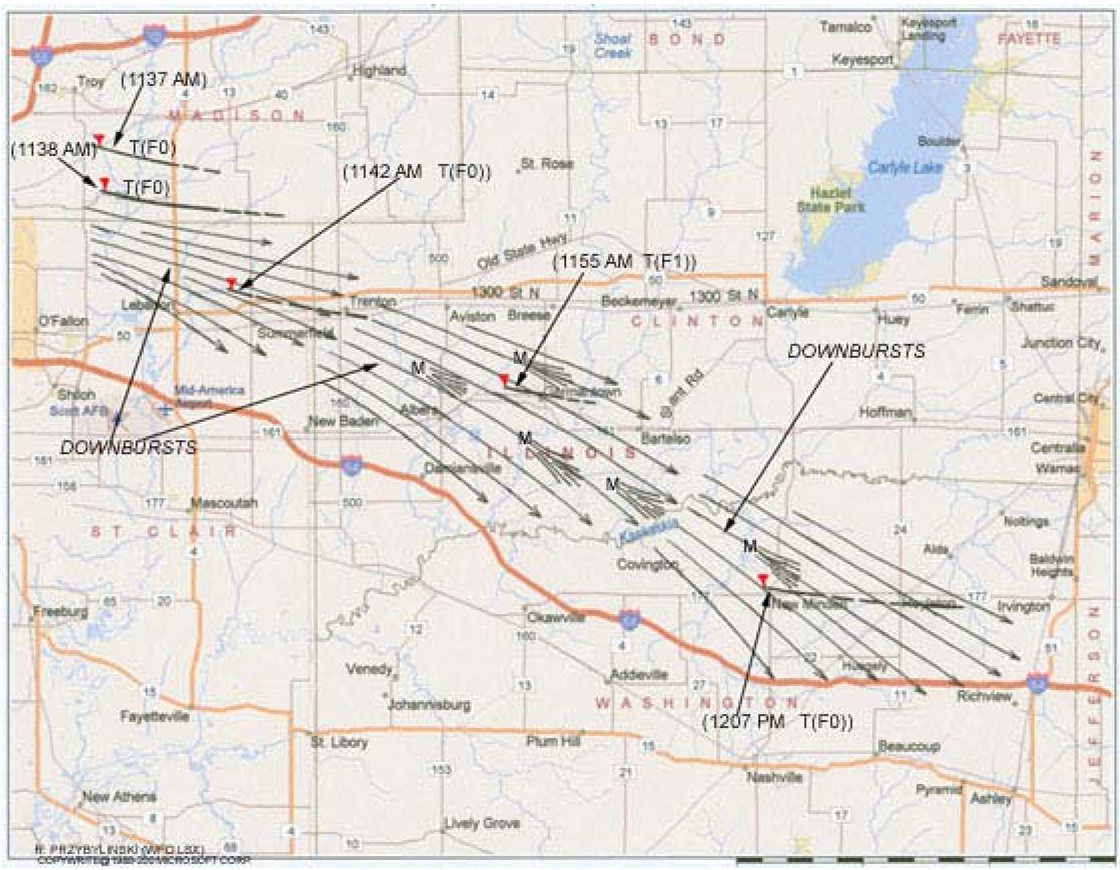

Exhibit 3-17: STORM DAMAGE MAP: Friday, July 21, 2006. M represents locations of microbursts and T signifies locations of tornado touchdowns.

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

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by the lack of additional weather stations and trained spotters. Most likely, there are other areas affected by high wind speeds that went unrecorded.

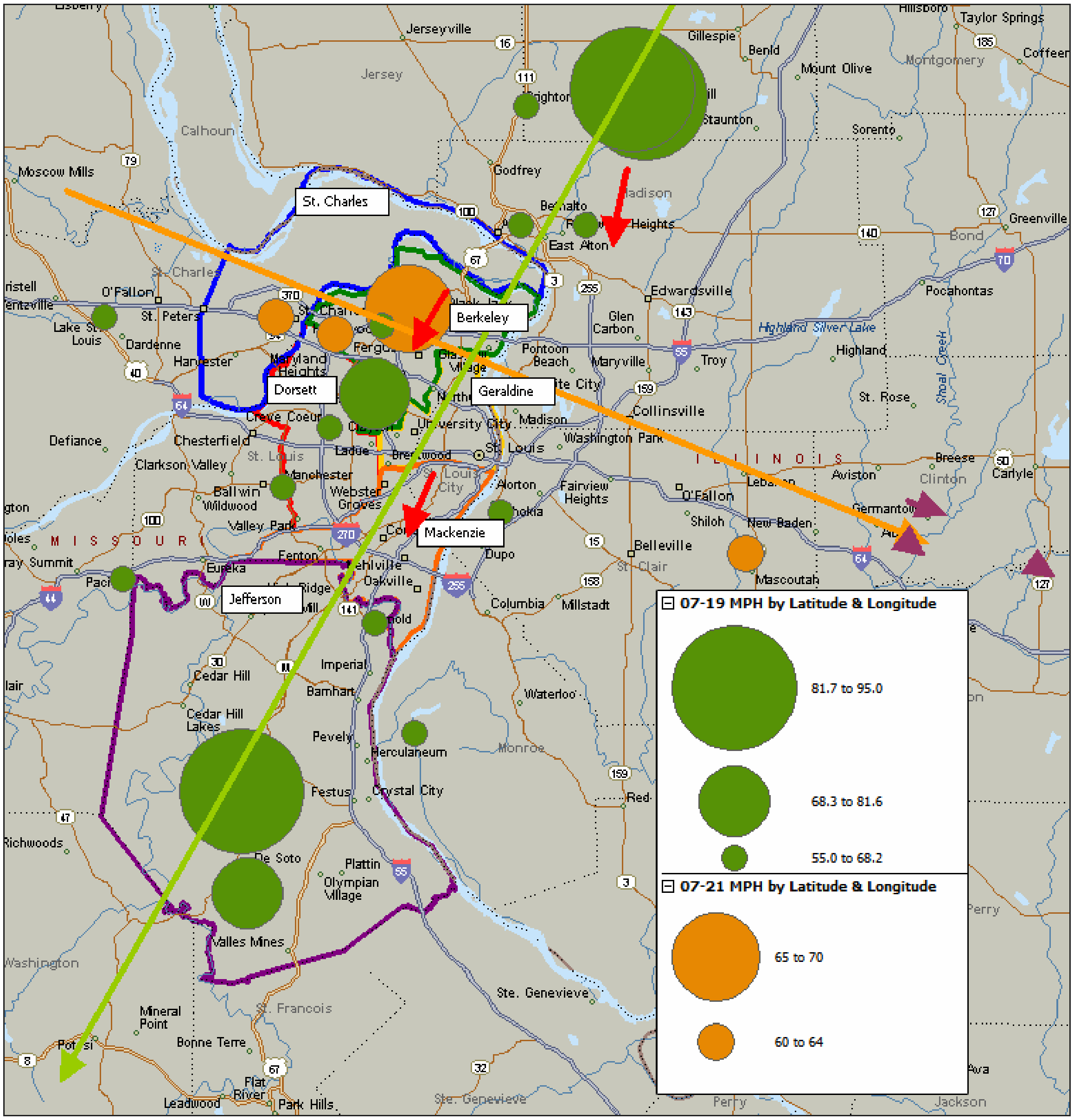

Exhibit 3-18: July Storm Events

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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.

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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.

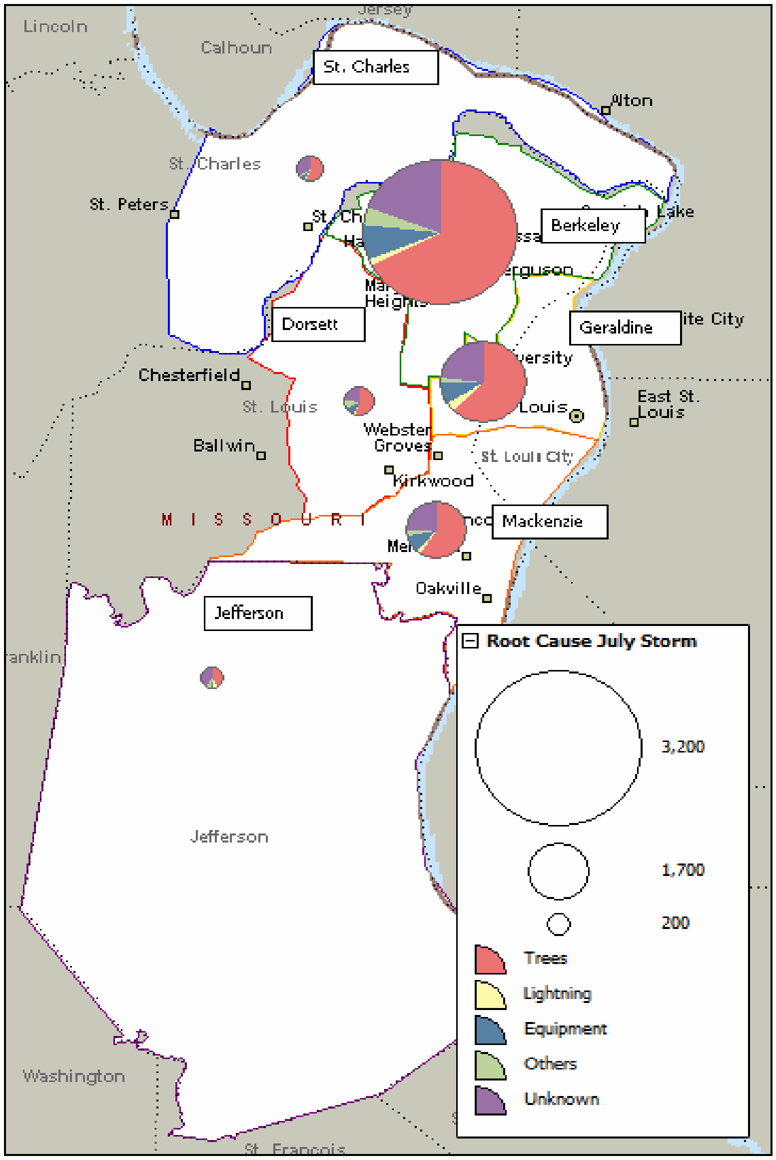

Exhibit 3-22: July Storm, Root Cause by District

(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,

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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.

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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 –

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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]

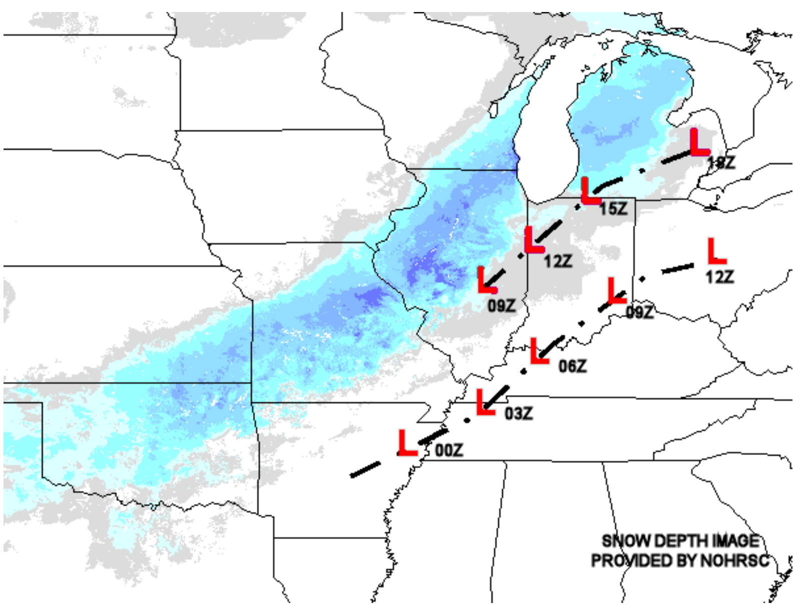

Exhibit 3-25: MODIS Polar Orbiting Satellite Snowfall Detail

[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.

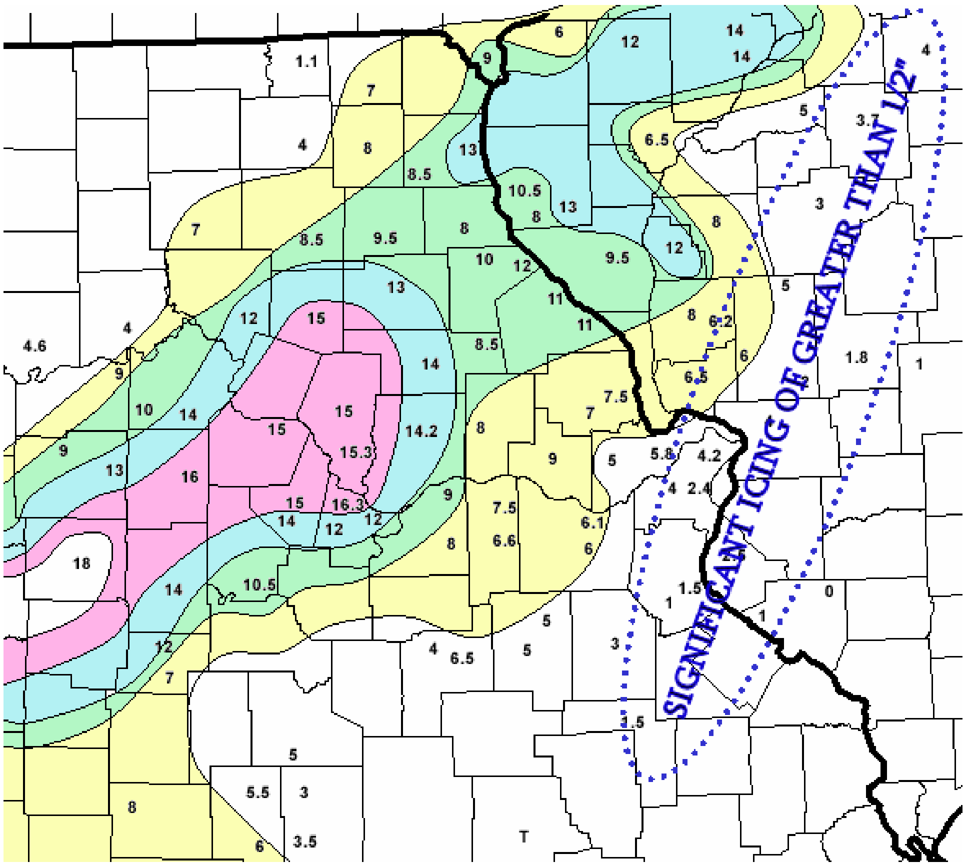

Exhibit 3-26: Snowfall Totals

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.

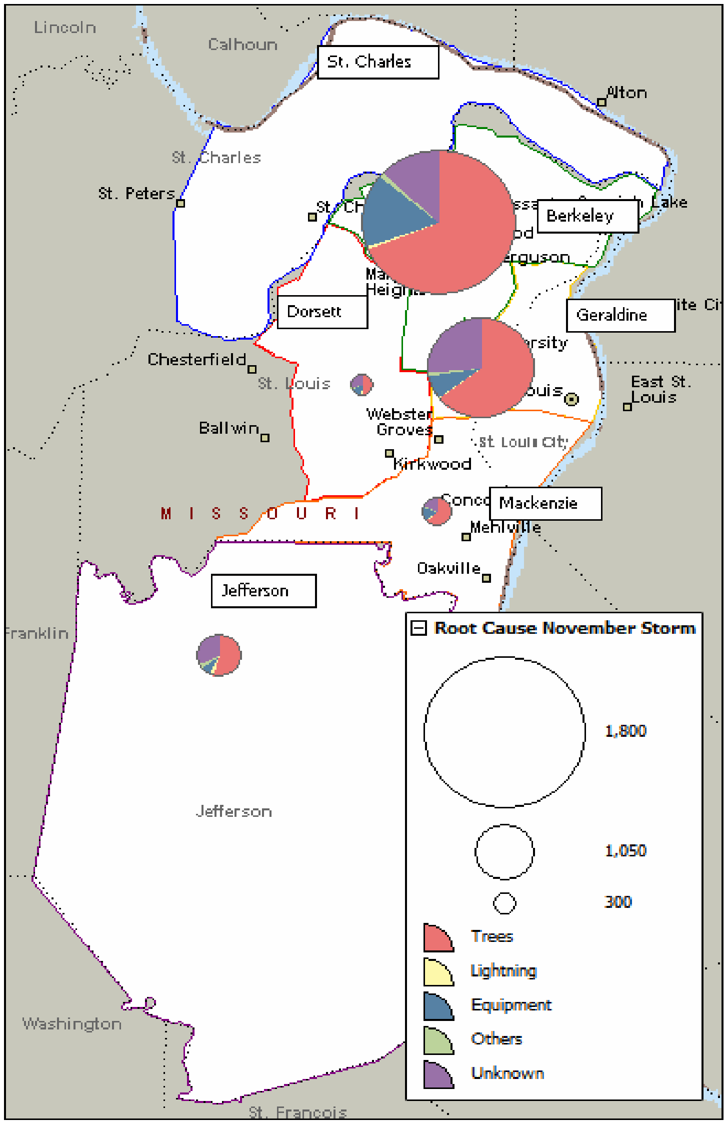

Exhibit 3-30: December Storm, Root Cause by District

(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

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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

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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.

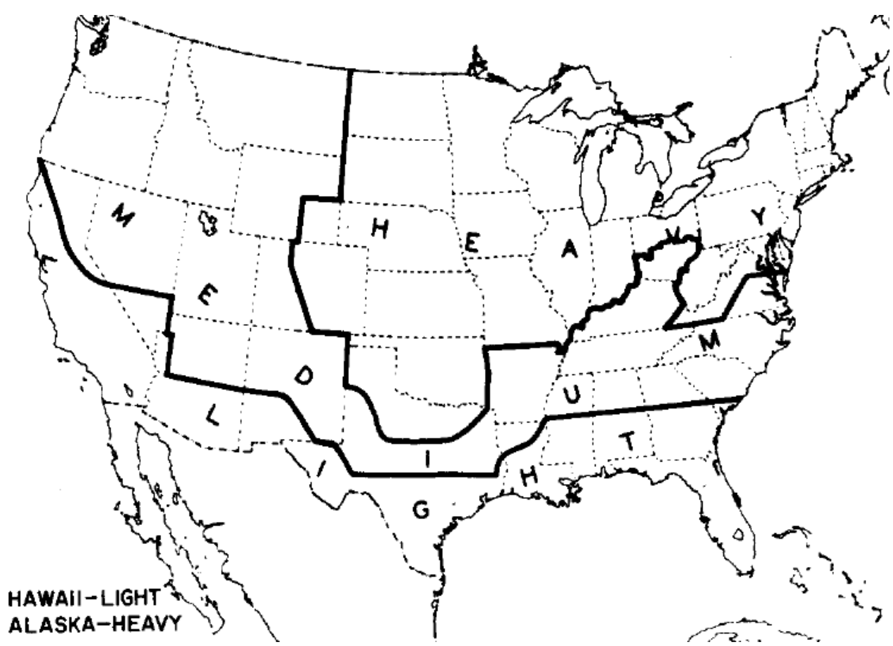

Exhibit 4-1: Overhead Line Loading Districts (NESC Figure 250-1)

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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.

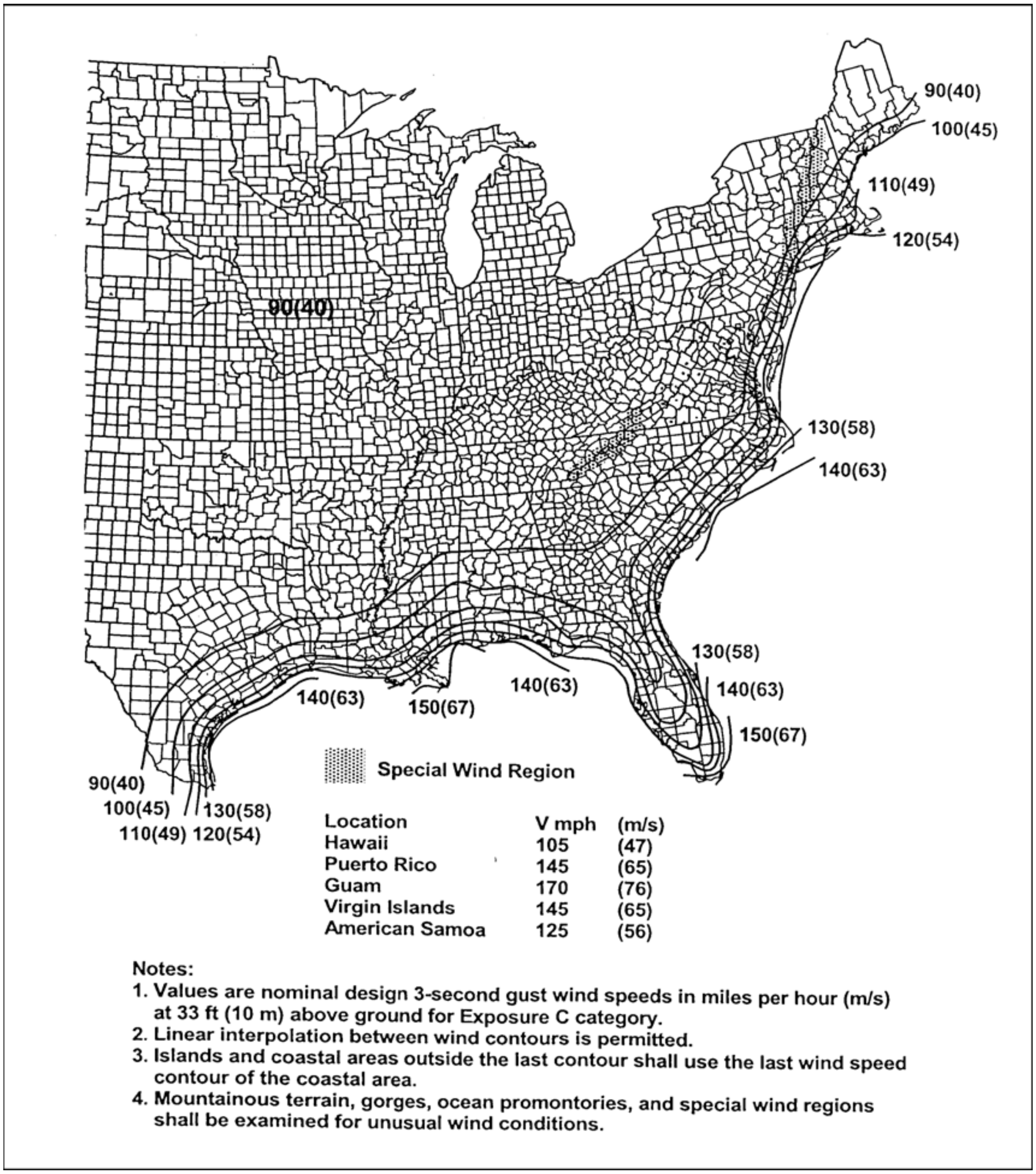

Exhibit 4-2: Basic Wind Speed Map (NESC Figure 250-2(B)

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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.

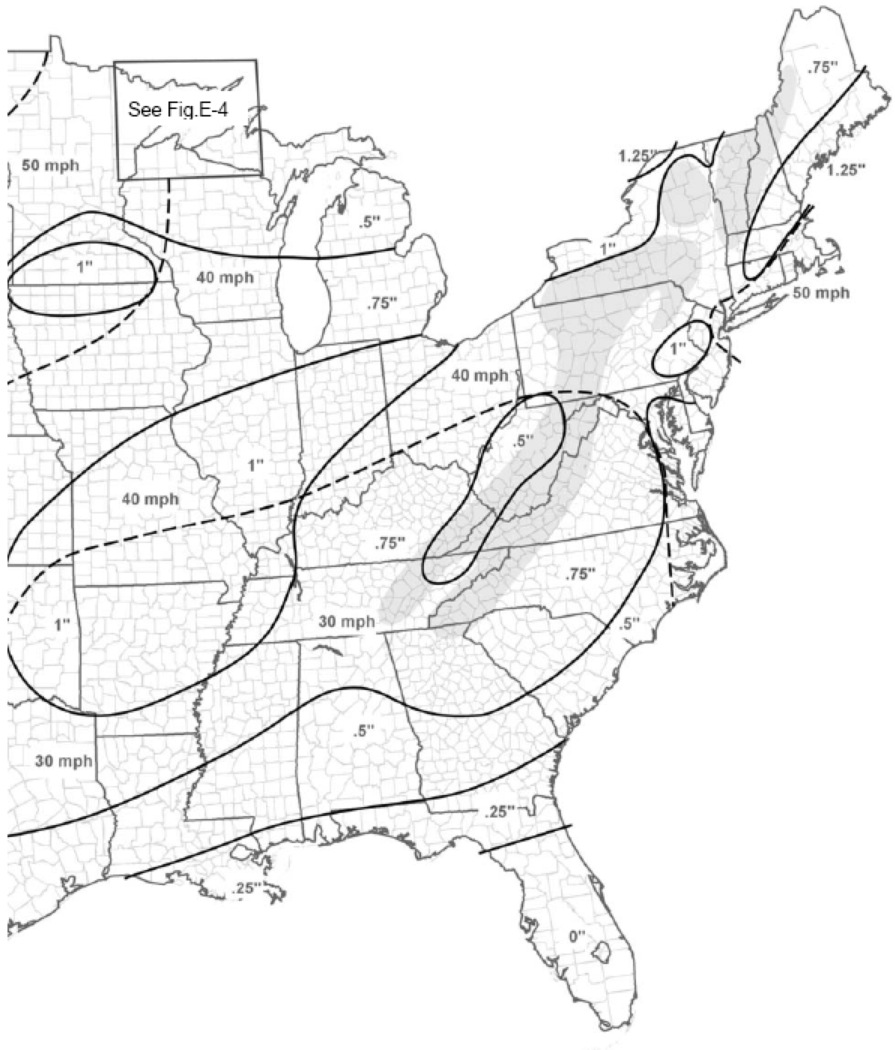

Exhibit 4-3: Combined Freezing Rand and Wind Zones (NESC Figure 250-3)

Summary of NESC Requirements for Distribution Poles in AmerenUE Service Territory

- Grade C construction is required for most distribution structures

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- 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

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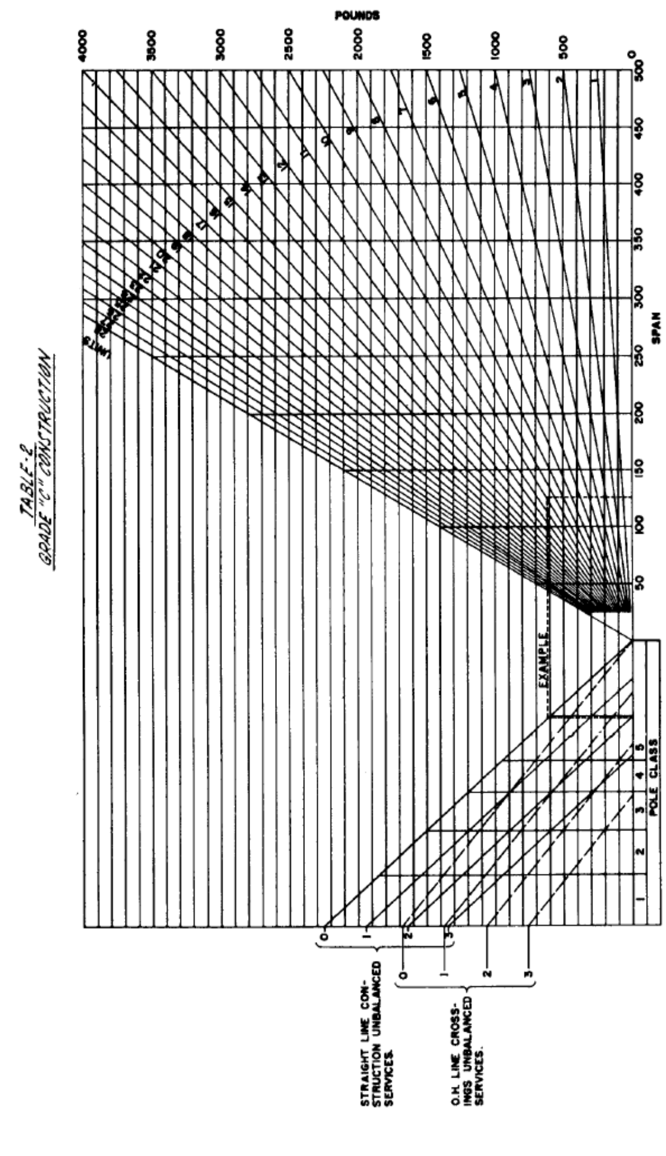

DISTRIBUTION CONSTRUCTION STANDARDS Ameren

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REV. NO: 0
REV. DATE: 09/20/94

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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

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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 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.

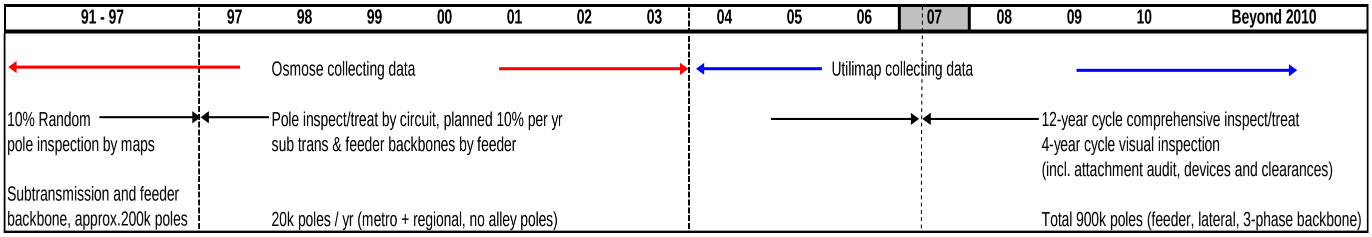

Exhibit 5-1: Pole Inspection Program

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).

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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.

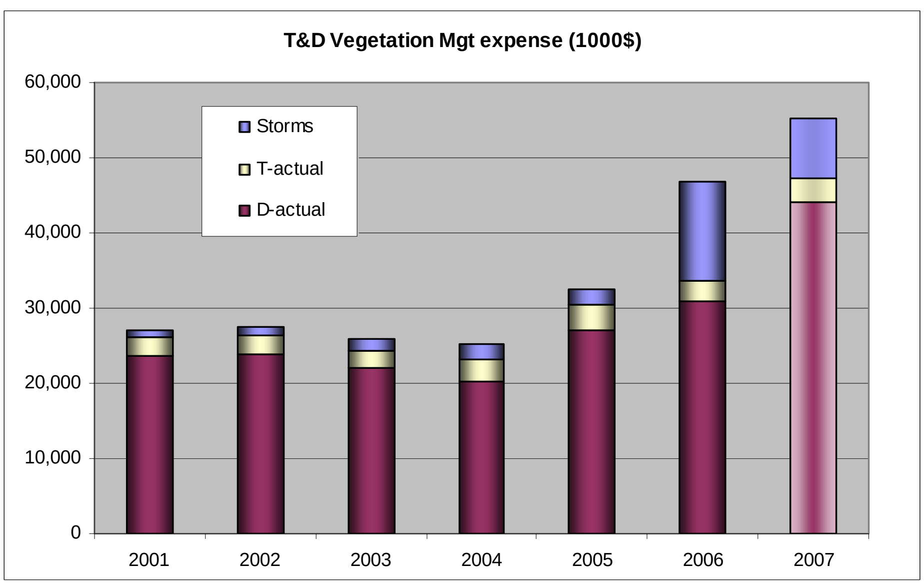

Exhibit 5-4: Vegetation Expenditures 2001 - 2007

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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.

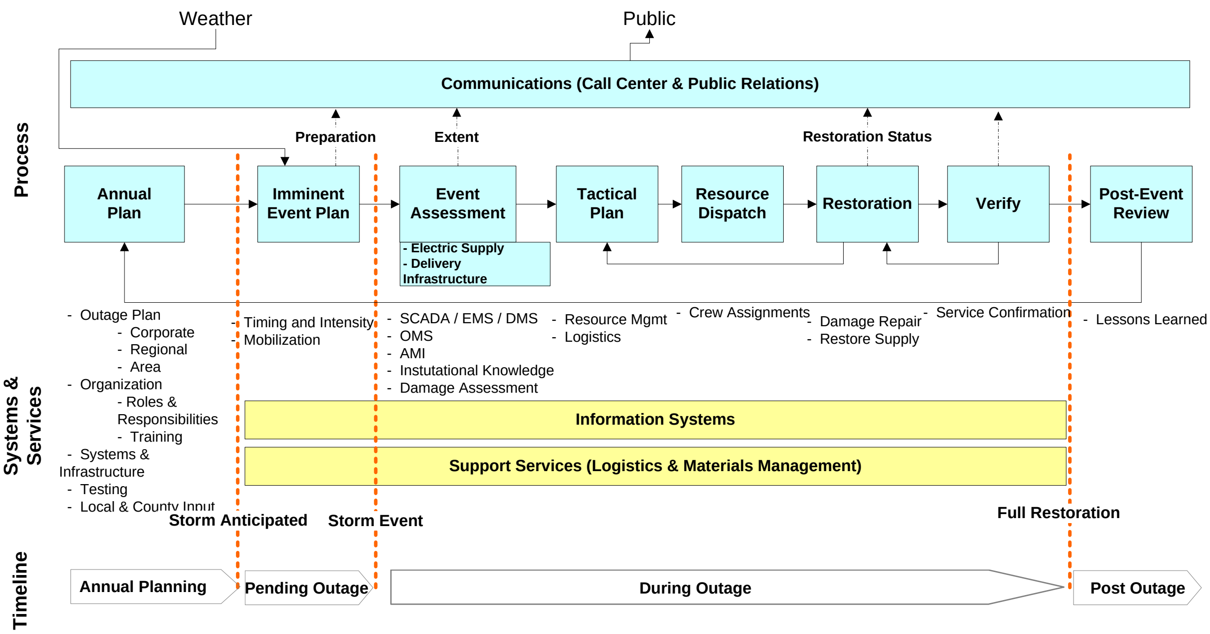

Exhibit 6-1: Outage Management Process

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,

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- The approach to determining the initial level of damage,
- The process for conducting a detailed analysis of storm damage to support restoration activities,
- The independent process for forensic analysis of storm related failures,
- The company's approach and channels used to obtain additional crews to support the restoration effort,
- The company's triggers for mobilizing and demobilizing the work force,
- The process for managing and prioritizing critical customers,
- The communications plan for informing the public and government agencies of the extent of the damage and, more importantly, the expected restoration time, and
- The tools required for managing logistics and sourcing additional repair resources to match the level of damage.

6.1.3 Organization (Roles and Responsibilities)

Essential to the timely restoration of service is a well-defined emergency restoration organization that defines:

- Critical management positions with their attendant qualifications, responsibilities and authorities,
- Clear assignment of responsibility for the strategic and tactical elements of the restoration effort,
- Policies to govern the restoration effort,
- Processes for managing, directing and implementing restoration activities,
- Clearly defined functions which support the processes,
- Prioritization of restoration activities down to the service level categories,
- Required skills for critical positions,
- Required training and its frequency,

- Resource call out lists, and
- Critical checklists used as reminders for each position identified.

6.1.4 Plan Execution (including event plan, assessment, tactical plan, dispatch, restoration, verification, communications, and support services).

This section defines how the utility will conduct the restoration efforts, including:

- Weather forecasting and the determination of the level of storm for early and continuing customer communications,
- Emergency Operations Center (EOC) mobilization and demobilization,
- Service or operations center mobilization and demobilization,
- Crew and material staging area mobilization to adequately permit managing ten times the normal number of crews,
- Logistics (sleeping accommodations, meals, laundry, vehicle fueling, etc.) mobilization,
- Initial “first cut” of damage level for determining initial restoration goals and the number of crews required,
- Detailed damage assessment,
- Work prioritization based on severity of damage,
- Area tactical plan,
- Resource dispatching,
- Management of the physical T&D facilities restoration,
- Progress reporting,
- Customer communications through multiple channels,
- Coordination with governmental agencies at the local, state and federal levels,

- Forensic evaluation of the failed system components,
- Post storm review, and
- Coordination with public agencies.

6.1.5 Systems and Services

Underpinning the entire effort from event initiation through post event review is the integration of critical support systems including:

- The customer information system used to capture and communicate specific outage data at the customer level,
- Customer contact applications and enablers: Integrated Voice Response Unit (IVRU) and web,
- An outage management system (OMS) designed to map individual customer outages to a physical representation of the distribution system. This will provide critical information on the size and nature of the event,
- A supervisory control and data acquisition (SCADA) system, providing information on the state of the transmission and distribution (T&D) systems and, in some cases, allowing physical control of critical T&D components,
- A workforce management system (WFM) that facilitates the movement and tracking of materials and personnel,
- A mobile workforce management system (MWF) to provide mobile, automated dispatch and work ticket capability for field forces,
- A resource monitoring tool to manage the additional foreign and contract crews,
- The advanced metering infrastructure (AMI) facilitates meter reading and the determination of whether a customer is receiving power,
- An energy management system (EMS) used for load flows and management of switching orders and clearances, and
- An outage dashboard that updates all parties including executive management on the restoration progress.

7. Emergency Restoration – Annual Plan

The ability to respond to any type of emergency begins with capability planning. In the electric utility industry, system damage due to weather or other natural causes is the most common emergency. The ability to respond efficiently and effectively to widespread system outages is a direct result of comprehensive planning and training for such an event.

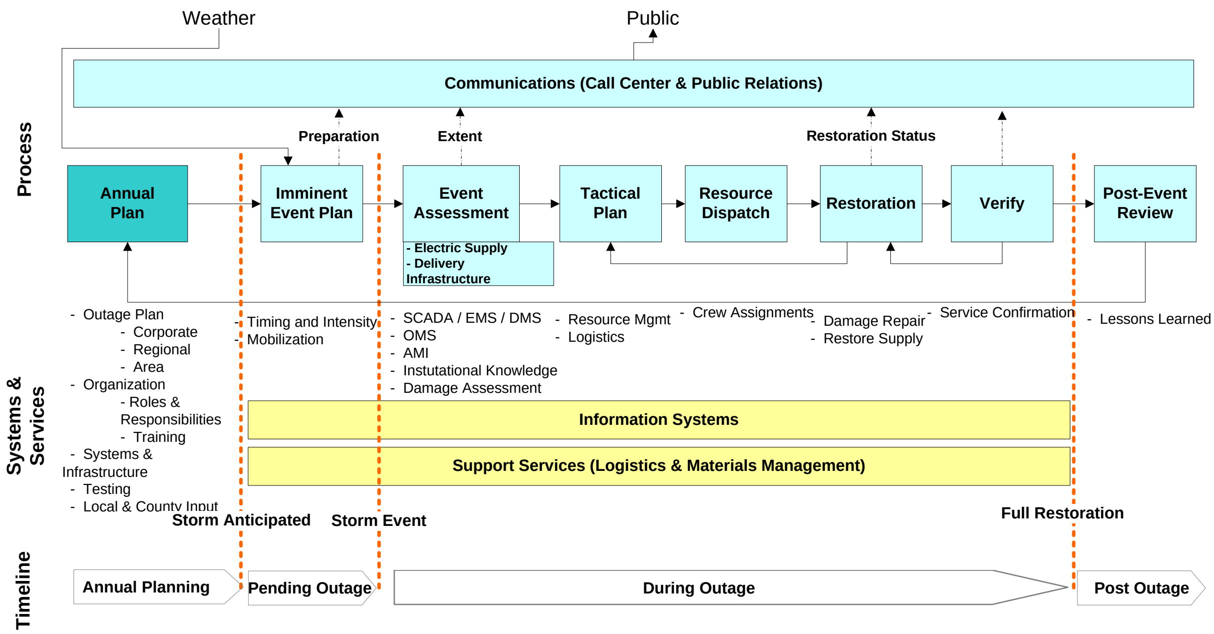

Exhibit 7-1: Outage Management Process – Annual Plan

7.1 Industry Practices

Throughout the electric utility industry, companies routinely review and update emergency response plans on an annual basis. Generally, the responsibility for managing these plans is assigned to a specific person or group located in the T&D operations function. Depending upon the type of emergencies to be handled, annual planning may involve detailed personnel training and drills with emergency simulations. Annual planning by leading utilities includes the review and incorporation of improvements resulting from previous event experience, also from the experience of other companies learned through various industry committees and working groups.

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7.2 AmerenUE Practices

Consistent with industry leading practices, AmerenUE modifies and updates the EERP on at least an annual cycle. Lessons learned from events during the previous year, as well as potential improvements from other drivers, are incorporated as improvements into the EERP. Updates can emanate from either the Asset Management's Engineering Services or Distribution Operations. However, the owner of the plan is the Distribution Operations department.

The responsibility for maintaining and implementing the plan resides with the Manager of Distribution Operations. Unlike some other utilities, who have a separate group to maintain, conduct debriefs and update the restoration plan. The Distribution Operations organization maintains the plan and is responsible for ensuring its implementation during major restoration efforts. During an actual emergency, the organization will set the restoration strategy and determine the resource requirements. All restoration information are reviewed and approved within this group to ensure a consistent public.

The EERP works well for Level I and II storms, but the plan did not perform to AmerenUE's expectations during the major storms of July and December of 2006. The following six conclusions were reached with respect to the overall plan:

- The AmerenUE EERP provides a consistent approach for responding to any emergency,
- AmerenUE's EERP plan is consistent with industry leading practices, but will benefit from several enhancements designed to address severe storms.
- AmerenUE's EERP organization is consistent with leading practices found in the electric utility industry,
- AmerenUE adapted to the unique challenges of the major events very well,
- Training and job aids are critical components of an emergency restoration plan and AmerenUE has incorporated these tools into the EERP for many of the positions, and
- AmerenUE's approach of using the OAS system to guide the repairs is effective for Levels I and II, but becomes questionable in Level III events.

7.3 Conclusions

7.3.1 The AmerenUE EERP provides a uniform approach for responding to any T&D emergency.

The intent of the EERP is to define consistent emergency procedures for the company, which should translate to an appearance of consistency and uniformity to the public. As written, the plan clearly defines the roles and responsibilities of personnel and leaves specific actions to the individuals. The plan implies the following specific guiding principles for all AmerenUE actions:

- Return all customers' service as soon as possible (For Levels I and II there is a 72 hour goal),
- Ensure employee and public safety, and
- Maintain environmental stewardship.

The primary role of Emergency Operation Center (EOC) is to support and coordinate overall restoration activity in the Divisions. The EOC is responsible for ensuring that the Divisions have the resources and materials to affect a uniform restoration of service across the Missouri system. The Divisions have their subordinate plans, which are tactical in nature. Those interviewed for this review generally felt that the primary division of responsibilities performed well in both the July and December events.

7.3.2 AmerenUE's EERP plan is consistent with industry leading practices, but will benefit from several enhancements designed to address severe storms.

AmerenUE's plan benefits from many years of constant refinement. However, these refinements were based on Level I and II storms. The following seven findings address more severe storms:

- The current storm levels should be expanded with clear definitions for the severe storm levels,
- AmerenUE's goal of completing all restoration work within 72 hours is commendable, but this goal will likely be unattainable with wide-spread major damage,

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- Critical ancillary elements of the overall EERP are not fully integrated into the master plan,

- Division level plans which make up the tactical component of the overall EERP can be inconsistent in their content or ties to the overall EERP,

- AmerenUE currently does not provide for a forensic failure analysis as part of its plan,

- AmerenUE's plan did not include a means for unburdening the system dispatchers, which in turn created some delays in executing work while crews waited for WPA clearances, and

- AmerenUE's EERP does not include checklists for before, during or after the emergency.

7.3.2.1 The current storm levels should be expanded with clear definitions for the severe storm levels.

The leading practice within the industry is to categorize events and tailor the appropriate response for each category. Generally, there are at least three levels of emergency conditions defined using any combination of the following descriptors:

- Weather and wind types,
- Number of customers without service,
- The amount of time estimated to restore all customers,
- Estimated level of damage,
- Whether the problem is isolated to one area or is it system wide, and
- Need to bring in outside crews to support the restoration.

Exhibit 7-2 shows the determinants that several leading utilities use to define the restoration effort. The most common determinant is the type of weather, followed closely by the type of winds. The other determinants are more sporadically applied.

Determinant	Northeastern	Southeastern	Southern	Western	AmerenUE
Type Weather	♦	♦	♦	♦	
Type Winds	♦		♦	♦	
Projected Customers out	♦				
Estimated Restoration time	♦				
Estimated System Damage	♦			♦	
Operating Areas Involved		♦ [9]			♦
Type & Location of Crews		♦ [10]			♦
LEVELS	5	4	5[11]	3	3

Exhibit 7-2: Determinants Applied to Emergency Definitions and Event Levels[12]

The AmerenUE approach tends to rely on the operating areas involved along with the number of crews. These two determinants are considered as "after the fact", in part because AmerenUE does not have the luxury of a long lead-time for approaching weather that many of the coastal utilities have.

Exhibit 7-3 shows one company's approach to defining specific categories. In each category, management has gone to great lengths to define clearly the weather conditions that apply including the impact to their service territory in the form of customers impacted and project restoration time. This level of specificity, allows them to make more informed judgments about what is likely to happen so that appropriate restoration decisions and actions can be planned.

[9] For transmission
[10] For transmission
[11] Consistent with the five categories of Hurricanes
[12] KEMA Storm Benchmarking Data Base and Analysis

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Storm Category & Resource Requirements	Typical Weather Conditions	Projected Number Customers Affected	Estimated Restoration Time
1 - Upgraded (Regional resources)	• Thunderstorms, rain and moving fronts • Moderate sustained winds • Moderate frequent gusts • Condition is short to mid term • Light to moderate damage to electric	Up to 7,000	8-12 Hours
2 - Serious (Other Company Resources)	• Heavy thunderstorms, rain • Strong sustained winds • Strong frequent gusts • Condition exists for several hours • Heavy damage to electric system • Heavy, wet snow	Up to 15,000	12-24 Hours
3 - Serious (Foreign Resources)	• Severe thunderstorms, Extremely heavy rains • Strong sustained winds • Severe frequent gusts • Condition 12-18 hours or longer • Extensive damage to electric system • Heavy, wet snow	Up to 40,000	1-2 Days
4 – Full Scale	• Nor'easter type storms, heavy rains • Strong sustained winds • Severe frequent gusts • Tropical storms • Condition exists for 6-12 hour	40,000-60,000	2-3 Days
5 – Full Scale Coastal Storm	• Hurricanes Category 1-2 • 25-50% Damage to distribution system • Condition exists for 12 hours	60,000-80,000	≤ 1 week
	• Hurricane Category 3-5 • >50% Damage to distribution system • Condition exists for >12 hours	>100,000	> 1 week

Exhibit 7-3: Leading Practice for Storm Definition[13]

[13] From a Northeast Utility's Storm Plan

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AmerenUE's approach to defining storm levels centers on after the fact determinants; affected areas and to a lesser degree, the resources required. AmerenUE has the following three storm levels at present:

- "Level I Storm – typically this type of storm damage can be handled by the affected Division's local resources and possibly the partial resources of an adjacent Division."
- "Level II Storm (Major Storm) – This restoration effort will involve the AmerenUE EOC and it is expected that the customers can be restored using AmerenUE employees and contractor employees currently on the AmerenUE property."
- "Level III Storm (Major Storm) – This restoration effort will involve the AmerenUE EOC. For damage of this magnitude, it expected that the customers would be restored using AmerenUE employees, on property contractor crews, off property contractor crews and Mutual aid partners if needed. This storm may also involve use of the Extensive Damage Recovery method (See Section Six)."[14]

While AmerenUE's definition of areas (Divisions) affected is reasonable, the definitions around resources can be interpreted in several different ways. Again, this set of definitions was determined by the nature of the storms and the lack of advance warning afforded the company.

Before the events of July and December 2006, Levels II and III were considered major storms. In fact, Levels II and III are reasonably small to moderate storms that cause isolated or generally localized damage to the T&D system. These storms' restorations are in 72 hours or less. The 72 hour restoration goal set by management is reasonable.

The level of damage is described by the estimated resources required to complete the restoration within management's goal. Level III storms can be described as a catchall for all other storms requiring the use of more resources than are generally on the property.

[14] Ameren EERP dated 5-1-06, Page 5

7.3.2.2 AmerenUE's goal of completing all restoration work within 72 hours is commendable, but this goal will likely be unattainable with wide-spread major damage.

KEMA has not come across many utilities that have established restoration goals in advance of a storm event. This puts AmerenUE on the leading edge of storm recovery practices. This goal has served AmerenUE well in its Level I and II storm recovery events. For Level III events, it has proven to be challenging.

Since Level III encompasses all other storm conditions, including the type of events that occurred during July 2006, December 2006 and January 2007, having a preset restoration goal is difficult. In these unique events, management would be better served having the senior EOC management team set the goal after there is a preliminary assessment of the magnitude of the damage.

7.3.2.3 Critical ancillary elements of the overall EERP are present, but not fully integrated into the master plan.

A leading practice identified by KEMA is to have all the critical elements of a plan tied together in the master plan. This affords management a complete view of the restoration effort required to restore the system, coordinate with other governmental agencies and communications with the public. Specifically, these plans contain the following restoration elements:

- Organization,
- Position descriptions with qualifications and training requirements,
- Strategy,
- Critical checklists,
- Process maps or descriptions,
- Description of IT system tools,
- Call out rosters,

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- Critical Customers,
- Critical local, state and federal contacts,
- Communications plan,
- Mutual aid contacts,
- Contractor rosters,
- Staging areas and layouts,
- Lodging, laundry, crew transport (between staging areas and sleeping accommodations) and food services contacts and arrangements,
- Vehicle support, and
- Portable generator sourcing, etc.

An individual generally maintains these plans, or more likely a dedicated group, as is the case in several recent utilities KEMA reviewed. KEMA is not implying here that this individual or group is solely responsible for developing the elements, but that they are responsible for assembling the master document and ensuring the necessary updates are completed. This ensures that restoration knowledge management is fully documented. In some states like New York, the entire plan is filed annually with the State Commission.

AmerenUE has all these elements, but they are not assembled into a coherent master plan. Generally, all these elements have worked well at AmerenUE with exceptions covered in other areas of the audit review. Further, some of these elements, e.g. the vehicle fueling, discussed later, are not documented.

7.3.2.4 Division level plans that make up the tactical component of the overall EERP can be inconsistent in their content or ties to the overall EERP.

Division level plans make up the tactical component of the overall EERP and are therefore the critical link between the field activity

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and the EOC. Generally, the Division plans are not consistent in their content or ties to the overall EERP. Exhibit 7-4 compares the plans provided to KEMA.

PLAN COMPONENT	Gateway	Boone Trails	Gravois Valley
Plan purpose	X	X	X
Activation criteria	X	X	X
Define senior mgmt roles	P[15]	X[16]	P
Define subordinate roles		X[17]	
Staffing requirements	X	X[18]	
Damage assessment process defined	X		X
Staging well defined	X	X[19]	X
Material requirements	X	X	X
Logistics parameters	X	X	X
Mgmt callout roster	X	X	X
Field Checker callout roster	X	X	X
Hotel, caterer & restaurant contact information	X	X	X
Fuel source contacts	X		X
Other support contact information	X		X
Critical customer list			
Local government officials/services contacts			
Substation & feeder lists		X[20]	
Substation & feeder priority lists			
Customers with self generation			
Key checklists		X	
List of potential crew squad leaders		X	

Exhibit 7-4: Comparison of Divisional Emergency Response Plans

As seen in Exhibit 7-4, the plans contain the majority of information necessary to call out personnel and acquire needed outside logistics support. What was noticeably absent from the plans included:

- Critical customer lists and contact information,
- Local government officials and services contacts, although the EOC maintains a contact list,

[15] P in Exhibit 7-4 stands for Partially complete KEMA's opinion
[16] From Ameren's Boone Trails Plan – Uses automated tool for contact information
[17] From Ameren's Boone Trails Plan – Uses automated tool for contact information
[18] From Ameren's Boone Trials Plan – Identifies the process to be applied
[19] From Ameren's Boone Trails Plan – Includes specific contact information and aerial photos
[20] From Ameren's Boone Trails Plan – Includes customer count by feeder and service center responsibility

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- Substation and feeder priority lists, although one plan included a list of both with the number of customers, and
- A list of customers with some level of self-generation.

Maintaining some of these lists can be quite an undertaking, but doing so will aid management in setting priorities that are more effective.

There were several other elements covered by some Divisions and not by others. The information contained in these plans is critical local knowledge. This knowledge can aid management in better focusing its response to a significant outage with assurance that it has not forgotten any important element.

7.3.2.5 AmerenUE currently does not provide for a forensic failure analysis as part of its plan.

A recent addition to emergency restoration plans is the need for a forensic failure analysis process and team. This was first developed in the Southeastern utilities to determine the nature of the failures and how best to minimize them in future storm events. In Florida, where utilities face hurricanes annually, the State Commission is requiring all regulated utilities to have a process incorporated into their plans.

AmerenUE currently does not provide for a forensic failure analysis as part of its plan. As a result, KEMA was only able to accomplish a high-level review of the failures that occurred on the system. Had a process and team been in place, KEMA could have provided more information leading to an overall comprehensive system hardening strategy.

7.3.2.6 AmerenUE's plan did not include a means for unburdening the system dispatchers, which in turn created some delays in executing work, while crews waited for WPA clearances.

When utilities are required to bring in multiples of their normal crew complement there is bound to be some congestion. Specifically, this congestion occurs around the system dispatchers, whose responsibility is to issue clearances and switching orders. Clearances

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are the front line of safety protection for the crews and public. All utilities take the clearance process very seriously and provide specialized training to their system dispatchers who are generally the only authorized agents to grant clearances. Switching impacts the state of the system, i.e., how energy is moved across the system and is an integral part of the restoration process.

The leading practice in utilities that regularly experience major outages -- leaving over fifty percent of their customers without service for long periods -- is to divide the management of the restoration into smaller more manageable areas. This can be accomplished by assigning feeders or substations to specific individuals who have full control of the state of the substation and feeders assigned. In one southern coastal utility, they incorporated a very formal process for assigning the control of a substation and its feeders to a local manager. The process has very clear instructions on how to conduct hand-offs in either direction with a formal paper trail. That local manager then controls all the restoration and switching activities on his assigned feeders.

At the time of the 2006 storms, management had not previously experienced this level of system destruction, but responded very quickly by expanding its work force five-fold. This huge increase in the number of crews put a burden on the system dispatchers and tools they use to issue clearances. This situation delayed many crews in beginning their work, as they had to wait for clearances to be granted. Ameren did activate a new Functional Agent program in an ad hoc fashion during the July storms, albeit on a limited scale.

7.3.2.7 AmerenUE's EERP does not include checklists for before, during or after the emergency.

Checklists, whether manual or technology-based, are essential to confirming that an emergency response role has been properly executed. Leading practices indicate that emergency restoration plans should include checklists for all jobs to serve as reminders of each position's responsibilities.

Emergency response role employees are asked to perform unusual tasks on short notice during periods of potential stress. A role-specific checklist ensures the employee completes all expected tasks, obtains all information needed, and provides proper feedback to customers and other stakeholders.[21]

7.3.3 AmerenUE's EERP organization is consistent with leading practices found in the electric utility industry.

The leading practice in the electric utility industry is to have a formal emergency restoration organization defined with the key positions fully identified and their respective roles, responsibilities and authorities defined. This organization is designed to go into effect as soon as certain threshold conditions are met. At that point, key positions are staffed within a short period and the call out for the critical skills begins.

Generally, the Emergency Operations Center (EOC) leads these organizations. Some utilities have begun to adopt the Incident Command Structure (ICS), created by the federal government. The ICS differs from the EOC in that for any size event there is an Incident Commander while the EOC is generally reserved for the larger or more complex events. Both of these approaches are effective.

An effective emergency organization will have the following elements clearly defined:

- Command structure,
- Critical positions,
- Master personnel roster with backups identified,
- A formal process communicating critical restoration information,
- Mobilization and demobilization triggers,
- A group to develop the restoration strategy,
- A group(s) to manage and direct the physical restoration efforts,
- Personnel assigned to managing:
  - Staging resources,

[21] Review of EERP

– Accommodations to rest crews,

– Feeding crews,

– Guiding foreign crews,

- Checklists for each position identified in the plan delineating their responsibilities,
- Personnel and support systems dedicated to providing timely information to the various stakeholders, and
- Liaisons identified to work with government agencies and other first responder organizations.

AmerenUE has a well-developed restoration organization. There are primarily two levels, the EOC and the Divisions. The EOC is the strategic and leadership group for the restoration effort and is co-located with the Electric System Operations at AmerenUE's headquarters.

The AmerenUE EOC is the nerve center of the operation where the restoration strategy is set and additional resources are identified and contacted. The EOC is responsible, through the communications organization, for crafting the messages given to the stakeholders. Specifically, the EOC defines the media message content. The one exception is the automatic updating of restoration statistics to AmerenUE's Outage website.

Exhibit 7-5 shows the AmerenUE EERP organization. The EOC personnel are responsible for interpreting the EERP to adapt to changing conditions during the event. The boxes to the right show the key department managers who have a significant role in storm restoration.

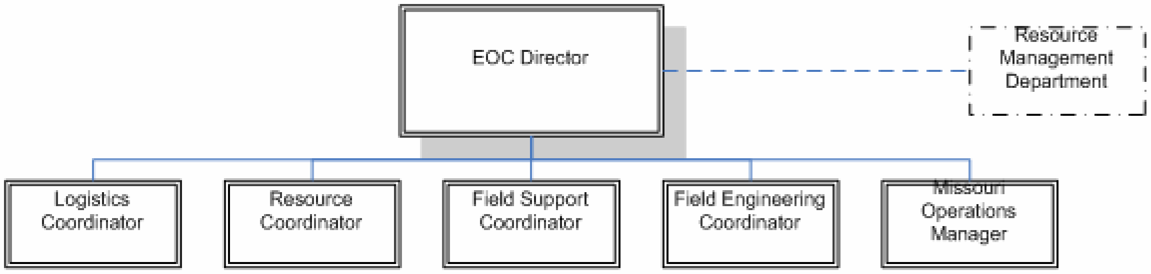

Exhibit 7-5: EERP Emergency Organization

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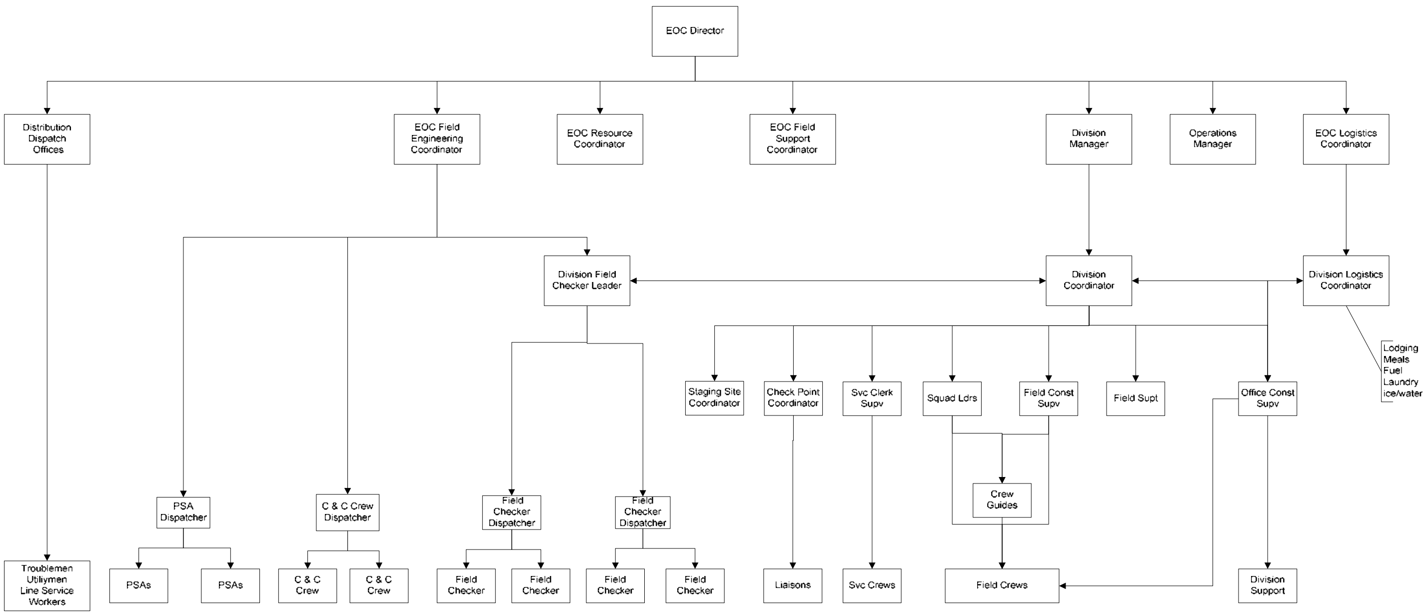

Exhibit 7-6: Depiction of both the EOC and Division Functions

The EERP provides position descriptions, but not the training or prerequisite qualifications requirements for the positions shown in Exhibit 7-5 and Exhibit 7-6. While the qualifications are not delineated in the plan, management has successfully matched the right people with the right roles for the critical EERP positions.

7.3.4 AmerenUE adapted to the unique challenges of the major events very well.

Critical to any utility's successful restoration effort is the ability of the personnel and management team to adapt to the situation presented to them.

AmerenUE did an excellent job of identifying EERP's shortcomings and overcoming each with a modification to the plan or process. Several examples include:

- Both storms hit with little notice, but AmerenUE was able to field resources numbering 3800 and 4400 or about five times the normal resources working on AmerenUE's property,

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- The increased logistical effort to house this many crews when many of the hotels were already full,

- AmerenUE's well developed relationship with the Missouri Department of Transportation which allowed the movement of unprecedented numbers of foreign and contract crews through neighboring states rapidly, and

- As areas were completed, the resources were quickly moved to support other areas where the progress was slower.

7.3.4.1 During the storm, effectiveness of Division management was impacted by the magnitude of the damage in their area of responsibility, but each Division quickly adjusted its respective plan.

In today's electric utilities, KEMA sees fewer Area Operations (Division) Offices staffed by fewer people while covering a larger territory. During normal operations, this is a cost effective structure; however, during severe storms it will stretch the best of the operating organizations as system damage is highly dispersed.

Some utilities will further divide their operating centers into smaller units to provide more local control over smaller areas. This approach ensures that smaller communities are not forgotten during a restoration effort and permits the required focused attention.

KEMA did see evidence that the Divisions generally functioned well in their storm roles. As stated earlier, one Division Manager opted to invoke Section Six of the EERP. Other Division Managers would have preferred to have faster notification of arriving foreign crews to expedite work assignments. As the crews came to AmerenUE they were assigned to Divisions, but the Field checkers had not provided enough information to produce the needed work packages as they were still evaluating the damage.

7.3.5 Training and job aids are critical components of an emergency restoration plan; AmerenUE has incorporated these tools into the EERP for many of the positions.

The majority of utilities provide training to assigned emergency response personnel. This training can take many different forms, including but not limited

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to classroom, tabletop, and field exercises. A significant number of utilities capture these costs in their annual budgeting and accounting processes.

KEMA concurs with this leading practice for training, but also recommends the addition of a formal system of training evaluation. To ensure that training is effective, participation is measured and analyzed while the skills to be acquired and/or maintained are tested during and after the emergency response role training.

Because emergency response roles may be different from normal assignments, training is important. Because emergency response roles are assumed on short notice and with limited time for preparation, checklists, supporting technology, and other tools and aids should be available for employees.

AmerenUE does provide training for several functions including the Field Checker and the new post storm Functional Agent. The Field Checker is the front line position for identifying and reporting the extent and nature of the damage. The Functional Agent is a new position designed to take control of a substation or feeder and manage all the work including the Workman's Protection Assurance (WPA).

7.3.5.1 AmerenUE has a formal Field Checker (Damage Assessor) training program, but should have provided more qualified Field checkers to handle an event of this magnitude.

Well-qualified damage assessors are critical to any storm plan and restoration efforts. A qualified and knowledgeable damage assessor can establish a more efficient and effective restoration process. These individuals provide critical information regarding the specific nature of primary failure that allows crew dispatchers to send the right type of crews and materials to hasten the repair. The practice of using trained damage assessors is considered a leading practice in the utility industry.

Training programs are designed to provide the damage assessor with required tools to adequately describe the damage. Then appropriate crews and materials can be assigned for repairs. At leading utilities, damage assessors are pre-selected based on their knowledge of the system and geography. Many utilities budget for the training, which is often mandatory.

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AmerenUE's damage assessors are known as Field checkers. The majority of Field checkers reside in the Division Field Engineering functions and are eminently qualified to perform this vital function. The backup for the Division Field Engineers comes from the St. Louis Corporate headquarters' engineering function. These additional personnel have varying qualifications and levels of proficiencies and therefore require the most training.

The training program covers the following topics:[22]

- Establishing the scope of a storm (short-lived or multi-day event) during the first six to 12 hours,
- Setting an initial target of 24 hours for a complete assessment,
- Setting work and environmental expectations for the Field checkers,
- Defining proper damage assessment practices and procedures,
- Explaining the damage assessment process,
- Reviewing use and terminology of overhead circuit maps,

[22] Source: Review and analysis of Company documents

- Reviewing the potential safety issues (downed live wires) and how to deal with them in the field, and
- Reviewing general types of T&D equipment and structures.

There is no formal or informal means for evaluating how well the attendees learned the skills put forth in the class. Further, basic skill requirements for the Field checkers do not appear to be formally defined in any document.

7.3.5.2 AmerenUE does not measure the effort devoted to emergency response planning and training.

Unless training time and its costs are budgeted, other "measured" priorities will take precedence. Without proper training, restoration efficiency may be adversely impacted and will incur higher costs. Training is not budgeted at AmerenUE and instead charged to overhead accounts, which can diminish training.

7.3.6 AmerenUE's approach to using the Outage Analysis System (OAS) to guide the repairs, works well for Level I and II storms, but becomes questionable in Level III events.

Many of the leading utilities who regularly face storm events and normal outages have installed Outage Analysis Systems (OAS). OAS supports management in the following ways:

- Prioritizes the work according to parameters set by the utility,
- Defines the extent of a particular line/service outage,
- Finds the closest available crew,
- Determines the number of customers impacted, and
- Estimates the restoration time and other functions.

The AmerenUE system was developed over ten years ago with periodic fine-tuning over the years. AmerenUE has fully integrated SCADA and its CellNet automated meter reading tools into the solution. Further, it has tied its outputs to its Outage website that gives its customers a very granular look down to the Zip Code level.

OAS has performed well in the Level I and II events, and probably some smaller Level III events. However, its application in the type of restoration situations brought about by the storms experienced in July and December 2006 is questionable. There are several reasons for this conclusion:

- Depending on the nature of the failures and where they occur, relative to the substation and customers, it is possible to get double counts of customers affected,
- Any restoration times calculated by OAS will need to be field updated once the full extent of the damage is known on a particular feeder, and
- The prioritization of work may not be optimal as the crews can be required to incur more windshield time as they move around an area performing the prioritized restoration work instead of finishing a feeder or lateral. KEMA did not attempt to quantify this number but did receive comments from Division management.

Fortunately, the EERP provides an alternative for this situation (Section Six, Extensive Damage Recovery) in the plan. In the event of a significant level of damage, management will switch its restoration strategy to one that dedicates a crew(s) to work a specific feeder from the substation out. Many utilities adopt this particular practice when faced with the kind of damage produced in the July and December 2006 storms.

Management did not fully apply this alternate strategy across the system during these storms. However, it was employed in one of the hardest hit Divisions to more effectively address its restoration.

7.4 Recommendations

7.4.1 Redefine the existing storm level classifications to include at least one additional level.

Levels I and II are reasonable. Divide the existing Level III into a Levels III and IV. The division between Level III and IV should focus on the overall estimated restoration time required. For example:

- Level III would be for severe storms where less than 200 feeders are locked out and less than 225,000 customers are out with an estimated repair time less than 8 days. Further, the numbers are greater than what is expected for a Level II event.

- Level IV would be for severe storms where there are over 200 feeders out and over 225,000 customers out with an estimated repair time of over 10 days.

7.4.2 Integrate all subordinate emergency plans into the master EERP.

EERP will include the following plans and components to ensure best practices for major storms are captured for future use. For example:

- Emergency Communications Plan,
- Support Logistics Plan (Lodging, Feeding and transportation for crews),
- Standardized content and formal inclusion of all divisional emergency response plans to align with the master EERP,
- Define the work process and storm triggers for mobilizing and demobilizing the Functional Agents role,
- Fuel requirement calculations and determination for the number fuel tankers necessary to support the expanded fleet,
- Coordination with the Missouri Department of Transportation (MODOT) to obtain emergency declarations under emergency conditions permitting contract and mutual aid vehicles to cross state borders unimpeded,
- Document all workflows and responsibilities for the major storm restoration processes,
- Identification of receiving staging areas located along major thoroughfares located at AmerenUE's service territory perimeter,
- Checklists for each position identified in the EERP for before, during, and after work activities,
- A fully defined process for conducting an initial damage assessment during the first hours of a Level III and IV event,

- Define and execute training requirements with evaluation criteria for Field checkers and Functional Agents, and
- Definition of the timing and content for scheduled storm drills.

7.4.3 Institute a formal Forensic Analysis process to run concurrently with damage assessment.

To ensure that AmerenUE has maintained its T&D systems appropriately, there should be a formal Forensic Analysis process that can be deployed during a major restoration effort. The purpose is to evaluate the nature of the failures to determine if AmerenUE could have mitigated the failure through design or maintenance activities. Specifically, AmerenUE should:

- Develop a formal forensic analysis process that captures system failures during Level III and IV events,
- Develop a methodology to select a statistically valid sample for a specific Level III and IV event,
- Decide whether to conduct forensic analysis with in-house resources or by third parties.
  - If in-house, develop a detailed process for analysis and the accompanying data capture tools and training programs, and
  - If contracting for the service:
    - Develop a set of criteria to qualify contractors,
    - Select a contractor using AmerenUE's accepted bidding process,
    - Prepare a formal contract with specific performance criteria, and
    - Conduct joint exercises to ensure both AmerenUE and the contractor are prepared.

7.4.4 Expand Section Six of the EERP to include the development of self-administered work islands during Level III and IV storms.

Section Six is the only section within the EERP that addresses how the restoration should proceed in the event of a severe Level III restoration. It is critical that this section outline in some level of detail how to identify the most damaged areas and the process for restoring the effected areas in the most orderly fashion.

As a result of implementing this recommendation the role of OAS will change. In Level III and IV restoration efforts, the initial focus will be on repairing feeders and laterals from the substation in those areas where the damage is extensive. The following eight activities must be covered at a minimum:

- Define the concept and role of self-administered work islands,
- Determine the level of damage (poles and spans down) using the initial damage assessment,
- Estimate and obtain the required resources by crew type,
- Identify clear triggers for self-administered work islands,
- Determine the need for Functional Agents,
- Develop a formal process for transferring clearance control to a decentralized certified functional agent ensuring clarity in the transfer of accountability,
- Codify the role of Divisions in managing and supervising all in-house, contract, and mutual aid crews working within a division, and
- Reinforce the roles and responsibilities of safety supervisors with respect to self-administered work islands.

While KEMA is recommending this be included in the EERP, we understand that it will likely be implemented by the Divisions.

8. Emergency Restoration – Imminent Event Plan

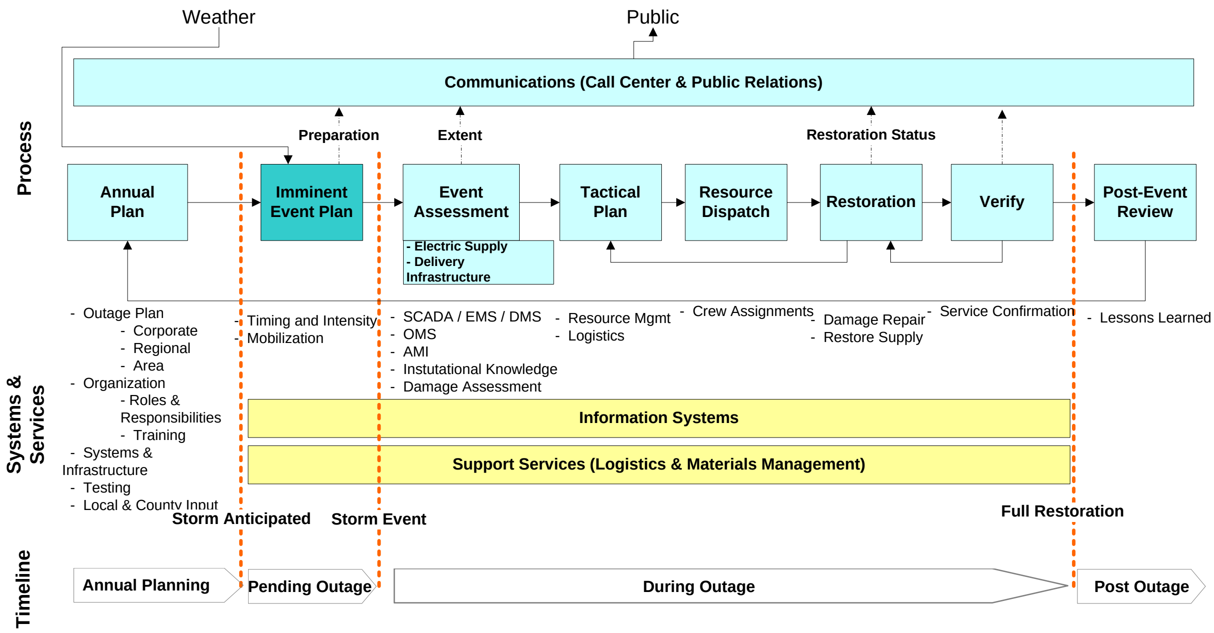

Exhibit 8-1: Outage Management Process – Imminent Event Plan

8.1 Industry Practices

Throughout the electric utility industry, companies have plans in place that detail when and to what extent that company's emergency response plan goes into effect. The first stage of the plan is, most often, the advance planning and mobilization that occur in anticipation of a specific event. The best example of this action is found in companies exposed to tropical storms and hurricanes where significant advanced warning allows for mobilization on an escalating scale. As part of any emergency response plan there must be detailed information on the various stages of planning, mobilization, and the "triggers" for those stages. This early planning and mobilization is tailored to the company and the specific exposure it experiences. Whether the company is in an area of exposure for hurricanes, tornadoes, earthquakes, sub-tropical storms, ice, or wind will determine what the specific plans and triggers should be.

8.2 AmerenUE Practices

Like other utilities, AmerenUE's practice in this area is driven by the amount of advance notice the company has of impending severe weather. AmerenUE, in its 2006 storms,

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received no advanced warning as the weather service indicated that the July storms would miss AmerenUE's territory. In addition, for the ice storm of 2006, the weather service indicated that the majority of the storm activity would pass to the north of AmerenUE. AmerenUE opens the EOC once an event begins so the amount of specific event planning is minimal. However, within the EERP there are provisions for ongoing readiness for emergency response.

8.3 Conclusions

8.3.1 AmerenUE's severe weather events did not offer the luxury of advance warning to permit pre-mobilization.

This is a crucial point to understand. Unlike many Southeastern or Pacific Northwestern utilities that get several days warning that a storm is on the way, AmerenUE does not. As a result, AmerenUE has to be prepared to initiate its EERP on extremely short notice.

8.3.1.1 The nature of the July Windstorm(s) offered no opportunity for advance warning and consequently AmerenUE was not in a position to pre-mobilize divisional or corporate resources.

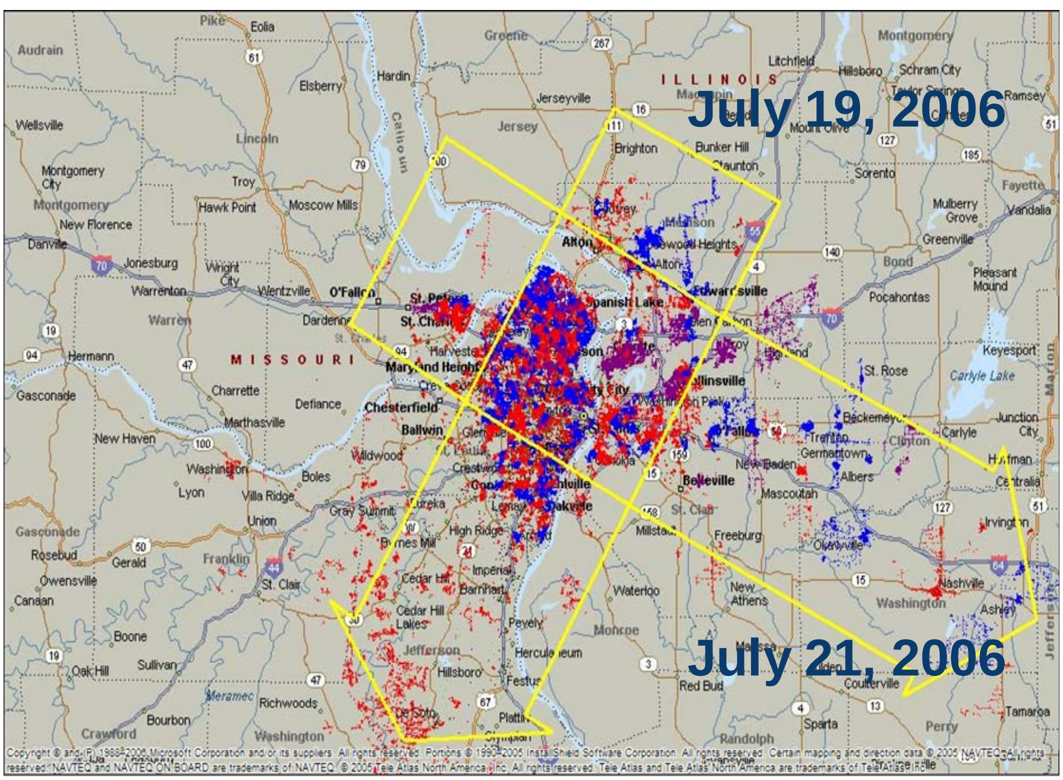

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Exhibit 8-2: July Windstorm Paths

The major events in July were both windstorms occurring with no warning and with sudden onset. As Exhibit 8-1 indicates, the initial windstorm on July 19, 2006 blew from the northwest with damage focused in and around the St. Louis metro area. The second wind storm event on July 21, 2006 blew from the northeast also with sudden onset and no warning. Some major events can be predicted to a certain degree. Examples include a progressing winter storm front or the build up and approach of a hurricane. The nature of the two July events with their sudden onset did not offer AmerenUE any warning to the impending event, and consequently, AmerenUE was not able to mobilize for the restoration response in advance.[23]

8.3.1.2 AmerenUE had advance warning of the impending December and January ice storms. Divisions were placed on alert and due to the geographically dispersed weather front, AmerenUE made the prudent decision to stage internal resources within divisional boundaries.

The nature of the December and January ice storms offered AmerenUE some advance warning of the impending major event. AmerenUE alerted divisional and first responder resources to mobilize for the upcoming restoration event. Due to the large geographic extent of the weather front, AmerenUE prudently did not re-assign district resources to neighboring divisions until the extent of the damage could be ascertained.[24]

8.3.2 AmerenUE follows industry-leading practice of monitoring weather services for impending weather conditions.

It is a well accepted practice within the industry for dispatch offices and emergency operations centers to subscribe to national weather services to receive as much advance notification of an impending weather event as possible. The AmerenUE Distribution Dispatch Offices (DDO) adopts this practice and uses a service called Weather Sentry to monitor (National Oceanic Atmospheric Administration, NOAA) weather data for weather forecasts and lightning strikes.

[23] Ameren OAS analysis, Press Releases
[24] KEMA Interview MK08, Ameren Press Release

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Based on this information the DDO observes the development of pending severe weather and alerts divisions and the EOC management appropriately.[25]

8.3.3 AmerenUE is enhancing its storm prediction capability by pursuing an initiative to improve localized weather monitoring during the pre and initial hours of a major event.

AmerenUE has recognized that its storm damage prediction capability is a weakness in its storm restoration process. Currently, AmerenUE's information source is from the national weather service that provides an overview assessment of pending weather trends. This type of information is not sufficiently granular to predict localized damage impacts. AmerenUE is addressing this situation by discussing opportunities with vendors to enhance damage prediction abilities. The initial concept is to deploy additional weather-monitoring stations throughout AmerenUE's service territory, providing a finer reporting granularity to better assess actual weather conditions. The ambition of this initiative is to enable predictive modeling of the potential system damage in the first hours of a major event.[26]

8.3.4 AmerenUE's practice of using a specific group to call in contractors is a leading industry practice.

Leading edge utilities will generally begin lining up additional resources in advance of a pending storm. As soon as there is a high probability that a storm will strike, utilities begin the process of acquiring resources. AmerenUE, in both of these storms, had little to no warning, but the AmerenUE process for this is well defined and worked extremely well.

In order to better manage and control external resources, AmerenUE has elected to accomplish this through its Energy Delivery Technical Service's Resource Management organization. The requirements for outside resource assistance are estimated by the EOC Director, the Resource Manager, and other managers. The Resource Manager's team then begins the process of lining up resources from various contracting companies. Another group calls in mutual aid (other utility companies) crews.

The EOC management determines in which affected areas to deploy the crews. As crews arrive they are immediately directed to the appropriate Division's

[25] KEMA Interview MK16
[26] KEMA Interview MK19

staging area for safety and operations orientation, followed by their initial assignment.

AmerenUE differs in the process at this point by assigning foreign crews to a dispatcher to guide and direct their work activities for the duration of the restoration. KEMA believes this to be a valuable industry leading practice. These AmerenUE resources are part of the Energy Delivery Technical Service's Resource Management organization and not the Divisions' resources. For the most part this process worked very well.

8.4 Recommendations

8.4.1 Continue with AmerenUE's plan to deploy additional weather recording site and develop improved forecasting of potential damage capability.

AmerenUE is in the process of obtaining additional weather sites for its Missouri territory. These additional sites, along with a better weather modeling tool, will help to predict damage and its severity. KEMA concurs with AmerenUE on the following four activities:

- Identify the number and location of additional weather stations to provide a more granular view of actual weather progression,
- Developing and testing a model that will reasonably predict the potential damage created by a weather event,
- Integrate the prediction model's results to AmerenUE's new storm categories for early triggering of storm classifications and potential restoration resource needs, and
- Provide a means for back casting actual versus predicted weather results for continual model refinements.

8.4.2 Continue with AmerenUE's practice for notifying, mobilizing, and managing foreign and mutual aid resources.

AmerenUE has honed its ability to obtain crews on short notice and provide field management when the foreign crews are deployed. KEMA believes that this continuum of obtaining and managing foreign crews is a leading practice and should be continued. An improvement is to provide better notification of when

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the crews are to be arriving in the Divisions. During Level III and IV restoration efforts, the notification issue should pose less of a problem since the crews are assigned to working either a feeder or a set of feeders associated with a specific substation as opposed to working specific Outage tickets.

9. Emergency Restoration – Event Assessment

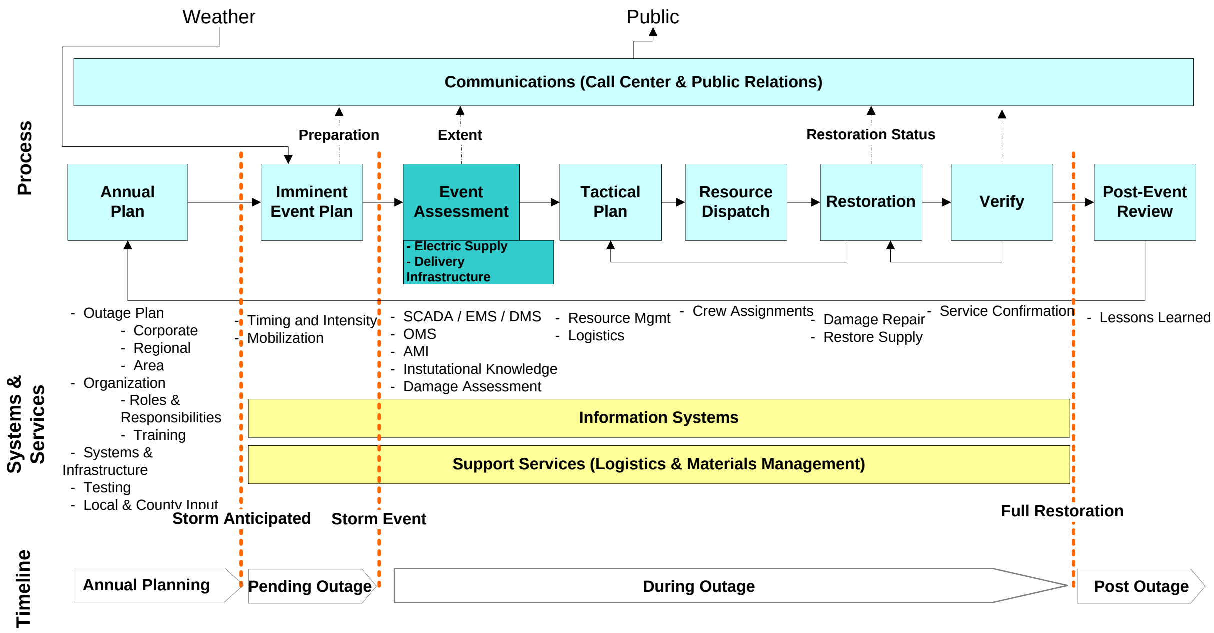

Exhibit 9-1: Outage Management Process – Event Assessment

9.1 Industry Practices

Quickly and accurately assessing damage from a major event varies widely throughout the industry. Those companies on the leading edge of this process are equipped with technology that enables earlier decision making on what areas need the most attention, in terms of on-site assessment and overall extent of damage. In all companies any technology used to facilitate this process is a tool to assist the early focus of the physical assessment. Technology deployed to field assessors permits building of a database containing the number of sites requiring repair, materials and labor estimates, and restoration estimates. In utilities employing outage management systems, the information from this technology will provide EOC management with a more robust and a more clear understanding of the level of damage. Throughout the industry however, this is largely a labor intensive process that requires smooth processes and focused responses in order to provide early information for effective decisions on resource allocation.

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9.2 AmerenUE Practices

AmerenUE uses four primary business tools to assess the magnitude of the major event. They are:

- SCADA and EMS system observations at the Distribution Dispatch Office (DDO),
- OAS which logs all customer calls,
- Field damage assessments, and to a limited degree,
- CellNet's Automated Meter Reading information.

AmerenUE's Electric Emergency Restoration Plan (EERP) defines responsibilities for assessing field damage during major events. These responsibilities include:

- Conducting an initial high level damage assessment, and a
- Detailed field damage assessment.

High-level damage assessments are coordinated and dispatched at the divisional level. It is at the division's discretion as to when to conduct a high-level damage assessment prior to initiating detailed damage assessments.[27] Section 4.2 of the EERP provides a general description of a high-level damage assessment but lacks any real specificity. The KEMA team did not find any evidence that a high-level field damage assessment process was routinely conducted in areas that exhibited Level III damage. One rural region used helicopter patrols to conduct a quick assessment of the system damage. The rural nature of the terrain dictated the use of an aerial assessment. This aerial inspection approach is not practical in urban areas or areas where the foliage canopy obscures the visual inspection of the system.[28]

AmerenUE conducted detailed damage assessments in all affected regions according to the process outlined in Exhibit 9-2.[29]

[27] Electric Emergency Restoration Plan
[28] KEMA Interview RG, BS
[29] KEMA Interviews MK06, MK17

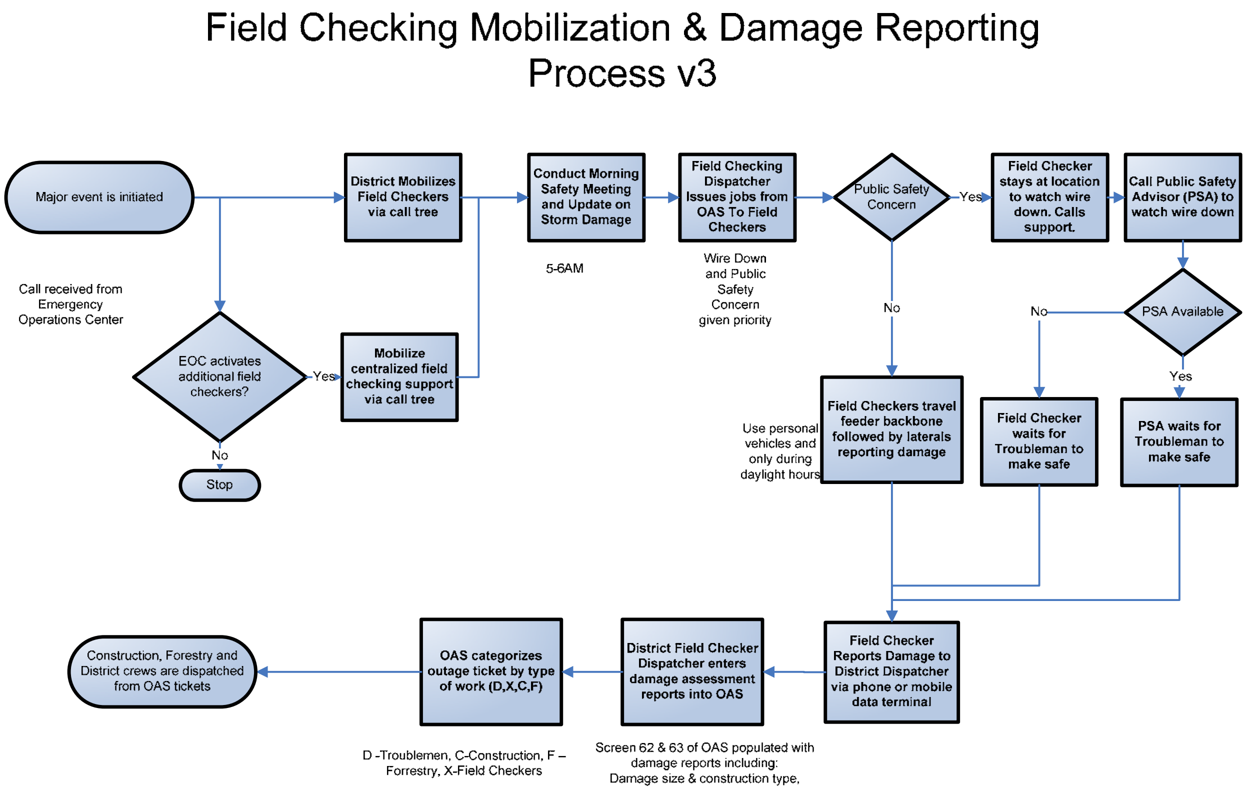

Exhibit 9-2: Field Damage Assessment Mobilization and Reporting

Mobilization of Division and supplemental field checking resources occurs through established call-out trees.

The field checker dispatcher prioritizes the OAS trouble tickets and dispatches field checkers to locations reported in the system. Field checkers use their personal vehicles to inspect system damage and generally conduct damage assessments according to the following priorities:

- Largest customer outage areas,
- Wire down reports, and
- Trouble tickets closest to the substation, followed by inspection of feeder laterals and finally secondaries.

Field checkers report system damage via cell phone to the field checking dispatcher, who in turn, enters the information into the OAS system. The information collected in the field includes:

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- A description of the magnitude of damage (single pole down vs. multiple span),
- Front/back lot construction,
- Type of construction including pole height, cross-arm design, conductor type, and
- A tree on line.

Field checkers place the highest priority on public safety concerns, especially wire down reports. At a wire down location, Field checkers prevent the public from entering the hazardous area. The Field Checker will request an AmerenUE Public Safety Advisor (PSA), through the PSA Dispatcher, to relieve the Field Checker or until either a troubleman or Cut and Clear crew can confirm the area is de-energized.

The field checking process is active during daylight hours. Due to safety implications, AmerenUE does not conduct field checking during the night period.[30] The July windstorm event started in the early evening; field checking of system damage did not initiate until the following morning.

Field checking generally continued for the duration of the major event. Once all the major damage on feeder backbones and laterals is identified, field checkers will transition to assessing damage on secondaries and service connections. When field checkers assess damage on secondaries and service drops it is a routine practice to hang a door tag informing the customer of AmerenUE's responsibility for electric service restoration and the actions the customer should take to restore cable or phone service, or to repair customer owned electric facilities such as weather heads. See Exhibit 9-3 for examples of door tags.[31]

[30] KEMA Interviews MK03, MK06, MK17
[31] KEMA Interview MK05

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Exhibit 9-3: Door Tag Hangers

9.3 Conclusions

9.3.1 The EOC appropriately uses the SCADA and EMS systems as the primary tool to determine the initial scope and magnitude of the event.

It is common practice in the industry to have a SCADA system installed. The SCADA, abbreviation for Supervisory Control and Data Acquisition, is a system that allows the remote monitoring and control of key electrical equipment at substation locations throughout the system. SCADA systems, initially installed in transmission substation facilities, have been installed in many distribution substations providing indication and control of distribution substation equipment in the past 30 years. SCADA applications at the distribution level generally will only indicate that a feeder is energized or de-energized and generally does not provide any insight as to the state of the feeder outside the substation fence.

DDO through SCADA receives the first indication of the magnitude of a major event. AmerenUE SCADA system is robustly deployed with most distribution substations in the St. Louis metro area providing indication of the system power flows. In rural areas, the SCADA system is less extensive. In these areas, there is limited indication of system power flows and remote switching of feeders. As feeders trip off-line, SCADA registers these events in seconds and displays the

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results in OAS. In more remote areas where SCADA does not provide an indication of distribution feeder status, AmerenUE relies on customer calls to determine the loss of service. During the July, December, and January events, the DDO received the first report of the extent of disruption to the power grid from the SCADA system.[32] This initial SCADA information is the primary source of information for the EOC in determining the extent and magnitude of the system disruption at the onset of the event.

9.3.2 AmerenUE's technology and processes for event assessments perform well to estimate restoration times for Level I and II events, but do not scale well for Level III events.

A common occurrence found by KEMA is the inability of emergency restoration plans and technology to scale effectively to address severe restoration efforts, unless the utility has had experience with extreme weather, similar to what Southeastern utilities experience with Hurricanes.

9.3.2.1 AmerenUE does not perform a formalized high-level statistical damage assessment process to estimate initial storm damage during Level III events. Instead, AmerenUE relies on its institutional knowledge of historical Level I and II events to make an intuitive decision to mobilize contract and mutual aid resources.

Leading industry practice during Level III events is to conduct a high-level assessment during the first six to eight hours after the initiation of the event. Leading utilities conduct an initial statistical assessment of the affected areas. The assessment process begins by driving the damaged system starting at the Substation (feeder header) and following the feeder along its path. This statistical assessment is designed to provide rough counts of downed lines, broken poles, and downed trees to the EOC. There is no attempt by damage assessors assigned to this statistical assessment to capture details of any single event; that is done later. This statistical assessment is critical information for the EOC to determine resource requirements and is needed to estimate the duration of the restoration effort.[33]

KEMA's interviews revealed that during Level III events there is no formal statistical damage assessment process for assessing high level

[32] KEMA Interview MK16
[33] KEMA Interview MK14

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system damage, estimating area wide restoration times, and consequently, crew requirements during the first six hours of the restoration effort.

AmerenUE does not have a formal model to predict the order-of-magnitude of expected system damage associated with impending weather conditions. Additionally, KEMA could not identify a formalized process for early estimation of restoration times. Consequently, the EOC relies on its experience gained from historical events and real-time SCADA and EMS information to make an initial estimate of the events magnitude. Management has not experienced storms of these magnitudes in the past and as such relied on their experiences of Level I and II events to make the call that more resources would be required than ever before to effectively deal with them. It is not until damage assessment reports are received from the field that AmerenUE was able to compile a comprehensive assessment of the extent of system damage and make an educated estimate of restoration times.[34] This process took up to a week to complete in some of the hardest hit areas.

Without the aid of an initial high-level statistical estimate of system damage, it is difficult for management to accurately quantify resource requirements other than taking the position of "obtaining every possible resource that is available." This can hamper the ability of Corporate Communications to provide the public with early order of magnitude assessment of the storm. AmerenUE's senior management had set a blanket target of 72 hours for the restoration of outage events. Without the input from a high-level damage assessment process AmerenUE could only ascertain from the number of customers out, the number of devices predicted out by the Outage Analysis System, and the number of feeders locked out by SCADA that the July events would require significantly more restoration time.[35] However, AmerenUE did much better projecting the December storm restoration time. The implications of this inability are reviewed in Section 13.3 of this report.

[34] KEMA Interview MK16, Ameren Electric Emergency Restoration Plan
[35] KEMA Interviews RG01, MK19

The EOC management would like to see the adoption of 24-hour coverage for a high-level statistical field damage assessment during the early hours of a major event to improve AmerenUE's ability to determine the level of the restoration resources that need to be mobilized.[36]

9.3.2.2 AmerenUE's detailed damage assessment process is effective at identifying system damage, which scaled well during the Level III events, but lacked consistency in the specificity needed for restoration crew dispatchers to efficiently deploy crews.

Damage assessment is critical to any storm restoration program. The purpose of damage assessment is to provide management with a clear picture of the level of damage to the T&D assets. This information has two primary objectives:

- Provide a detailed analysis of what needs to be repaired at each site, and
- Provide a prioritized pipeline of detailed work orders keeping restoration crews engaged from the outset of the major event.

Estimation of crew resources implicitly suggests an estimate of restoration time but, during Level III outages, no documentation or confirmation of that restoration estimate is made until crews are on site.[37] Additionally, the OAS system logic for estimating restoration is not designed to handle the volume of extensive damage experienced during Level III events.

Since 2005, AmerenUE has trained a significant number of additional field checking and public safety advisor resources to supplement the divisional field checking resources.[38] Currently there are approximately 200 trained field checkers and public safety advisors. The supplemental field checking work force comes from centralized engineering functions, while the public safety advisors are drawn mostly from administrative staff ranks. The role of the public safety advisor is to secure wires down sites until crews can make the area safe or effect repairs.

[36] KEMA Interview MK19
[37] KEMA Interview MK19
[38] KEMA Interview MK14, Field Checker Training Syllabus & Video

AmerenUE provides daylong training for this supplemental staff in the following areas:[39]

- Field Checker training,
- Public Safety Advisor training, and
- OAS refresher training.

The syllabus is comprehensive and covers the following topics:

- A review of field checking / Public Safety Advisor roles and responsibilities,
- Overview of the electric system configuration and protective devices,
- Safety issues covering safe field checking practices, minimum approach distances, and other safety topics, and
- A testing component to ensure adequate knowledge transfer.

However, a lack of formalized procedures and standardized checklists across the AmerenUE service territory introduced inconsistencies into the reporting of system damage. The primary purpose of field damage assessments is to ensure that restoration crews are dispatched efficiently and effectively with appropriate material and equipment complements. Restoration crew dispatchers are handicapped by the lack of specificity in damage assessment information entered into the OAS system reducing the efficiency of the restoration effort.[40]

Exhibit 9-4 shows an example of AmerenUE's distribution system in Clayton highlighting a back-lot system design prevalent in this area.

[39] Syllabus documents for Field Checker Training & Video, Public Safety Advisor Training
[40] KEMA Interview MK08

Exhibit 9-4: Example of Back-lot System Design

A lack of specific information from the field damage assessment could potentially lead to restoration resources arriving on site without the appropriate equipment to be able to access the system and effect repairs.

To assist in streamlining the field checking process, AmerenUE has issued mobile data terminals to supplemental field checkers.[41] These hardened laptops provide field connectivity to AmerenUE's OAS permitting direct field entry of damage assessments into the system. AmerenUE will continue to provide backup using other forms of communication in the event of cell tower outages. KEMA believes this is a distinct advantage and a leading practice as it shortens the time for damage data analysis.

9.3.3 Restoration crews provide direct feedback of an estimated repair time, however, this completion time may not be the same as a restoration time during large-scale events.

When an assigned crew reaches the work site, they perform a quick analysis of what must be repaired and the time needed to complete the repairs. This

[41] KEMA Interview MK01, MK17

information is radioed back to the construction dispatcher in order to refine the OAS estimate of restoration time. However, during Level III events the estimated restoration times provided by the OAS is not as useful in determining a restoration of service time during major events as there may be additional system damage both up and down stream side of the feeder preventing restoration of service.

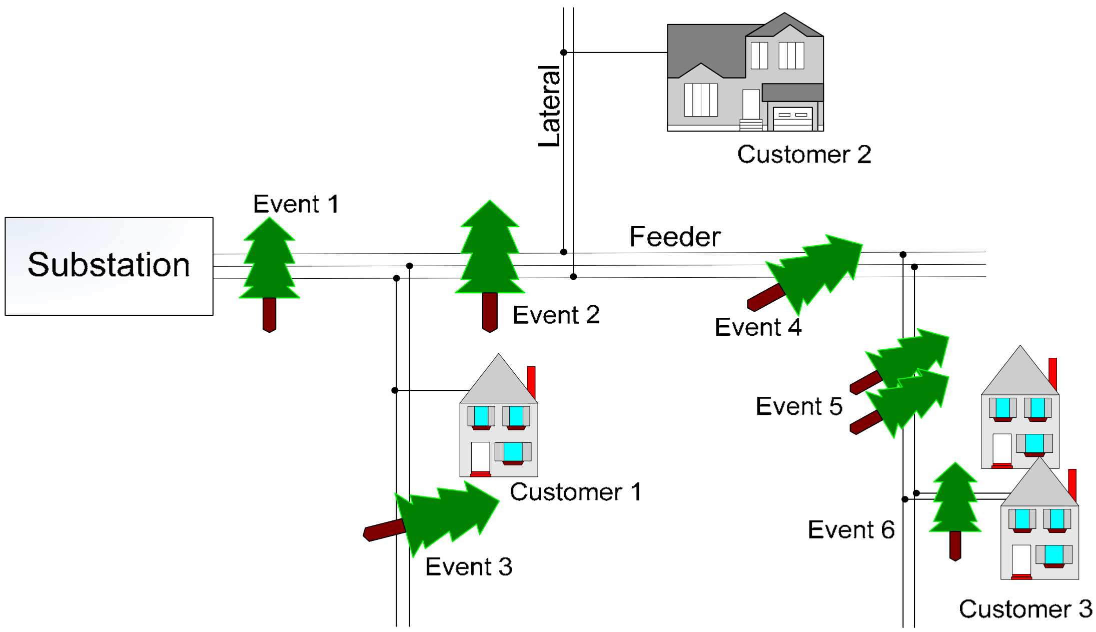

Exhibit 9-5: Outage Event Example

Exhibit 9-5 shows KEMA's reasoning for not equating restoration time with repair time. In this diagram, six emergency events (indicated by tree symbols) are identified on the feeder, its laterals, and services. Customer 1 may be associated with Event 1 in the OAS. When Event 1 is repaired, Customer 1 is returned to service. In this case, restoration time equates to repair given by the crew. Customer 2 may also be associated with Event 1, but because of a second feeder event, the restoration time would be the total time needed to repair for Events 1 and 2. The restoration time for Customer 3 will be the total time needed to repair events 1, 2, 4, 5 and 6. Compounding Customer 3's time is that its repairs cross from the feeder to the lateral and then the service; this means the actual repair time will be far greater than the simple sum previously stated. Repairs are done to Feeder (Event 1, 2 and 4), then the laterals (Event 5) and finally, the secondaries (Event 6).

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9.3.4 AmerenUE's adoption of a Public Safety Advisor position is a leading practice.

The PSA is a unique position to AmerenUE and a new leading practice. The role of this individual is to safeguard the public once a downed electric power line is identified. This frees the Field checkers to continue their damage reporting which drives the creation of work assignments in OAS.

In addition to the PSA AmerenUE has assigned Cut and Clear crews to the PSAs and the PSA Dispatcher. The Cut and Clear crews are responsible for cutting any downed power wire that could be a hazard. This relieves the PSA, police officer or firemen from having to guard a hazardous wire down situation for long periods of time. The Cut and Clear crews are outlining troublemen who are assigned to cover this critical safety work. Local troublemen are not used for this, as they are performing switching and other high order restoration line work.

9.4 Recommendations

9.4.1 Develop, design, and implement an initial damage assessment methodology to be conducted during the first six hours of the event that provides the proper determination of the storm classification, estimated required restoration resources, and initial restoration time estimates appropriate for public communication.

The leading practice in the industry is to implement an initial damage assessment to gain a reasonable understanding of the level of damage to the system immediately after the storm subsides. This assessment needs to be completed quickly so foreign crews (both contractor and utility crews) can be called in as soon as possible. KEMA suggests that feeder lockouts be the first indicator of severity and should be used to determine where the initial damage assessment should be conducted.

The required tasks include:

- Conceptualize the initial damage assessment process,
- Define the available inputs and required information outputs for the initial assessment,

- Define the work processes, roles and responsibilities, information flows, and methodologies to predict:
  - Proper classification of the storm event,
  - Macro estimate of resource requirements, and
  - Initial estimates of restoration time.
- Back cast the assessment algorithm to ensure reasonable accuracy and continued refinement,
- Develop work aids, tools, etc.,
- Integrate the initial damage assessment into existing processes, and
- Provide training to appropriate personnel.

9.4.2 Expand the use of the leading practice of using Public Safety Advisors (PSA) and Cut and Clear crews permitting Field checkers to focus on damage assessment while simultaneously ensuring the public is safeguarded from electric.

KEMA believes that AmerenUE could increase the number of trained PSAs to support the potential safety hazards. This would involve identifying new candidates and providing the required training. Depending on the extent of damage, AmerenUE may elect to create additional Cut and Clear crews to support the PSAs.

10. Emergency Restoration – Execution

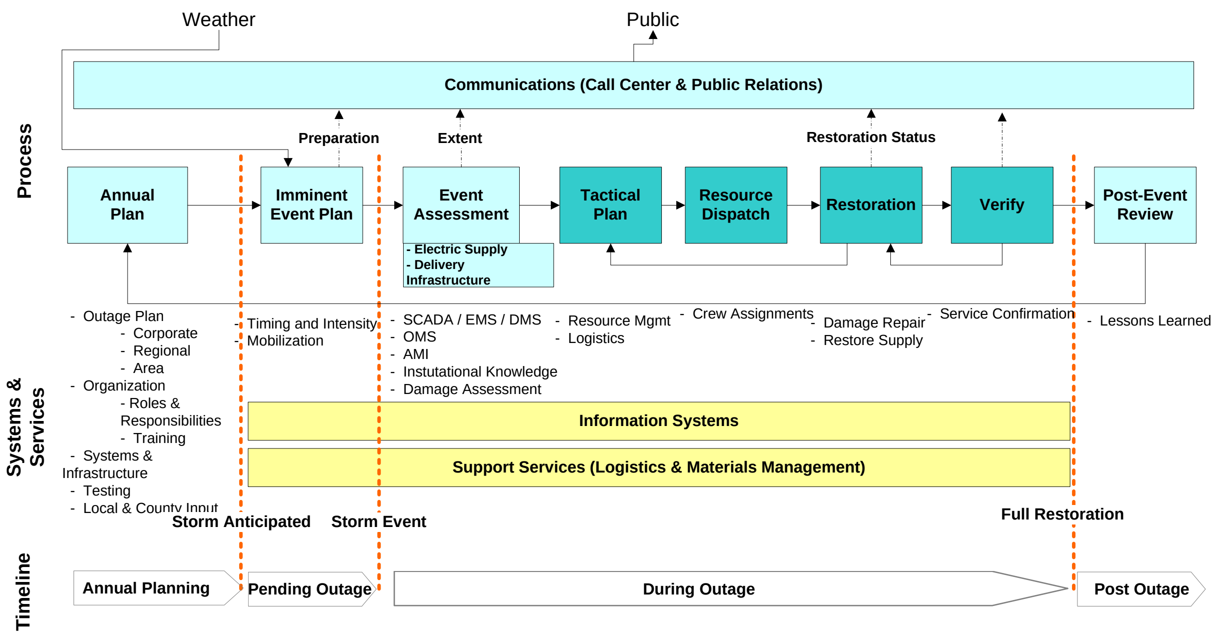

Exhibit 10-1: Outage Management Process - Execution

10.1 Industry Practices

Reliable utility services (electric, gas and water) are essential to maintain our standard of living and provide the infrastructure for our advanced economy. Utility employees recognize their "public service" role and generally exhibit a strong sense of duty, timeliness, compassion, and teamwork, which supports reliability. These attributes form the "utility culture". Consistently, the utility industry has seen increased levels of performance from its employees during the most adverse times and situations, such as outage events.

In addition to strong employee dedication to the "public service" role, effective execution of major event restoration requires the ability to quickly mobilize large numbers of resources, efficiently dispatch resources, and manage material disbursements and provide logistical support for the army of individuals involved in the restoration effort.

Industry leading practices include the ability to quickly re-assign employees from day-to-day responsibilities into a major event mode, have employees well rehearsed in their storm restoration roles, and efficiently choreograph restoration activities under challenging conditions.

10.2 AmerenUE Practices

AmerenUE employees exhibited a strong public service attitude in the execution of storm restoration duties. Even though the July windstorm event was the largest major event in the company's history and was followed by December and January Level III ice storms, employees went "above and beyond" in supporting the restoration efforts.

AmerenUE quickly accessed and mobilized in-house, contract and mutual aid resources.

Even though there were limited storm drills conducted in the last 18 months, AmerenUE efficiently re-assigned day-to-day employee responsibilities to support the storm restoration effort.

10.3 Conclusions

10.3.1 AmerenUE employees consistently demonstrated tremendous dedication and regularly went 'above-and-beyond' during the restoration efforts even after working three major events within six months.

The examples of many employees working well above expectations during the restoration are too numerous to catalog within this report. In fact, AmerenUE had the support of over 200 employee volunteers with logistics during the restoration effort and over 4,000 employees were either directly or indirectly involved.[42] During KEMA's review process, there was never any suggestion that AmerenUE employees lacked dedication to the restoration effort.

RESOURCE MANAGEMENT

10.3.2 The EOC's twice-daily conference calls were valued, facilitated a clear understanding of the restoration work, aided the movement of crews, yet did not support concise reporting of outage statistics for the purpose of external communications.

The leading industry practice is to have a central communications exercise multiple times a day to update all internal parties on the restoration effort.

[42] KEMA Interview MK12

Further, it allows storm managers to adjust crew numbers in the field to affect a uniform recovery effort.

During these exercises it is critical to ensure the right information is being presented.

10.3.2.1 The EOC effectively coordinated the macro level deployment of resources fulfilling its strategy of equalizing the restoration effort across the affected divisions.

The leading practice by utilities faced with this level of restoration is to bring the system backbone and laterals back as quickly and uniformly as possible across their system. This returns the greatest number of customers to full service quickly while ensuring that no one area is favored over another for restoration.

AmerenUE's Emergency Operations Center (EOC) followed this leading practice by coordinating the macro level assignments of resources to the affected divisional areas. The EOC's resource deployment strategy operated under the guiding principles of:

- Restore the last customers' service at the same time, and
- Minimize the geographic movement of the restoration crews to reduce non-productive travel (Windshield) time.

During the restoration effort, the EOC staff was able to effectively support divisional resources special requests for logistical support. As just one of numerous examples, the EOC tackled a special request for a divisional request for a boat.[43]

The EOC focused exclusively on working the storm restoration effort and was not sidetracked with requests to restore high profile customers.[44]

The EOC minimized the impact on restoration productivity by re-assigning restoration resources at the end of the working day.[45]

[43] KEMA Interview MK19
[44] KEMA Interview HS13
[45] KEMA Interview MK19

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10.3.2.2 The EOC's reporting of restoration magnitude and progress lacked rigor in providing a dashboard of outage statistics and assigned restoration resources limiting the ability to create status reports for internal and external stakeholders.

All interviewees valued the EOC's twice-daily conference calls. These calls facilitated the communication and macro level coordination of the current restoration status, supported tactical divisional needs, system wide damage assessment reporting and resource allocation. In addition, OAS provides a number of useful screens that provide much of the relevant information.

However, feedback to KEMA indicated that the July storms internal restoration message emanating from the EOC lacked consistency especially during the late stages of the restoration effort. No minutes or notes of the meetings were taken. Inquiries of the EOC from Corporate Communications, and the media as to the expected restoration time, were not readily forthcoming.[46] AmerenUE did improve during the December storm restoration.

A leading practice observed by KEMA in this area is for the EOC to prepare a short but consistent storm restoration report. This enhanced dashboard report would include customer outage statistics and the level of assigned in-house, contract, and mutual aid restoration resources and any known estimated restoration times by geographic area. This information is in bold type and is accompanied by a conspicuous date and time stamp for reporting to outside entities. Utilities adopting this practice will issue the dashboard approximately twice a day at fixed times and is the de-facto overview information needed for updating internal resources as well as for crafting media and public communication messages.

[46] KEMA Interview MK12, MK05

10.3.3 While AmerenUE had no difficulty mobilizing additional resources, its Divisions experienced bottlenecks in dispatching resources to work sites.

Overall the process of managing a five-fold increase in crew resources worked well, yet there were several issues uncovered. These are explained in the following sub-sections.

10.3.3.1 AmerenUE had no difficulty mobilizing AmerenUE Illinois, contract and mutual aid crews.

Based on the magnitude of major events the EOC quickly determined the severity of the events necessitated mobilizing all available in house, contract and any available mutual aid resources. AmerenUE followed industry practice in its resource mobilization priority as shown in Exhibit 10-2.

Mobilization Priority	Resource Type
1	In House/Onsite Contractor Crews
2	Off-site Contract Crews
3	Mutual Aid Crews

Exhibit 10-2: Order of Resource Acquisition and Mobilization Priority

During the first windstorm of July 19th, AmerenUE was delayed in mobilizing mutual aid crews, partly due to a lack of a clear picture as to the extent of the damage and mutual aid partners unwilling to release crews until the storm passed their service territory. Following the second windstorm of July 21st, AmerenUE immediately mobilized all available resources. During the December ice storm, AmerenUE mobilized foreign and mutual aid resources almost at the outset of the event.[47]

During the July, December, and January storms, AmerenUE used contract and mutual aid resources to supplement in house restoration resources. AmerenUE had no difficulty in contacting and mobilizing mutual aid resources.[48] Although, during the December and January ice storms, mutual aid assistance was only released to AmerenUE

[47] KEMA Interview MK09
[48] KEMA Interview MK09

once the weather front had passed without causing damage in the mutual aid utility's territory.

The mutual aid crew delays, during the July event, did not materially affect the restoration effort as approximately 600 to 700 contract resources were on site during normal day-to-day operations and were immediately diverted to storm restoration. See Exhibit 10-3.

Contract Crew Type	Onsite Prior To July Event	Onsite Prior To December Event
Vegetation Crew	390	460
Line Construction Crew	80	125
Directional Boring	30	50
Inspection Programs	37	13
Substation/Transmission Construction	50	50
Total	**587**	**698**

Exhibit 10-3: Approximate Normal Daily Contract Resources[49]

10.3.3.2 A lack of coordination of contract and mutual aid resource arrival times caused divisional level bottlenecks in dispatching resources.

Information flowing from the EOC, contract, and mutual aid managers, lacked specificity as to arrival times of restoration resources at specific divisional locations. The deployment of large numbers of crews to a division created management issues for the division. One Division Manager suggested that a more orderly staged deployment and enhanced communication from resource management would allow better integration of assigned resources into the restoration work activities. Some crews arrived 16 hours later than expected and other crews arrived without the division having prior knowledge. This resulted in lost productivity while resources waited for work dispatch assignments.[50]

49 KEMA Interview MK09, MK19
50 KEMA Interview HS17

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The impact on public perception is significant when the public has been without service for days and observes a large number of resources waiting at staging areas or divisional depots for work assignments.

10.3.4 The January restoration effort benefited from the use of AmerenUE's new Mobile Command Center (MCC), by providing a local operational command post, but to be truly effective at coordinating regional restoration efforts during future events, AmerenUE will need more than one MCC.

A common theme across the industry during large restoration efforts is the challenge of maintaining operational oversight in the coordination of restoration work and handling the administrative burden associated with issuing work clearances to a large number of field resources. Leading practices within the industry has been to establish command centers located at staging areas within affected operating centers that can take on the following needed activities:

- Orientation and safety briefings for in-house, foreign and mutual aid resources,
- The issuance of work orders,
- The issuance of job aids, such as system and geographic maps, construction standards, and the like,
- A tactical post situated close to damaged areas, and
- A facility to track the issuance of work clearances within the affected region.

Starting in late 2006, AmerenUE researched leading practices in emergency mobile command centers from within and without the utility industry. AmerenUE's Mobile Command Center, provides office space, communications, and field interfaces to AmerenUE's Outage Analysis System. Exhibit 10-4 shows AmerenUE's single Mobile Command Center situated at AmerenUE's Dorsett facility. Its first deployment during the January 2007 ice storm assisted the restoration effort by acting as a field deployed tactical command post, providing locally distributed system and road maps, distributing AmerenUE's work clearance procedures, and construction standards.[51]

Exhibit 10-4: Mobile Command Center

To be truly effective at alleviating administrative burdens associated with local tactical restoration efforts and issuing Workman's Protection Assurance, AmerenUE will need more than one MCC and a formalized procedure for decentralizing the issuance of work clearances.

<u>RESOURCE DISPATCHING</u>

10.3.5 AmerenUE benefited from the Missouri Governor's delegation of authority to MODOT to initiate emergency plans. This delegation accelerated resource mobilization by allowing easy passage of mutual aid fleets across Missouri state boundaries.

The Missouri governor has delegated the authority to the MODOT to approve requests for emergency declarations under storm conditions. This permits exemptions from driving time limits, mediates International Fuel Tax Agreement (IFTA) and International Registration Plan (IRP) administration, and provides AmerenUE the opportunity to process the multitude of arriving fleet under a single blanket order. This reduction in administrative burden benefited the

[51] KEMA Interview MK01

restoration effort in Missouri; AmerenUE reports that other states without this benefit experienced delays in receiving mutual aid assistance due to fleet stoppages, while awaiting paperwork at state boundaries.[52]

10.3.6 The orientation of contract and mutual aid crews during the July storm event omitted critical information needed to secure line clearances from the Distribution Dispatch Office (DDO).

Even though foreign crews received orientations upon arrival on the premises that specifically included safety briefings and procedural reviews of line clearance requests, the orientation missed critical information needed to interface effectively with the Distribution Dispatch Office. Specifically, foreign crews at times lacked an assigned crew number, the OAS trouble ticket reference, and the feeder identifier. This significantly hampered the issuance of clearances during the first three days of the July restoration event.[53]

In response to this process breakdown, the distribution dispatch office is now distributing informational cards to foreign crews at staging areas or from the mobile command center.

10.3.7 AmerenUE's practice of providing 'Bird Dog'/Crew Guides and remote dispatching support was instrumental in efficiently managing the unprecedented number of contract and mutual aid crews on-site during the restoration effort.

A leading practice across the industry is to provide foreign crews with a guide to accomplish the following:

- Guide foreign crews around the system,
- Support the clearance and switching processes,
- Chase materials, and
- Relieve the foreign crews of some of the administrative burden inherent in storm restoration.

[52] KEMA Interview MK04
[53] KEMA Interview MK16

Utilities can take a number of different approaches to this including using retirees, training "Bird Dogs", and breaking up local crews to be integrated into the foreign crews. The goal in all of these options is to eliminate any AmerenUE imposed "road blocks" for the foreign crews to ensure maximum productive work time possible.

AmerenUE could not effectively dispatch the large volumes of contract and mutual aid resources with the existing divisional dispatch staffing levels. AmerenUE re-assigned centralized resources to dispatch foreign crews, and paired 'Crew Guides' from local divisions with foreign crews to assist with local knowledge of the system.[54] This practice worked well and enhanced the productivity of both contract and mutual aid crews.[55]

10.3.7.1 AmerenUE benefited by engaging retirees to assist in the dispatching of foreign and mutual aid crews but, with the exception of the Resource Management Department and one division, does not actively maintain a list of qualified retirees.

Given the scale of the restoration events, even with the mobilization of in-house remote dispatchers, AmerenUE was still stretched for crew dispatching ability and engaged the assistance of retirees with familiarity of the T&D system, knowledge of AmerenUE's OAS, and experience in dispatching field crews. AmerenUE was fortunate in accessing these retirees, as it does not formally maintain lists of retirees with these specific skill sets in all Divisions.[56]

10.3.8 During July's event, the backlog of clearance requests delayed crews in their work. In response, AmerenUE decentralized the clearance taking process in an ad-hoc fashion.

The clearance process is an essential safety tool to protect the crews from inadvertent switching actions that could cause a serious energized line contact. The leading practice by utilities facing severe weather such as hurricanes, generally provide a process for decentralizing this clearance taking process. In providing such a process, these utilities eliminate significant crew delays caused by waiting for clearance approval from system dispatchers without endangering other crews.

[54] KEMA Interviews MK01, MK05
[55] KEMA Interview MK05
[56] KEMA Interview MK05

10.3.8.1 The abundance and backlog of clearance requests significantly delayed crews in the initiation of repairs.

It is normal to expect a significant increase in line clearance requests during major event restoration efforts and AmerenUE was no exception. Industry leading practices in this area focus on two main themes:

- The goal is to minimize the processing time between field crews and system dispatchers for issuing clearances. This can be accomplished through a series of practices that include remotely pre-configuring the system during the night shift, staggering morning start times for crews to help level system dispatch office workloads, and having switching sequences pre-prepared reducing switching sequence transcription and preparation times.

- When the system damage is sufficiently severe, delegate authority for issuing clearances to field agents who formally take functional accountability for both a complete substation and its feeders, or on a feeder by feeder basis, thereby eliminating the interface with the bottlenecked system dispatch office. This agent retains the accountability for that part of the system until all restoration efforts are completed and formally returns accountability to the system dispatch office.

During AmerenUE's restoration efforts, both in-house and foreign resources experienced delays in securing line clearances from the St. Louis Distribution Dispatch Office (DDO).[57] Four factors compounded the delays in securing clearances:[58]

- The inability to scale the number of desks and the associated staff and communication channels being operated at the DDO,

- No preparation during the night shift at the DDO or at the divisions for the coming day's clearance requests,

- A lack of staggered morning start times to level the inbound clearance request work volume, and

[57] KEMA Interviews MK06,MK08, MK09, MK14 & MK16
[58] KEMA Interviews MK16, MK03

- A feeder analysis needs to be performed to create the switching sequences for each line clearance request.

At the time of the storms the DDO had three vacancies for 22 staff positions assigned to the function. During regular day-to-day operations, six desks are staffed during two-day shifts and night coverage includes two dispatchers. Exhibit 10-5 shows the shift coverage at the St. Louis DDO. During restoration efforts there is substantial overtime to go along with the opening of additional desks.

Shift	Staff on Desks
6 AM – 2PM	6
2PM-10PM	6
10PM-6AM	2

Exhibit 10-5: St. Louis Dispatch Office Shift Coverage During Normal Operations

These 22 dispatchers are dedicated to the St. Louis area and while system control activities via SCADA can be transferred to other AmerenUE dispatch offices, the issuance of line clearances to crews for the St. Louis area must be handled at the St. Louis distribution dispatch office. This created bottlenecks in processing line clearance requests for restoration resources.[59]

The dispatch office did not have prior knowledge of the planned work activities for the following day and consequently could not prepare switching orders during the night shift in advance of the morning workload for clearance requests.

All restoration resources started their field activities at dawn and once arriving at the job site initiated clearance requests from the DDO. Each morning, starting at around 8AM, line clearance requests inundated the six dispatching desks crippling the DDO's ability to handle clearances and adding delays to crews commencing work.

Since the July storm, the DDO has prepared "canned" switching instructions for each isolating device in the St. Louis metropolitan area. In the future, this preparation will eliminate the need to write

[59] KEMA Interviews MK21, MK08

switching orders from scratch reducing clearance processing times. However, a caution must be included with this comment as the current system state could be different from assumed in the "canned" switching orders. Utilities that have adopted the practice of pre-preparing switching orders include a formal step of verifying the validity of the switching sequence with the current configuration of the system.

10.3.8.2 During Level III events, AmerenUE benefited from the introduction of an ad-hoc "Certified Functional Agent" process, delegating line clearance responsibility for a complete feeder or substation to a field agent, but has yet to formalize the practice.

In the future, to alleviate the growing bottlenecks experienced during the first three days of the July storm for line clearances, AmerenUE created the Certified Functional Agent role. Dispatching will delegate functional responsibility for complete feeders to "Certified Functional Agents" alleviating some of the DDO work volume. This delegation of authority assisted in dispatching restoration resources more effectively and worked well in the latter half of the July storm. However, given the safety implications and the ad-hoc fashion in which this practice was implemented, the "Certified Functional Agent" concept was not activated during the December and January events. The benefits of a "Certified Functional Agent" were proven in July. While 20-30 employees have been trained in this new role, there is no sense of urgency to formalize the "Certified Functional Agent" practice for adoption in future major events.[60]

RESTORATION and VERIFICATION

10.3.9 AmerenUE's adoption of industry leading practices in prioritizing restoration work restored the largest number of customers as quickly as possible, but in some cases, may have inadvertently reduced productive repair time.

AmerenUE adopts industry-leading practices in prioritizing and working the restoration effort on a feeder. The sequencing of restoration follows the priority, highest to lowest, of feeder backbone, laterals, and finally secondary/service

[60] KEMA Interviews MK09, MK13

connections. This approach results in the largest number of customers being restored to service as quickly as possible.[61]

While this is a leading practice, its implementation within AmerenUE during these severe storms actually made some crews less efficient by routing work based on number of customers likely to be restored. This caused crews to hop around feeders and laterals sacrificing repair time for additional windshield time. [62] Had the crews focused more on restoring a complete feeder first the windshield time would have been less. Section Six of the Electric Emergency Restoration Plan references this approach.

10.3.9.1 Limited 24-hour shift coverage by forestry contractors, allowed vegetation-clearing efforts to be conducted safely and to stay well ahead of line restoration crews.

Most of the utility industry has transitioned to provisioning vegetation management services on contract. As long as contract terms and conditions encourage vegetation contractors to support storm restoration efforts, this industry accepted practice has not had any negative material impact on vegetation clearing during major events. Generally, vegetation management resources work autonomously from line crews and ensure that clearing is done in advance of line crew restoration work at a specific location. It is usual practice for forestry resources to operate with 15% -20% of its work force active during “Off-hours” of each day during major event conditions.

AmerenUE had no difficulty mobilizing its five vegetation contractors to support clearing efforts. Vegetation resources beyond the five property contractors were easily located and mobilized as the existing contract relationships offered access to supplemental vegetation crews during the storm. Working autonomously from line crews and with 24-hour shift coverage, vegetation crews easily stayed ahead of the line crews. Even though vegetation management resources operated in shifts with 24-hour coverage, safety

[61] KEMA Interviews MK01, MK06, MK08
[62] KEMA Interviews with division managers

performance was outstanding with no major incidences and only two minor vehicle accidents reported.[63]

10.3.10 AmerenUE practices to repairing customers' weather head equipment vary between divisions affecting customer restoration and tainting the customers' perception of AmerenUE's restoration efforts.

During the latter stages of the storm event, the majority of the restoration work volume focused on restoring individual customer services. While the weather head equipment on the customer's premise is not AmerenUE's responsibility, it is integral to the restoration of service. Some region's restoration activities, Boone trail as an example, included temporarily or permanently fixing the customer's weather head equipment while restoring customer services.[64] This practice lead to two responses from customers, neither of which is in support of improved customer satisfaction:

- AmerenUE's call center staff received customer complaints located in divisions that did not restore service because of damaged weather head equipment. The customer complaints focused on incurring cost and further delay before restoring service.
- Customers from areas where field resources made temporary repairs to weather head equipment expressed frustration to call center staff when AmerenUE directed customers to third party electricians for permanent repairs.[65]

This is an issue in many utilities and the majority of companies will not repair the service entrance after the weather head because of the potential liability the companies could create. Further, there is the potential for carrying more materials associated with the repair. However, one company did authorize service crews to make the repairs, saying they wanted to minimize the inconvenience to its already inconvenienced customers.

[63] KEMA Interviews MK10, MK15
[64] KEMA Interview HS17
[65] KEMA Follow up communication with Call Center Manager

10.4 Recommendations

10.4.1 Enhance the internal informational dashboard displaying current and historical information during the progression of the restoration to provide customer outages and restoration resource levels.

Restoration dashboards are becoming increasingly popular for good reason; they put critical restoration information at the fingertips of all that need the information.

Add the high-level restoration times by overall service area and districts as the underlying data becomes available. The EOC should be prescreening the information and controlling the updating frequency to ensure a consistent messaging to all concerned.

10.4.2 Define the process and enhance the communications between the EOC, Resource Management and the Divisions relating to resource volume and arrival times to assist Divisions in improving efficient crew dispatching.

Provide the divisions with advance warning of crew arrival times so the work can be ready for the crews minimizing any waiting time. This will be more easily accomplished if the earlier recommendation of moving the crew receiving staging areas is moved to the perimeter of the service territory instead of at the local Division work staging areas. Further, with AmerenUE's mobile crew dispatchers and escorts, this adjustment should be easily accomplished.

10.4.3 Adopt a "Restoration Work Island" approach under Level III and IV emergency conditions.

The Restoration Work Island will apply only to areas of significant system damage and should be no larger than a substation and its feeders or a specific feeder. It would be no smaller than a single feeder. In essence, Division management in conjunction with the EOC will identify potential Restoration Work Islands. One field supervisor will be assigned to manage all the restoration activities inside the Restoration Work Island boundaries.

Level III or IV storm impacted areas, where there is only minor or spotty damage, will continue to have the restoration work priority set through the OAS.

Restoration Work Island clearances will be issued through either the system dispatch office or a Functional Agent. This determination will be the responsibility of the EOC manager or his designee. The EOC manager is in the best position to determine the work load of the system dispatchers and the potential crew delays.

The Restoration Work Island approach during restoration will provide the following benefits:

- Crews will work in contiguous areas reducing windshield time, consequently completing more work in the same time period,
- Areas will be restored more consistently, and
- Crews will not have to wait for work assignments as they will be assigned to work a specific feeder or set of feeders.

Achieving the above result will require the following AmerenUE actions:

- Expand Section Six in the EERP to include a description of the Restoration Work Island strategy and approach, and
- Define processes and procedures for adopting a Restoration Work Island approach under Section Six storm restoration activities.

10.4.4 Expand the number and use of Mobile Command Centers (MCC) during Level III and IV events.

The MCC is another leading practice for AmerenUE. However, in Level III and especially Level IV storms, more MCCs are necessary to reduce burden on both the Division and EOC management teams. Management should consider phasing in several more of these centers.

Ideally, when the EOC or Division identifies the need for several Restoration Work Islands in a small geographic area, bringing in an MCC to field coordinate these restoration activities will ease the burden on all restoration management.

AmerenUE management indicated that the future MCCs will have some configuration changes consistent with the evolving role the MCCs will play in future storms.

10.4.5 Continue nurturing the strong working relationship AmerenUE already has with MODOT, the State EOC and local EOC's .

The model working relationship established with the Missouri Department of Transportation should continue to be fostered with other local and state agencies.

10.4.6 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 DDO for clearance taking and ensure that the process is formalized in the EERP.

Providing non-AmerenUE crews with information cards explaining how to communicate with the dispatchers and the Function Agents during a clearance process will hasten the overall clearance process. If possible, some of the specific crew information can be entered at the time the card is issued. Then all that would be necessary is the OAS or feeder section information, depending on whether the crew is working under the dispatcher or a Functional Agent.

10.4.7 Refine the certified functional agent program to secure more employee participation.

AmerenUE's adoption of the Functional Agent is a leading practice. This practice will greatly reduce the delays caused during the clearance granting process. To enhance the process and ensure that the individuals trained for the role remain current in their understanding of the clearance methodology, KEMA suggests the following actions be included:

- Provide work aids to ensure that the skills remain current even though there is infrequent use of the skills, and
- Participate in the DDO at some level of frequency to refresh skills.

10.4.8 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.

AmerenUE has proven that tree removal work can be done safely and ready for line crews to work. KEMA believes this practice should continue as long as the safety of the crews is preserved.

10.4.9 Evaluate the benefits and risks of providing temporary repairs to customers' weather head equipment under emergency conditions.

Weather head replacement is a new leading practice being adopted by some utilities. The benefit to the customer is shorter outage time, while the benefit to the utility is customer good will. KEMA understands that there are at least two issues with this practice. First, is the liability associated with making attachments to the customers' house and potentially certifying that the internal wiring is safe to reconnect. Second, is the potential conflict with the local electrician's association, with respect to reducing their work. AmerenUE should do a thorough evaluation of how best to proceed with such a program. Specifically, AmerenUE should at a minimum:

- Analyze and evaluate alternatives to include:
  - Cost,
  - Supply chain implications,
  - Liability implications,
  - Regulatory requirements such as licenses,
  - Goodwill, and
  - The impact to local electricians needs to be assessed.

11. Emergency Restoration – Information Systems and Processes

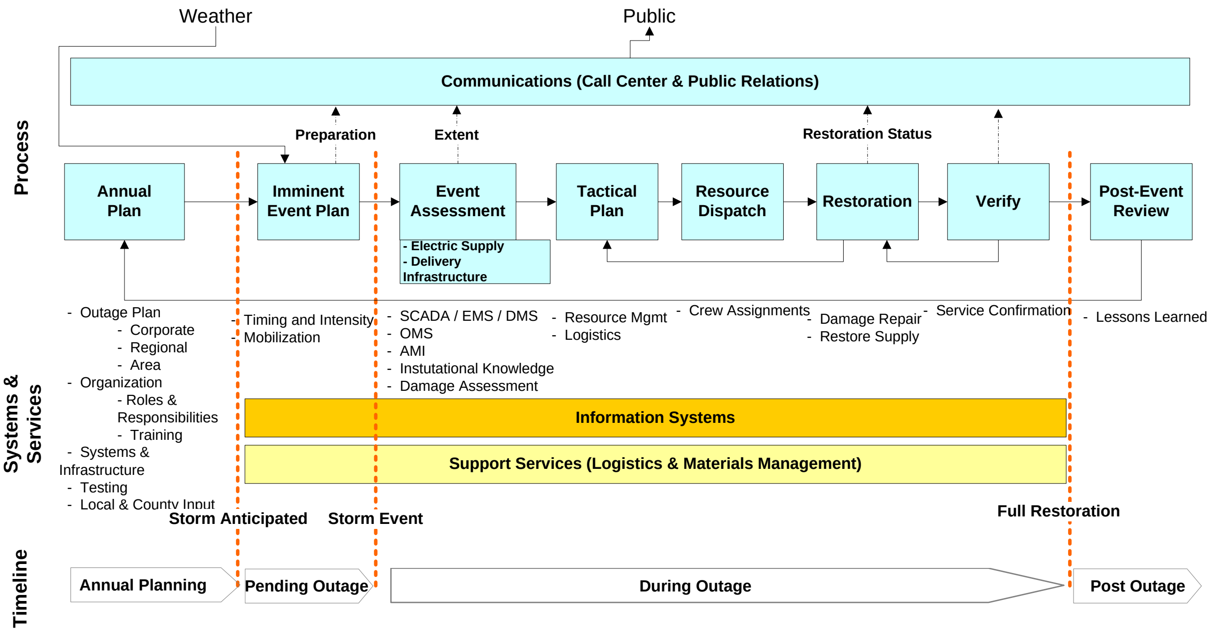

Exhibit 11-1: Outage Management Process – Information Systems

11.1.1 Industry Practices

Exhibit 11-2 below illustrates a leading set of integrated information systems for supporting outage management processes.

Schedule RJM-E1-150

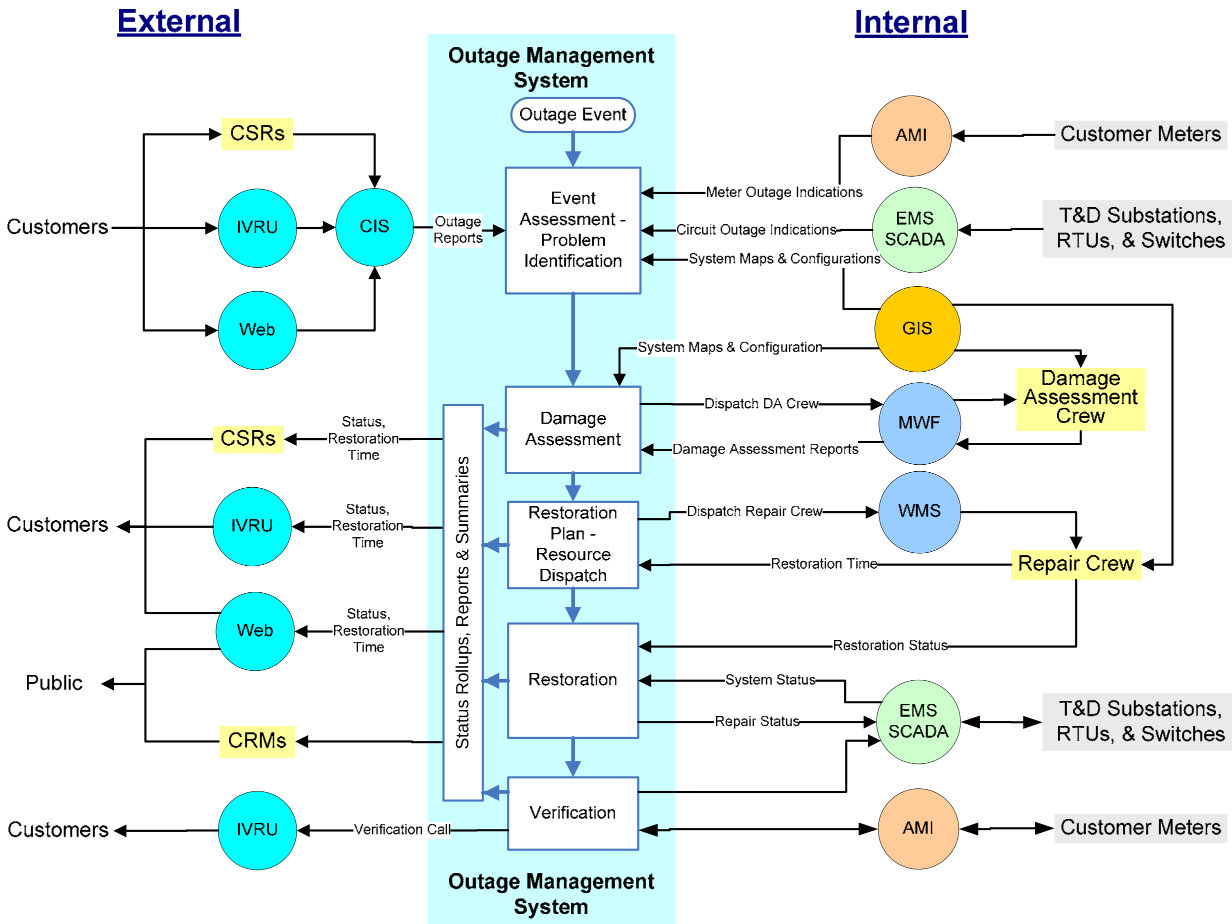

Exhibit 11-2: Leading Practice Integrated Systems for Outage Management Processes[66]

The key components of this solution include:

- **Customer Information System (CIS):** Managing information about customers, customer services, metering and billing, with supporting Interactive Voice Recognition Unit (IVRU), web posting and other customer and public communications.

- **Outage Management System (OMS):** Managing trouble tickets, outage analysis and assessment, crew dispatch and restoration process.

- **Advanced Metering Infrastructure (AMI):** Automated meter reading, meter data management, meter "last gasp" outage reporting and processing,

[66] KEMA IT Thought Leader

and automated remote interrogation of the AMI network for power restoration verification.

- **Systems Operations Supervisory Control and Data Acquisition (SCADA), Energy Management System (EMS) and Distribution Management System (DMS):** Real-time monitoring of the electric transmission and distribution network, energy supply, equipment operating status, and remote switching and control.
- **Geographic Information System (GIS):** Detailed geographic mapping of utility transmission and distribution facilities and equipment, network connectivity, equipment information and field configuration.
- **Work Management System (WMS):** Work order processing and management, resource assignment, job status and completion tracking
- **Mobile Workforce Management (MWF):** Automates field crew operations with mobile workforce dispatch, scheduling and routing, remote electronic connectivity, and automatic vehicle location.
- **Interactive Voice Response Unit (IVRU):** In the context of outage management, the IVRU routes calls to CSRs and enables allows customers to self-report and receive outage information.

A leading OMS maintains an up-to-date distribution system connectivity model that reflects the current configuration of the electric system. Reported outages are analyzed against the physical system model compared to the current operating status of key equipment, e.g., substations, transformers, and switches.

A leading OMS has business rules that allow the efficient management of large-scale outages and restoration efforts. Proper integration of key systems, including CIS, IVRU, EMS, and MWF significantly reduces the need for manual and redundant data entry, and allows efficient transfer of data to those who need it.

The SCADA/EMS systems supply valuable real-time information about operating conditions and system configuration. When combined with the OMS connectivity model, circuit outages can be quickly identified and outage reports mapped and analyzed.

A leading OMS provides a library of planned switching scenarios the switching coordinator uses to manage outages. Restoration procedures and processes can also be defined in the OMS to help with large-scale distribution outage restorations. The procedure defines the correct sequence of events to safely and effectively restore circuits. The sequencing is coordinated with the real-time system status from the EMS.

Integration between the OMS and a mobile workforce management (MWF) system allows dispatching of OMS analysis results to field personnel. Field information, such as outage validation, cause, and estimated time to restore are sent back electronically to the OMS, passing seamlessly to the CIS for call center notification and IVR message updates.

Integrating GIS to the OMS allows electric connectivity data to regularly pass to the OMS for developing the model that reflects the as-operated configuration of the electric system in the field.

A leading AMI system when integrated with OMS provides for automated reporting of customer outages using the "last gasp" capability of the meters. OMS can automatically determine if a customer's meter matches a specific outage report and then provide a specific outage status. This function can be operative within the utility's IVRU or implemented within the local carrier network for maximum volume.[67]

The AMI system is an effective tool for outage restoration verification. The process interrogates the AMI network to determine whether selected meters have power and are once again sending information. While this technology has some inherent limitations (it is not designed for this primary purpose), this application can provide an automated capability for systematically verifying power restoration at some customer sites.

11.2 AmerenUE Practices

AmerenUE has made a significant investment in its systems infrastructure and is on the leading edge of technology adoption within the industry. Exhibit 11-3 summarizes AmerenUE's systems infrastructure as it supports outage restoration.

[67] KEMA Principals' call center experience

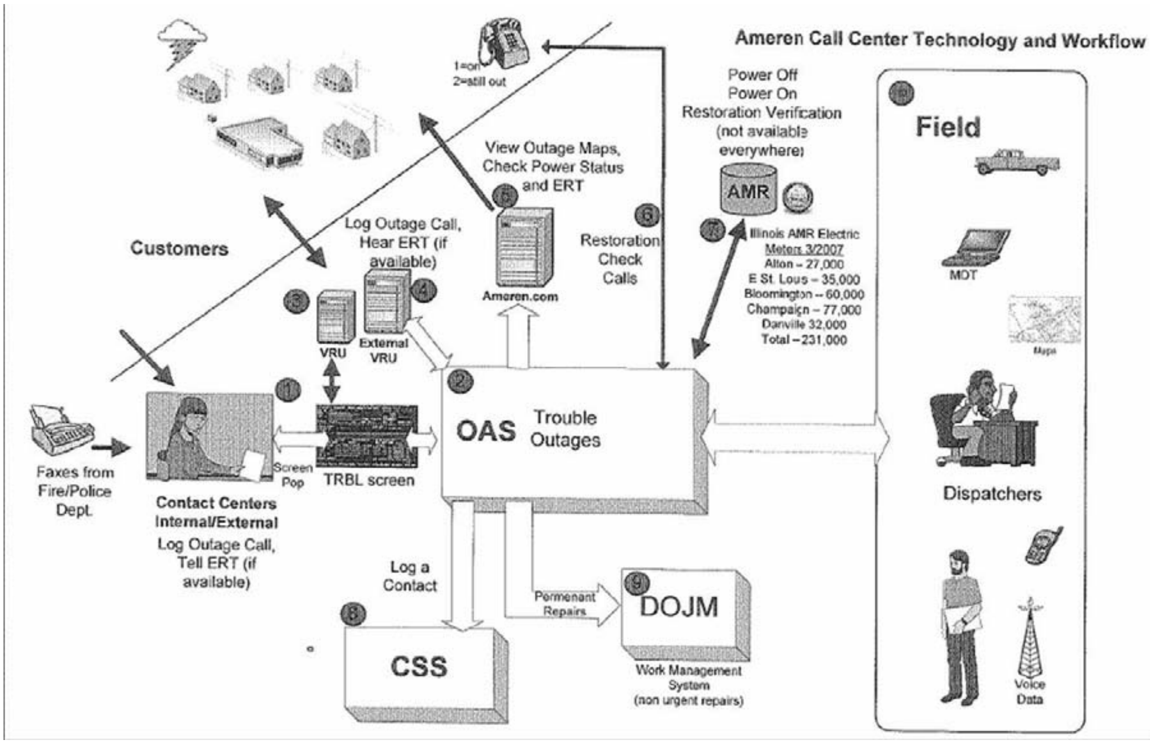

Exhibit 11-3: AmerenUE Call Center Technology and Workflow[68]

The following is a description of how outage events are handled on a day-to-day basis at AmerenUE.[69]

1. Customer Service Representative (CSR) receive calls and logs outage reports into the Outage Analysis System (OAS) trouble screen. The OAS provides an Estimated Restoration Time to the CSR as well as the dispatching status of the trouble ticket.

The OAS, a mainframe based technology, was installed in 1993. Since that time, AmerenUE implemented continuous improvements/enhancements to the effectiveness of the system. In addition, AmerenUE has greatly extended the system functionality through interfaces to other AmerenUE systems.

2. The OAS analyzes customer calls to determine the most likely failed system device, automatically creates a restoration work order, and records specific details of an outage event.

[68] KEMA Interview MK13
[69] AmerenUE Systems and work flow.pdf

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The OAS system implements business logic to determine the most likely failed system component. This logic identifies the most likely upstream isolating device for a group of customers reporting an outage event and assigns a single trouble order to this customer group.

3. Inbound customers outage calls are handled by Call takers (CSRs), and the Voice Response Unit (VRU). When available, the estimated restoration times are communicated.

4. Outage call overflows are handled by a third party VRU, which accepts outage calls, and interfaces directly with the OAS. OAS data is extracted every ten minutes to provide the external VRU with updated Estimated Restoration times, offering customer's handled by the third part VRU current restoration estimates.

5. The AmerenUE.com website provides customers an overview of AmerenUE's current system outages and restoration effort by zip code, and offers a means to determine the power status at their residence or business.

Exhibit 11-4 and Exhibit 11-5 are examples of how this information is displayed on AmerenUE's website.

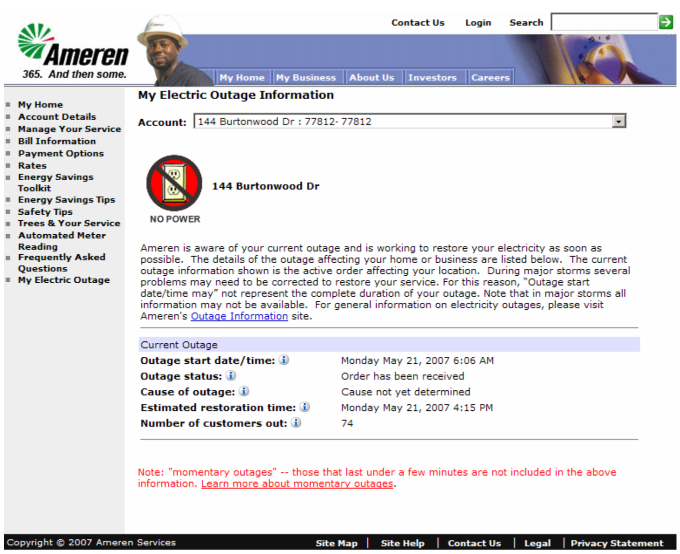

Exhibit 11-4: Example 1 of AmerenUE's web based outage information

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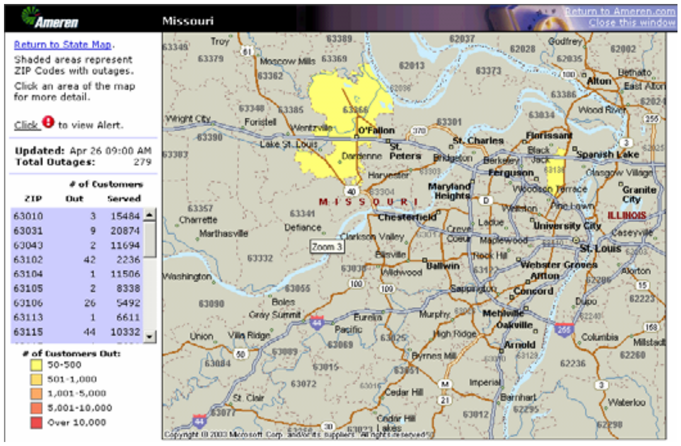

Exhibit 11-5: Example 2 of AmerenUE's web based outage information

6. When outage orders are completed, the OAS system automatically initiates outbound customer calls to confirm service restoration. Customers are only called between the hours of 7am and 10pm.

7. AmerenUE's AMI system automatically reports power outages and power restoration for some of the affected meters to OAS. In order to eliminate false outages from momentary interruptions the AMI system delays sending its information for 12 minutes. Outages sensed by the AMI meters are batch processed into OAS every five minutes. As a result, there can be a 12 to 17 minute delay from the occurrence of the event to being available to AmerenUE employees in the OAS.

In the event a feeder locks out, SCADA will automatically update OAS within seconds.

8. The Customer Service System is updated with the record of the customer's outage call. Customer outage history and reliability improvements, such as recent tree trimming, line maintenance, etc., are recorded in OAS, and made available to Call Center Representatives while addressing a customer's inquiry or complaint.

9. When a trouble event requires permanent repair after service restoration, OAS automatically generates a work order in the DOJM (Distribution Operations Job Management) system.

10. Troublemen and construction resources can access critical information systems including the OAS and Geographic Information System (GIS) system through field deployed hardened laptops with wireless connections.

In addition to the functionality described in the above paragraphs relating directly to outage handling, AmerenUE provides additional functionality by integrating systems with the OAS platform. This includes:

1. GIS Maps and Visual Dispatch – Through the integration of GIS Map viewing software with OAS, AmerenUE employees can easily identify the geographic location of a failed system device or outage orders. Additionally, AmerenUE employees can easily review the geographic location of service outages, wires down, and other service problems. The visual representation assists in quicker problem analysis and improvement management of field resources.

2. Outage E-mails and Paging Service – Outage volumes are periodically monitored and e-mails and pages are automatically generated for operations employees at a set customer outage volume thresholds.

3. Distribution Dispatch Office (DDO) storm management intranet site – An intranet site provides reporting of customer outage counts and outage orders by geographic location to the DDO and the Emergency Operations Center.

4. FOCUS Reports – A collection of ad-hoc reports are available to monitor outage volume and activity. These reports include hourly call volume, feeder damage summaries, a listing of open orders, alerts on excessively long restoration orders and a summary of estimated restoration times.

Similar to many other electric companies in the industry, AmerenUE employs staff to monitor and service these systems during day-to-day and emergency events.

11.3 Conclusions

11.3.1 The OAS outage determination logic and business reporting did not perform well under Level III events.

OAS functions extremely well in Level I and II restoration efforts. OAS handled the full volume of calls and orders experienced during the July and December 2006 storms and provided critical insights into the extent and location of the storm damage. However, the OAS Estimated Restoration time calculation module was not designed to fully support the magnitude of damage experienced during this level of storms. OAS's calculations of Estimated Restoration times are known to be unreliable under these circumstances. Following the August 2005 Missouri Public Service Commission (MOPSC) storm review, AmerenUE

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implemented logic to disable the automatic reporting of Estimated Restoration times to customers, unfortunately this is the information that is most needed and desired by customers. Two findings support our conclusion.

11.3.2 Misinterpretation of OAS information led to incorrect information being manually summarized and reported to the public through press releases and press conferences. Due to the severity of the damage and the magnitude of restoration effort, inflated customer outage/restoration numbers were reported through media channels.

AmerenUE's OAS has two inherent weaknesses that result in the system producing misleading information major outage events. Both issues stem from the breakdown of applying outage analysis logic originally designed for routine outage volumes to major event. The two issues are:

- The system's business logic groups in bound outage information, whether from customer calls, or CellNet, into a prediction of a single system failure, generally identified as the most likely upstream isolating device on the feeder or lateral. The logic does not take into consideration that, during large-scale events, system damage has most likely occurred at additional downstream locations and is not isolated to the systems predicted single location. The systems predicted restoration time estimates. The repair time is the sum of repair times for a single damage location and does not factor in the non-linear relationship that repairs to downstream damage has on estimated restoration times.[70] As a result, AmerenUE quickly turns off the Estimated Restoration Time function in OAS.

- Once the system damage is repaired, field resources clear the OAS trouble ticket entry. If the OAS has grouped multiple customers to this trouble ticket, upon clearing, the system assumes that all the grouped customers are restored. During Level III events, this is rarely the case, as downstream damage is yet to be repaired or for that matter even identified.[71] As Field checkers continue to identify downstream damage, or customers call for a second time, OAS issues new trouble orders. This can result in double counting customer outage counts even though the customers were never originally restored to service.

[70] KEMA Interviews MK13, KEMA Call Center Observation
[71] KEMA Interview MK19

11.3.2.1 AmerenUE's mainframe based outage analysis system allows incomplete entries and lacks quantity information of damaged assets, handicapping AmerenUE's ability to summarize damage information into actionable management reports of resource and materials requirements for restoration efforts.

The OAS supported the dispatch of construction and restoration crews during the storm events. First responders, field checkers, and crews fleshed out each outage ticket with a detailed description of field damage facilitating efficient restoration resource dispatching. Each outage ticket in OAS was coded with the major classification of equipment damage such as pole, or transformer, etc. This damage information is supplemented with a free form text input format field in OAS and resulted in a wide variation in the specificity of the Field checkers' comments.

The coded fields in the OAS system indicate the type of damage but do not provide quantity information. An example of this would be for a location with pole damage where the OAS ticket indicates pole damage but does not indicate that three poles need repair. This information may or not be entered in the free form text entry field, is not required, and cannot be easily summarized.

Additionally, the specificity of the entries in the free form text field varied in the content of the entered information. Some ticket entries had detailed information about the damage location while other entries only had cursory information if any at all.

As a result, Divisional resources and the EOC management were somewhat handicapped in their ability to produce automatic reports of the extent of system damage. Each division and the EOC uses different spreadsheet formats to collect, synthesize, and report high-level system damage.[72]

11.3.3 AmerenUE improved its determination of restoration time estimates, for Level III events, integrating the information across several delivery channels.

AmerenUE recognizes the limitation of its OAS in accurately representing customer outage statistics and in providing estimated restoration times during

[72] KEMA Interviews MK03, MK06, MK19

Level III events. This significantly handicapped effective public communication during the three restoration efforts. In response, AmerenUE initiated a process review team to improve the field reporting and synthesis of area wide estimated restoration times during Level III events. The major elements of the initiative include:

- To provide more specific "area wide" estimated restoration time (ERT) information to supplement Corporate Communications information utilizing existing OAS functionality,
- To provide ERT information through AmerenUE's customer service channels (CSR's, VRU, and Web), and
- To execute a process that has clearly defined roles and responsibilities with the emergency Operations Center (EOC) as the process owner.

The team has made significant progress in defining this process to circumvent the limitations in OAS restoration time reporting under Level III conditions. This progress includes:

- AmerenUE has expanded its use of Mobile Data Terminals and hardened laptops with remote connectivity capability directly to the OAS, to employees who have been trained for field damage assessment duties during major events,
- The AmerenUE.com website's My Electric Outage functionality was enhanced in the spring of 2007 to provide additional clarification to customers of the many alerts and area restoration notifications, and
- The alerts were also integrated into the OAS screens used by Customer Service Representatives when answering customer outage calls.

In addition, all outage statistics and reporting are now extracted from OAS and housed in the same database to ensure consistent customer outage counts and restoration progress numbers are available to all internal and external stakeholders.

These improvements have been proven and tested during a small outage event in August of 2007. While AmerenUE has not experienced a Level III event since implementing these improvements, AmerenUE believes they will be able to perform well in future major events.[73]

11.3.4 AMI technology in place at AmerenUE could offer slight improvements in support of storm restoration activities.

AmerenUE's CellNet system is an early generation Automated Metering Infrastructure (AMI) solution, originally purchased for the primary goal of reading meters for revenue purposes. Individual meters have a function to provide a "Last gasp" report when power is lost as well as a "Power Up" report when power returns. AmerenUE has been using these features since the initial implementation of AMI. This "Last Gasp" and "Power Up" functionality is fed into OAS; however, there are a number of inherent limitations in AMI technologies in this regard. Regardless, AmerenUE is taking steps to integrate the system into outage restoration verification more effectively. The following findings amplify the issues.

11.3.4.1 During Level III events, AmerenUE does not interrogate the AMI network to determine the extent of customer outages nor to verify successful restoration of individual customers instead relying on a combination of pro-active customer callback procedures and passive public advisories to confirm service restoration.

AmerenUE is one of a handful of utilities that have gone to a fully AMI solution and has made a significant investment of approximately 1.2M electric and 130k gas AMR meters in Missouri alone.[74] The CellNet technology's major purpose is to automate meter reading and is not designed as a primary system in support of outage analysis, management, or restoration. Some features inherent in the CellNet system can support the outage management process, but must be considered a secondary benefit.[75]

The CellNet technology allows AmerenUE to read its meters through a fixed radio network. Meter information is fed back through a network of pole top collectors, distributed throughout the AmerenUE system, and ultimately fed to CellNet servers in Kansas City. CellNet aggregates the meter information, processes and filters the reports,

[73] Ameren document ERT Storm Approach – MO General.ppt
[74] KEMA Interview MK13
[75] KEMA Interview BS02

and forwards the information to AmerenUE's OAS system. Logic filters applied to the raw information parse momentary interruptions and failing AMI meters from the data stream.

A secondary benefit of the AMR system is the meter's "Last gasp" function. When power is lost at the meter, the meter sends a signal over the same network ultimately producing an entry in OAS indicating a loss of power flow. OAS treats this information in the same manner as if a customer called in an outage at their location.

For small-scale outage events, the system is automated and provides outage reports for some of the affected meters. However, several inherent issues have been identified with the outage reporting application in AMI technologies. First, during outage events that affect hundreds or thousands of meters, the "last gasp" from many affected meters all at once create radio contention. The signals clash and only a small subset of the events are heard on the system. This one aspect renders the AMI outage reporting application as an ancillary benefit, providing additional information for the OMS analysis application, as opposed to a primary communication system to detect outage events.

Major storm events are by definition associated with widespread power outages and are often associated with severe lightning. Widespread power outages and lightning contribute to loss of third-party data communication providers, as well as interruption in the AMI network. These interruptions can last many hours following a storm, prohibiting the normal functioning of the AMI network during this timeframe. AMI networks rely on battery back-up support designed for only several hours. These constraints, with respect to equipment damage, communication pathway loss, and limited battery back up, are inherent to the AMI system and further limit its ability to function as a primary tool in storm restoration management.

During the severe storms of last July and December, there were also various parameters not set properly in the CellNet application. The application locked up, rendering the AMI solution useless for a time.

Additionally, AmerenUE has not integrated its AMI system's capability into routine Level I and larger Level II events. The system does not automatically check the AMI network to confirm service restoration. AmerenUE's only confirmation that service is restored occurs through a call back process to customers that had previously reported an outage as well as through public advisories asking customers to call in again if their service is not restored.[76]

In the view of AmerenUE management, the AMI application has potential value during some restoration efforts to identify the remaining single outages after both feeder backbones and laterals have been restored. AmerenUE is currently working with CellNet on an automated, batch application for restoration verification. The system would interrogate a sample of meters at the distribution transformer level, i.e., one or two meters behind each transformer in an outage area to verify power restoration.[77]

11.3.4.2 The AMI infrastructure had a difficult time handling the volume of outage data created during the storms.

During the July event, the large number of AMI meters reporting service outages, and "Last Gasp" reports, bottlenecked the data flow from individual meters, through CellNet's Kansas City data aggregation server, to OAS.[78] The bottleneck resulted in the cessation of near real time AMI reporting to AmerenUE. Upon service restoration, the system usually took up to 36 hours to clear the event history before the network became usable again.[79] By this time, the backup batteries in the pole top collectors were exhausted. This situation did not instill confidence in EOC personnel that the AMI system could be a valuable tool during outages. This issue originated from poorly tuned system parameters compounded by a lack of consistent monitoring of the system by both CellNet and AmerenUE. Since the July 2006 event, both CellNet and AmerenUE have been working to resolve these issues. Another utility experienced similar issues during a recent major storm.

Even on a normal day, there are a number of delays both inherent and incorporated by design into the collection and processing of

[76] KEMA Interviews MK03, MK13, MK19
[77] KEMA Interview BS01
[78] KEMA Interview RG01
[79] KEMA Interview MK13

"Last Gasp" data resulting in delays of 12-17 minutes before AmerenUE's OAS sees the data. In the interim, during these major outage events, the SCADA system, where it is available, will have reported the feeder out and the DDO already taken corrective action. In those cases, the AMI data is now providing old information. Fortunately, the dispatchers have identified this data problem and manually ignored OAS entries originating from delayed AMI information in such cases. Recently AmerenUE installed filters in OAS to ignore old AMI information.

11.3.5 AmerenUE depends on its communications Network Operations Center (NOC) to support its internal information network. However, due to a lack of experience in handling Level III events, the NOC did not proactively monitor voice systems performance, nor was 24/7 coverage provided by voice network specialists for the call center during the July 2006 storm.

The NOC supports AmerenUE's operational systems through remote monitoring and on site trouble response. The NOC has developed a storm operations plan since the July 2006 storm. The plan calls for various levels of mobilization depending on the severity of the major event and includes the possible activation of 24-hour coverage and on premise support for resolving voice system issues.

AmerenUE reported incidences where incoming customer calls were lost between exiting the Voice Response Unit and being answered by a call center representative. During its 24-hour operation, the call center requested support from the NOC but was handicapped in resolving the issue due to a lack of 24-hour support.[80]

11.4 Recommendations

11.4.1 Continue enhancing the outage determination business logic in the OAS to improve the estimation of Expected Restoration Times and resource requirements during Level III and Level IV restorations.

Continue the enhancements to the OAS to further improve the determination of estimation of restoration times during Level II events. This should include:

[80] KEMA Interviews MK02, MK11

- Refining the handling of trouble tickets to avoid clearing entries associated with downstream damage on the feeders by amending the original outage ticket with Field Checker data on downstream events,
- Ensure the logic provides a means for reassigning customers to the closest known fault and decoupling the customers from the farthest upstream fault,
- Amending the OAS screens 62 and 63 to include counts of the damaged assets, spans down, poles down, etc., to support the estimation of resource requirements under Level III events,
- Improving OAS reporting functionality to support a quick damage assessment process for the EOC during its initial (0-6 hours) assessment of system damage and required resource requirements for restoration, and
- Test the recent enhancements to the OAS under simulated Level III and IV conditions to ensure it is functioning.

11.4.2 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.

Continue to develop a batch verification process to automatically verify service restoration of distribution circuits and some groups of single outages.

11.4.3 Evaluate the AMI (Advanced Metering Infrastructure) system ability to support large scale restoration events.

Continue the work between CellNet and AmerenUE to further identify and tune system parameters to alleviate bottlenecks associated with large data volumes during large-scale events.

12. Emergency Restoration – Customer Service

12.1 Industry Practices

The leading practice in electric utility customer service functions is to provide the first two-way communication with the customer before, during, and after outage events. As an outage event unfolds, the call center shifts from its initial role of receiving outage information from customers to providing restoration estimates designed to help customers cope with or react to the outage event. Near the expected end of the restoration period, the call center shifts to receiving outage information from individual customers still without power.

The customer service function includes the call center and its supporting technology. Generally, the supporting technology includes an Automatic Call Director (ACD), an Interactive Voice Response Unit (IVRU), and the utility's network telecommunications provider's network ("cloud") and related contracted-for overflow or backup capabilities. Utilities typically use various customer service and/or outage reporting systems to manage interaction with customers.

The volume of calls received is dependent on the:

- Severity of the outage,
- Customers' emergency preparations,
- Quality of the utility's external communications,
- Visibility and progression of the restoration,
- Availability and accuracy of restoration estimates, and
- Customers' communications capability during the outage event.

The call center should have access to information requested by customers. During outages, customers want specific actionable information to make their decisions. Each customer call that does not provide requested information may increase future call volume, as well as the frustration levels of customers and Customer Service Representatives (CSRs). At the same time, the utility may not have yet completed damage assessment or developed a specific restoration estimate for each area or outage.

12.2 AmerenUE Practices

AmerenUE's 250-seat virtual call center is consistent with industry leading designs. The call center provides two-way communication with the customer before, during, and after outage events. The call center is equipped with an ACD and IVRU. The call center is designed to support and augment the CSRs and can handle 150 calls while the remainder of the inbound calls will be queued for CSRs or queued for the IVR ports when they become available. AmerenUE provides both local and "800" numbers for customer contact, plus a dedicated number for police and fire calls. The AmerenUE call centers are designed to be "virtual" with the ability to shift calls among AmerenUE facilities in Missouri and Illinois, home located CSRs, and, if necessary, to a 3rd party staff augmentation firm located in North Carolina. AmerenUE also contracts for automated backup (overflow) service with the capacity of handling 30,000 calls per hour, shared among the Missouri and Illinois call centers. This service uses a bank of IVR equipment with a script and logic similar to AmerenUE's VRU. Information is shared from OAS every 10 minutes to ensure the Vendor IVR has information to communicate to customers. Exhibit 12-1 shows the inbound call flows.

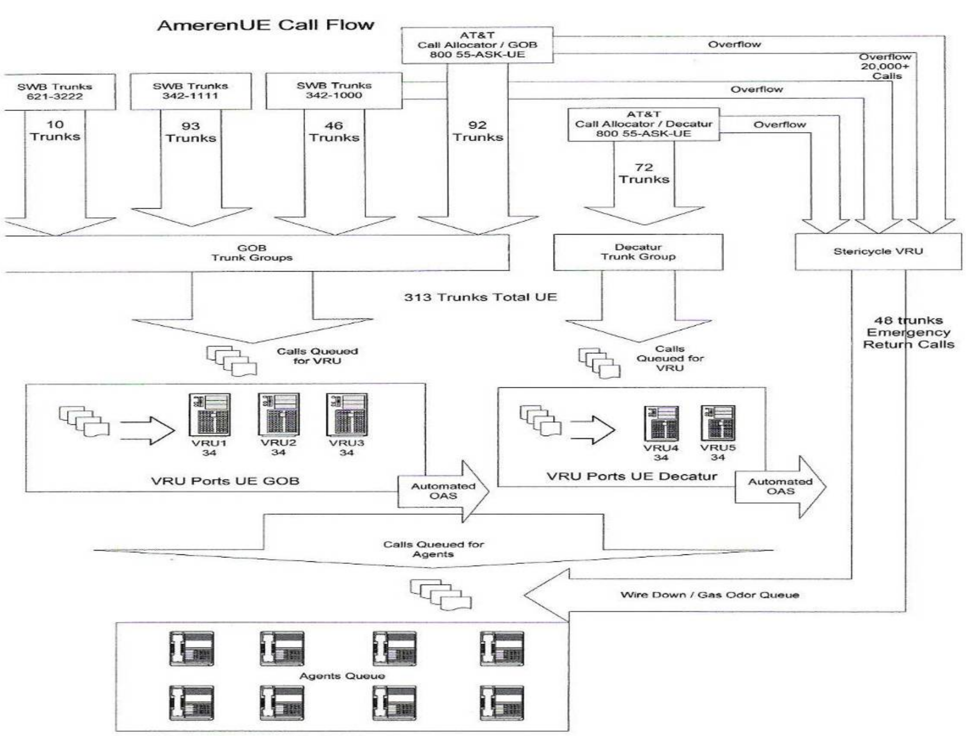

Exhibit 12-1: AmerenUE Inbound Call Flow

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12.3 Conclusions

12.3.1 AmerenUE's OAS for limited restorations (Level I and II) effectively communicates the status and provides estimated restoration times to customers.

CSRs and other AmerenUE personnel are trained in the use of OAS and training is offered often. The CSRs reviewed by KEMA were well versed in the use of OAS; and OAS performs in a timely manner.[81] Customers can provide a notice of a service interruption by their entries into AmerenUE's IVRU or through contact with a CSR. Customers can access outage and restoration information over the Internet during limited outages and review storm status by zip code or by direct entry based on service location account number or telephone number.[82]

Customers cannot use the IVRU to get restoration status. If a customer who has had a recently restored outage calls in, their call is automatically directed to a call-taker rather than allow them to log another "false" outage call. Customers have learned that they can call the IVRU to get an updated ERT. However, doing so, logs an outage call if they have been restored. The routing of this call to the CSR helps prevent this issue.

12.3.2 Because AmerenUE's OAS can take interruption data and provide timely restoration information from/to customers rapidly and effectively, during Level I and II restorations, AmerenUE has inadvertently raised customers' expectations during Level III restorations.

As discussed elsewhere, the OAS's capability to generate an estimated restoration time is not accurate or effective during a major storm (Level III), while damage is still being assessed and incremental foreign resources are being obtained. AmerenUE does shutdown the automated capability when a storm is determined to be major.[83] Additionally, during the July storm, AmerenUE was unprepared for the high volume on its Outage Map website resulting from the magnitude of the Level III storm and customers' desire for "real time" information.[84]

[81] KEMA Call Observations HS10
[82] KEMA Capability Review
[83] KEMA Interviews HS01, HS09, MK11
[84] KEMA Review of press clippings (St. Louis Post Dispatch, July 21, 2006) and KEMA review of Outage Information web page (7/24/06)

12.3.3 Customer service has established backup procedures to ensure that its call centers can continue to operate under a variety of potential problems.

The Call Center described its plans and procedures to operate without the support of OAS, if needed. AmerenUE has prepared for the loss of the OAS by readying paper outage "tickets" procedures to respond to "wire down" or "gas leak" calls and expeditiously "running" the paper tickets to the DDO.[85]

AmerenUE's virtual call center design further protects its operations if one call center should lose power, or otherwise become inoperable.[86] As described above, AmerenUE has designed its call centers to operate in tandem and has the capability of transferring or redirecting calls between its call centers in Missouri and Illinois and its North Carolina collection contractor. Further, AmerenUE's call centers are on one system and the employees have been cross trained (for outage information) between Missouri and Illinois.[87] This "virtual" call center design provides the flexibility to response to outages that might affect one or more AmerenUE call centers.

AmerenUE trains its CAD department employees annually to act as a resource for additional call center support.[88] Additionally, AmerenUE can use former call center employees; however, their training may not be up to date.[89]

AmerenUE's North Carolina service provider is trained to take certain calls, including outages. AmerenUE has contracted for automated overflow service, which can provide further backup capabilities.

12.3.4 AmerenUE reported two instances of the loss of calls during the storms.

During the July 2006 storm, AmerenUE's telecommunications network provider dumped calls due to its concern about overloading the public telecommunications network. AmerenUE has reviewed this situation with the provider and steps have been taken to avoid a recurrence.[90] During the January 2007 storm, AmerenUE's Automatic Call Director (ACD) placed approximately 4,275 calls in a dead queue

85 KEMA Interview HS09
86 KEMA Interviews HS01, HS09, MK11
87 KEMA Interview HS01
88 KEMA Interview HS01
89 KEMA Interview HS01
90 KEMA Interviews HS01, MK02, MK11

due to an equipment software failure. Customer Service and IT are reviewing that situation and will be implementing a fix to remedy the software failure.[91]

12.4 Recommendations

12.4.1 Complete the review of the loss of customer call situations.

AmerenUE should review the structure of its communications to determine opportunities for better service and avoid potential sources of lost calls. Specifically, AmerenUE should:

- Determine the needs of inbound communications stakeholders within and external to AmerenUE,
- Review potential call volumes during Level III and Level IV restorations,
- Determine the existing capabilities of its network provider and its virtual call center,
- Develop a series of realistic test scenarios for the external network and virtual call center, including appropriate loading on the network,
- Working with the external network provider, run the test scenarios under realistic conditions, and
- Evaluate the test results, and make appropriate changes.

12.4.2 Use the 800 network in front of Customer Service System/IVRU to enhance call-taking capacity and capabilities.

Using the 800 network in front of the call center and IVRU will allow AmerenUE to handle a greater volume of calls. This will eliminate the phone company's practice of pegging AmerenUE's incoming calls. The increased call volume can then, through Automated Number Identification (ANI), have a unique restoration message while allowing non-emergency calls to proceed to the call center. AmerenUE will be able to create real time messages for each of the ANI numbers and update as necessary. An added benefit to this configuration, as shown in Exhibit 12-2, is a potential reduction in the number of trunk lines coming into the call center.

[91] KEMA Interviews HS01, HS09, MK11

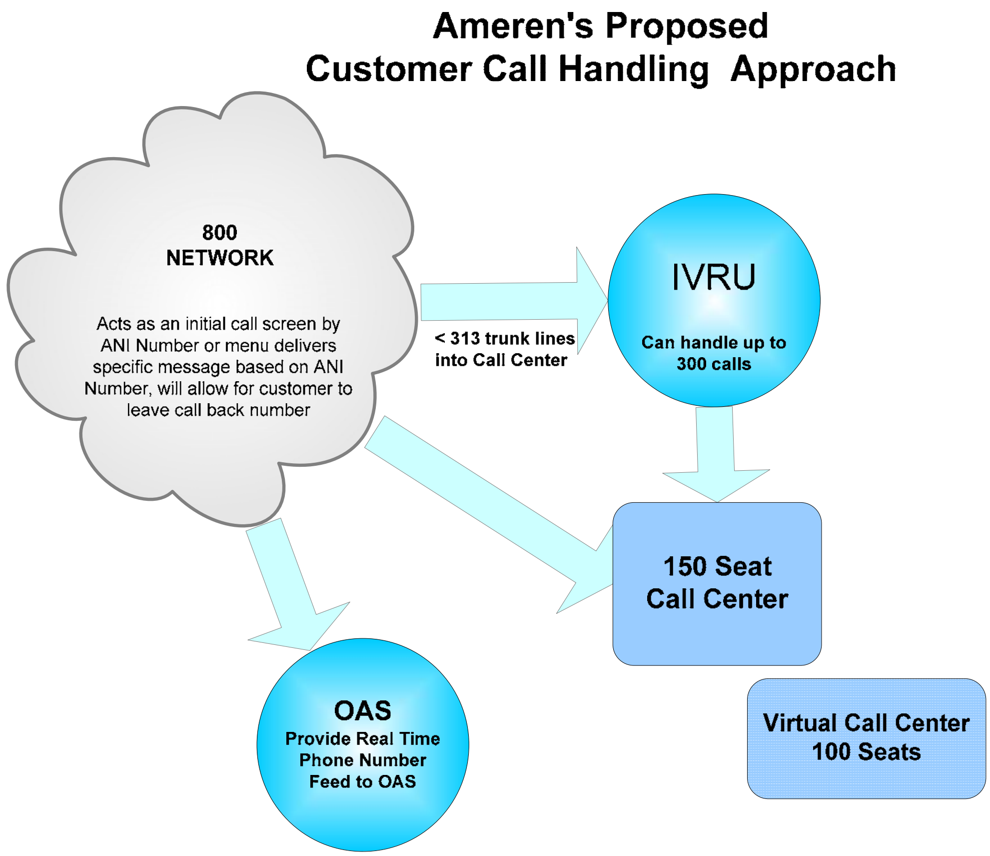

Exhibit 12-2: Using the 800 network as Front-end during Emergencies

13. Emergency Restoration – External Communications

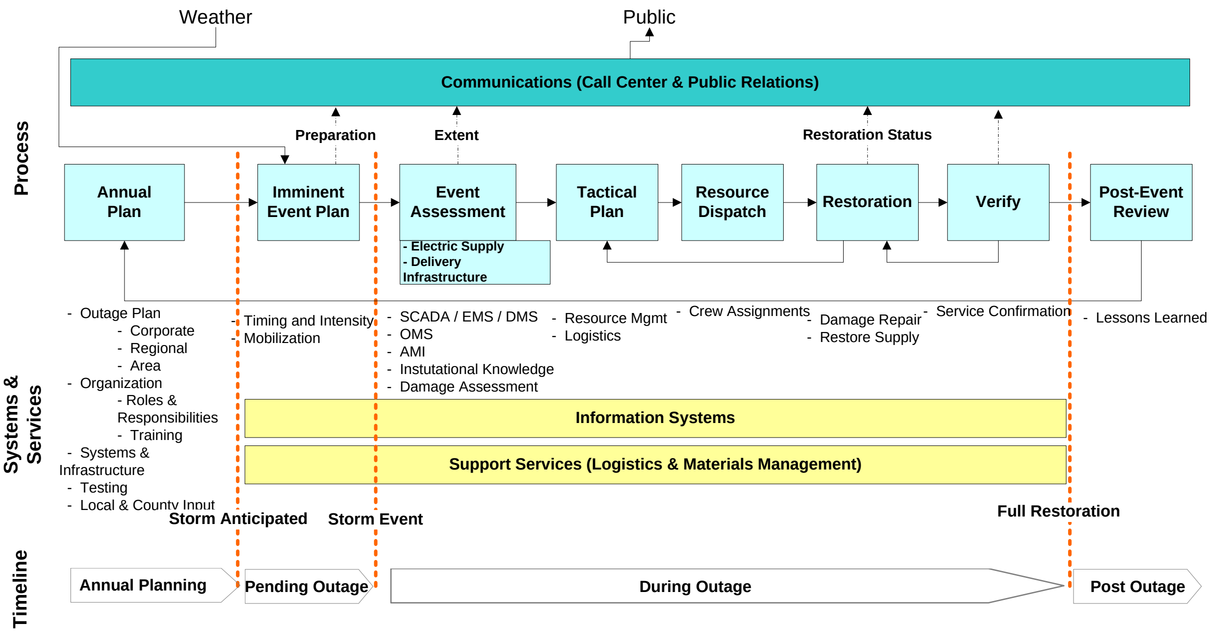

Exhibit 13-1: Outage Management Process – Communications

13.1 Industry Practices

A typical utility's external communications function provides information to customers before, during, and after outage events. External communications must also address the business community's needs to predict when service, and therefore, business, will be resumed. Government bodies such as local, county, state and regional authorities need restoration information to support public functions such as shelters, traffic control, food transportation and other essential public safety services such as healthcare and law enforcement. While it has similar functions as the call center, external communications is subject to customers' ability to receive TV, radio, print and internet media during outage events. Additionally, the media may act as a filter or interpreter, or even report news that dilutes the utility's intended message. Some utilities have messages pre-placed with radio stations to be played during storms to ensure the purity and clarity of its message gets to its customers. During restoration, the utility may decide to purchase radio time to send specific updated messages to its customers.

13.2 AmerenUE Practices

AmerenUE has a Corporate Communications organization, a Community Relations organization (functioning primarily in the metro St. Louis area) and a Key Accounts organization that are positioned to deliver messages and local information to affected customers, communities and other governmental organizations and major accounts during emergency events. All three departments rely on the twice-daily conference call initiated and managed by the EOC for timely and reliable information. In the suburban and rural areas, Division management also has a significant communications function including Customer Service Advisors (CSA).

AmerenUE has developed a (2007) Corporate Emergency Communications Plan and Manual.

13.3 Conclusions

13.3.1 The AmerenUE 2007 Corporate Emergency Communications Plan is comprehensive, well detailed and demonstrates that AmerenUE can develop appropriate communications processes.

The 2007 Corporate Emergency Communications Plan is detailed and defines key principles, the evaluation of emergencies, specific responsibilities, the establishment of the emergency news center (including the required support equipment), backup plans for loss of telecommunications capability, a step by step sequence of response actions to be made and detailed responsibility for the maintenance, distribution of the Plan.[92] However, the Plan has not been integrated with the Electric Emergency Restoration Plan.[93] The EOC provided, as an example, a less formal Emergency Communications Plan that dated from 1999. The 1999 version is very similar to the more polished and formal 2007 Corporate Emergency Communications Plan. AmerenUE updates its Emergency Communications Plan every three to five years.

[92] KEMA review of the Plan document

[93] KEMA Interview RG1 and KEMA review of Electric Emergency Restoration Plan

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13.3.2 The EOC and its twice-daily conference calls are viewed as responsive to the information needs of the various communications functions, however during the first two storms actionable information for customers, such as estimated restoration times, was not provided.

The twice-daily conference calls are viewed as a very important, useful intra-company communications method by Corporate Communications, Key Accounts, Community Relations, Customer Service, Regulatory, and the Divisions.[94] The EOC also provides information directly to state and county EOC and some localities upon request.[95]

Although Corporate Communications attended the twice daily conference calls and visited the EOC often, restoration information was not forthcoming or was inaccurate, due again to its having been difficult to ascertain given the magnitude of the storms.[96] During the July and December 2006 storms, no restoration time estimates were recorded as issued by the EOC. This limited the information that could be provided to customers (see below).

13.3.3 Key Accounts was able to leverage its relationships with major customers and provide them with actionable information.

Key Accounts followed the restoration process by attending the twice-daily EOC conference calls and using the company's press releases. Working as a team, Key Accounts contacted its customers twice daily and was able to provide key account customers with specific information about the overall timing of the restoration. This allowed those customers to use this information to determine if they should obtain generators or plan for further facility shutdowns. AmerenUE received many letters of thanks from key accounts.[97]

[94] KEMA Interviews HS01, HS03, HS09, HS13, HS17, HS18
[95] KEMA Interviews MK19, HS16
[96] KEMA Interview RG1 and KEMA Data Request
[97] KEMA Document Request HS03-01

13.3.4 During the first two storms, AmerenUE's initial communications to customers lacked specificity and provided limited actionable information during the restoration. AmerenUE did not provide localized estimated restoration times. However, in the second half of the January storm, AmerenUE did provide this needed information to customers.

Instead of waiting for a definitive damage estimate, AmerenUE should have communicated the severity of the outage to its customers sooner. Lacking specific information to communicate the severity of the outage in terms such as the expected length of the restoration (number of days), AmerenUE added additional stress to its customers during the restoration.[98] Some concern was expressed that AmerenUE senior management was unwilling to release estimates of the full extent of the storm.[99]

It is reasonable to expect that customers be informed of the potential extent of the storm event outage, even if a customer or area specific estimate cannot be provided early in the restoration process. This information would have allowed customers to make better decisions about how to best cope with the outage. Their options included staying in place, moving to relatives or friends with utility service, moving to a motel or hotel, or leaving the area. The public is encouraged by government agencies[100] to plan for self -sufficiency for up to 72 hours before mobilization of governmental assistance.

KEMA's review of AmerenUE's press releases for the three major storms indicate that terms such as number of customers out were used inconsistently by reporting numbers from different geographic focus.[101] Similar press releases used differing numbers on the same day and further confused the issue by not including a specific time.[102] There was no consistent format used to present the information to the public. Some press releases did not include the release time although all did include the release date. While AmerenUE did provide frequent press updates during the restoration process, its communications during that period did not use clear language nor provide a specific estimate of the number of days it may take to restore power. The information necessary was simply not available. AmerenUE should consider whether it issued too many press releases.

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98 KEMA Interviews HS03, HS13, HS16, HS18, MK11, MK12
99 KEMA Interview MK11
100 http://www.ready.gov/america/getakit/index.html
101 KEMA Interview HS04
102 KEMA review of communications materials and press releases (December storm)

Examples from the July storm include:

- "will take at least 72 hours (7/20)",
- "may be out as long as 72 hours-and some could be out longer than that (7/21)",
- No restoration estimates were provided (7/21 @2 PM), (7/22 @10 AM & 4:30 PM), (7/23 @noon),
- "restoration time may slip into Tuesday or Wednesday" (7/23 @4:30 PM),
- "AmerenUE officials originally estimated that the majority of the affected customers will be restored by Tuesday night, with the remainder Wednesday and the very last customers on Thursday" (Monday 7/24 @4:30 PM),
- No restoration estimate (7/25 @9 PM), (7/26 @9 PM), (7/27 @9 PM), and
- There was no evidence of localized or tailored restoration estimates during the July storm.[103]

Examples from the December storm include:

- "Lengthy outages are expected" (12/1 no time on press release),
- No restoration estimates were provided (12/1 @5 PM) and (12/1 no time on press release),
- "Bulk expected to be restored by end of day Wednesday, Dec. 6 with remainder Thursday and Friday" (12/5 @10 AM), and
- "Storm wrapping up today" (no date or time on press release).[104]

Examples from the January storm include:

- "AmerenUE Illinois Utilities Prepare for predicted winter weather watch", (1/12)
- "A restoration update will be provided later today. Lengthy outages are expected." (1/13 @8 AM), and

[103] KEMA review of communications materials and press releases
[104] KEMA review of communications materials and press releases

- No restoration estimate (1/13 @5 PM).

On January 14th at 5 PM AmerenUE began to provide specific restoration estimates by geographic areas and the information was provided on the subsequent press releases.[105]

13.3.5 AmerenUE does not have a well defined media process to convey restoration information directly to customers and thus was subject to the media's discretion, editing and juxtaposing of AmerenUE's intended message.

Utilities have considered whether message boards or postings in places of public assembly would be useful during mass outages. Some utilities purchase radio airtime to ensure their exact messages are delivered at specified times. AmerenUE did not use or consider this method of communicating with customers.[106] On occasion, AmerenUE has used existing media time or newspaper advertisements to communicate with customers during an outage.

AmerenUE does use press releases, press conferences and the management interview to communicate with customers. AmerenUE also uses email "Blasts" to share information. Presently, 386,000 customers are registered to receive these email messages.

By relying on the media's discretion to transmit AmerenUE's restoration messaging to customers, AmerenUE created the possibility that it would lose control of its intended message. KEMA's review of press clippings indicated that preceding negative events such as restoration from storms in 2004 and 2005 and inadequate tree trimming expenditures were mentioned along with AmerenUE's storm messaging,[107] thus diluting AmerenUE's intended message and reducing the public's confidence in AmerenUE capabilities and outage restoration efforts.

13.3.6 AmerenUE did not have a critical facility list or a methodology to define a critical customer facility. Therefore, it was not clear whether critical facilities receive the information they need.

Key Accounts and Community Relations have varying definitions of critical facilities and they can overlap in responsibilities for critical public service

[105] KEMA review of communications materials and press releases
[106] KEMA Data Request HS04, HS13, HS16 Fox, Gallagher, Cowan
[107] KEMA Review of press clippings (St. Louis Post Dispatch, July 21, 2006, also July 22, 2006)

facilities such as water and sewer service.[108] When requested, no one in the communications area produced a critical facilities list.[109] Individual customers can self-report medical needs and AmerenUE tracks that information in its customer information system.[110]

The EOC maintains two lists of priority customers, the first within OAS/CSS and covers all customer classes. The Distribution Dispatch Office maintains a very short list of priority customers fed from the 34kV system (major hospitals, fire, and police) that can be restored by a troubleman. The Divisions are responsible for prioritizing high priority customers not fed from the 34kV system.[111]

13.3.7 Community Relations has offered tours of the EOC and meetings with Company personnel were well received. However, when offered an opportunity to be on AmerenUE's e-mail list for storm updates, interest was low.

To foster communications with Metro St. Louis area communities, prior to the storm season AmerenUE's Community Relations manager arranged tours of the EOC to provide details of the restoration process. In addition, maps showing the specific AmerenUE District boundaries and listing the names and phone numbers of key District personnel to contact on service related issues was distributed to St. Louis metropolitan communities. As a follow-up to all this AmerenUE offered to provide e-mail restoration updates during major outages. Little interest was expressed by the participants. Interest in the e-mail updates may have been low because many municipalities are accustomed to contacting AmerenUE's EOC directly by telephone as their information needs develop.[112]

13.3.8 While a draft AmerenUE communications plan exists, there appears to be no corporate wide focus on communications.

A Communications Plan for Severe Storms[113] and a Corporate Emergency Communications Plan does exist (described above).[114] Without a defined corporate communications strategy, the efforts of Corporate Communications, Employee Communications, Key Accounts, Community Relations, Customer

[108] KEMA Interviews HS03, HS16
[109] KEMA Interviews HS03, HS11, HS16, HS17
[110] KEMA Data Request HS01, HS09, MK11
[111] KEMA Interviews HS17, MK19
[112] KEMA Interviews MK19, HS16
[113] KEMA Data Request HS13-1
[114] KEMA Data Request HS13-2

Service, Regulatory and Customer Service Advisors located at the Divisions appear unevenly supported and unevenly executed. Effective communications with customers begins during periods of normal business and the relationship thus developed adds support during times of stress such as emergency restoration.

13.3.9 Over a number of years, AmerenUE has reduced its outreach to the community. This reduction appears to have affected the level of goodwill and communications between AmerenUE and its customers.

During periods of adversity and operating performance problems, AmerenUE has limited or no “banked” goodwill and relationships to offset customers’ perception of current events. No formal program to encourage active participation by AmerenUE employees in charitable, community, volunteer activities, and appointment to governmental bodies exists.[115] AmerenUE no longer has a Speaker’s Bureau.[116]

13.3.10 Division management augments its CSA by encouraging and supporting employees that volunteer to join and support groups such as the local chambers of commerce.

KEMA analyzed the coverage of local governmental meetings, participation in local and county EOC, boards and authorities, chambers of commerce and community organizations and found the coverage uneven across the divisions.[117] To overcome limited communications resources, Division management encourages its employees to participate in community meetings, boards and chambers.[118] This practice can provide important benefits to AmerenUE and career development opportunities to the employee. Additionally, it creates a sense of goodwill and opportunities to explain restoration practices in advance of a storm. However, because AmerenUE does not have a Corporate Communications Strategy or Plan the efforts within the Divisions differ in breadth and level of intensity.[119]

[115] KEMA Data Request Gallagher, Davis, Cowan, General
[116] KEMA Interview HS16
[117] KEMA Data Request Division Manager Survey
[118] KEMA Interview HS17
[119] KEMA Data Request Division Manager Survey

13.3.11 While the recent J.D. Powers survey confirmed that AmerenUE is not viewed positively by its customers, many employees report that their immediate neighbors have a much better view of AmerenUE and its storm restoration efforts.

The recent survey ranked AmerenUE second worst in the Midwest.[120] Anecdotally, AmerenUE employees report that their neighbors understand and recognize their extended efforts to minimize storm restoration times.[121] This different level of customer opinion indicates that a broader or more intensive communications strategy may provide benefits to AmerenUE.

13.3.12 While the Missouri Public Service Commission received a large number of customers' comments about AmerenUE during and after the three storms, the volume was not unusual or excessive considering the magnitude of the storms and the on-going rate case and other issues.

The Missouri Commission provided a detailed listing of AmerenUE customers' calls received by the Commission from 2002, with specific customer names and other identifying information removed. The calls covered a wide range of issues important to customers. For a significant number of calls the caller's concern could not be ascertained from the information provided. As expected, call frequency increased during and after the three storms. The notations provided by the Commission support the conclusions within this report relating to estimates of restoration times, communications and operations. KEMA analyzed the call data provided and considering the magnitude of the three storms, the number of calls received by the Commission do not appear to be excessive.[122]

[120] KEMA Interview MK12, KEMA Data Request MK12-01
[121] KEMA Interviews HS05, HS08, HS09, HS12, HS15
[122] KEMA review of Commission supplied data

13.4 Recommendations

13.4.1 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.

AmerenUE must create public messages in line with the EOC restoration dashboard information. Specifically, AmerenUE should:

- Determine the needs of stakeholders (senior management, restoration employees, regular employees, suppliers, customers, key accounts, governmental entities, state and county EOC, regulators, etc.) within and external to AmerenUE, including frequency of updates, format and content,
- Determine and arrange for reliable and timely sources for the information,
- Determine which AmerenUE communication function (Corporate Communications, Community Relations, Key Accounts, regulatory, Division Management, senior management, etc.) is responsible for the delivery of information to a specific external stakeholder in the manner and format that meets their needs (phone, fax, e-mail, radio, other),
- Document the communications process including specific responsibilities,
- Develop and run realistic test scenarios that includes external stakeholders,
- Evaluate the test results and make appropriate adjustments, and
- Document the communications process and integrate within the ERP.

13.4.2 Develop a process to deliver AmerenUE's restoration information and estimates directly to customers in a form under AmerenUE's control.

AmerenUE must control the message content to its customers and other stakeholders, to the extent possible. Consider implementing the following actions:

- Evaluate media and other delivery methods (radio, text messaging, web, posting boards at mass assembly locations, dynamic billboards etc.),

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- Structure a trial process,
- Develop communications partners (radio stations (limited number with specific coverage), text, web and mass assembly locations),
- Document the communications process including specific responsibilities,
- Develop and run realistic test scenarios that includes external delivery methods,
- Evaluate the test results including penetration and timeliness and make adjustments, and
- Document the communications delivery process and integrate within the EERP.

13.4.3 Enhance the newly created critical facility list and define responsibilities and expected outcomes.

For an effective restoration, and to minimize public inconvenience, AmerenUE must communicate with the operators of critical facilities and therefore needs to have a structured process to identify those facilities and determine the optimum communications method and the information required by the operators. AmerenUE should undertake the following actions with regard to critical facilities:

- Define critical facilities in conjunction with stakeholders (senior management, suppliers, customers, key accounts, healthcare, other utilities, cellular providers, governmental entities, state and county EOC, disaster recovery (Red Cross and other shelters), regulators, etc.) within and external to AmerenUE,
- Identify critical facilities,
- Cross reference critical facilities to OAS, SCADA, CellNet, etc.,
- Determine specific information needs and delivery methods by type of critical facility,
- Assign specific responsibilities by type of critical facility to specific internal AmerenUE organizations,

- Document the critical facilities communications process including specific responsibilities,
- Develop and test realistic test scenarios that includes external stakeholders,
- Evaluate the test results and make adjustments, and
- Document the critical facilities communications process and integrate within the EERP.

13.4.4 Refine the Corporate Communications Strategy.

AmerenUE's relationship with customers, regulators, and public officials' goodwill has been severely strained by the three storms. AmerenUE should rebuild those relationships to ensure that the restoration process for future storms and outages are not impacted by poor relationships or unnecessary public comments. AmerenUE should undertake the following actions with regard to a Corporate Communications Strategy:

- Develop over arching goals for the Corporate Communications Strategy including performance measures,
- Document the needs of stakeholders within and external to AmerenUE,
- Consider alternative methodologies to reach goals (including strategies used by utilities and non- utility organizations),
- Determine a reasonable, sustainable long-term budget (including staffing additions), also consider reduction of unproductive or unrelated activities,
- Define which AmerenUE function (senior management, Corporate Communications, Community Relations, Key Accounts, Regulatory, Division Management, governmental relations, etc.) is responsible for the communications with each specific external stakeholder in the manner and format that meets their needs,
- Document the Corporate Communications process including specific responsibilities and performance measures,
- Measure results, and
- Adjust the Corporate Communications Strategy as appropriate.

14. Supply Chain

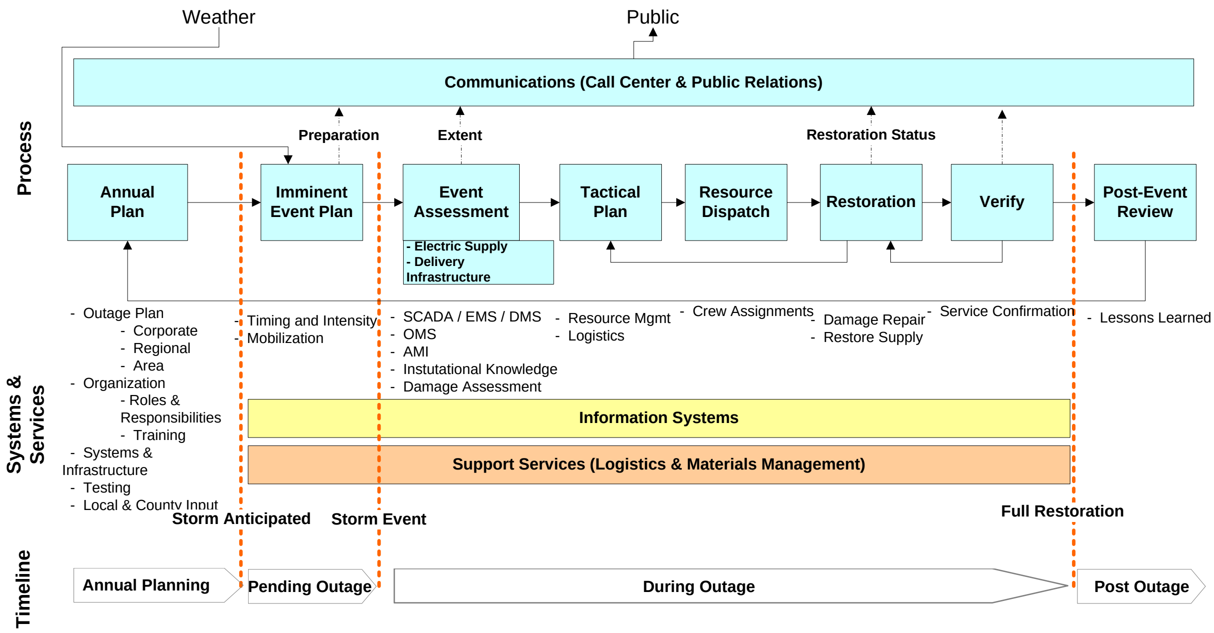

Exhibit 14-1: Outage Management Process – Supply Chain

14.1 Industry Practices

At all utilities, an outage event requires the availability of materials needed to repair or replace damaged infrastructure. These materials must be delivered to the right location in a timely fashion to maintain crew productivity. Supply Chain Operations must receive specific requests for materials from operating centers and must communicate delivery times and locations to field operations. The effectiveness of the Supply Chain directly affects the planning and execution of any storm event.

Due to long lead times for certain materials, Supply Chain Operations (purchasing, inventory control, storerooms, and distribution functions) requires planning to respond to an outage event. Pre-stocking of outage reserves within operating center storerooms or at other locations is needed to ensure rapid response and reduce transportation requirements during outage events. Further, major restorations consume materials at rates well above any reasonable level of outage reserves. The establishment of dedicated storm reserve stock is a small cost to ensure timely restoration from a major outage. Supply Chain Operations must have plans in place to manage rapidly changing inventories, restock storerooms and crews effectively and order, track and expedite materials from suppliers.

14.2 AmerenUE Practices

Purchasing and inventory control operate from AmerenUE's headquarters. AmerenUE supports its Missouri restoration operations from its central Dorsett storeroom, other storerooms and a fleet of dedicated "storm trailers."

Based on previous experience, AmerenUE has detailed lists of required storm materials and begins the ordering process as the storm begins, in advance of the formal damage assessment.

AmerenUE has a materials management information system and application that operated in a mainframe environment for the three storms, but now a replacement system operates in a client server environment. These systems provide the needed functionality to source, request, procure, and issue materials. To overcome some inherent time lags within the materials management information system, AmerenUE uses spreadsheets and on-site material management coordination ("eyeballs") at the storerooms.

14.3 Conclusions

14.3.1 Supply Chain Operations performed very well before, during, and after each of the three storms.

At the beginning of each storm, inventory control placed large orders for the expected storm restoration materials usage. AmerenUE drew upon its documented storm requirements in previous storms to improve the accuracy in defining these initial orders for each of the three major storms.[123] One inventory control supervisor shifted from the corporate offices to the Dorsett storeroom to ensure that inventory levels were observed and confirmed first hand.[124] Key Supply Chain Operations personnel also shifted to other locations as needed. To insure clarity of roles, the responsibility for ordering was delegated to senior buyers, while the junior buyers assumed the expediting role.[125]

AmerenUE's Supply Chain Operations implemented procedures to supply materials, in needed and appropriate quantities and lengths and to meter out supplies to crews during the early days of the storms.[126] This attention to detail avoids material shortfalls. As a result of experience from the July 2006 storm,

[123] KEMA Interviews HS02, HS14, HS15
[124] KEMA Interviews HS14, HS15
[125] KEMA Interview HS15
[126] KEMA Interviews HS05, HS06, HS08

AmerenUE's stores department developed methods to cost effectively retrieve excess materials from departing contractors.[127]

AmerenUE's management worked collaboratively with the union and the bargaining unit employees supported the restoration effort well.[128]

14.3.2 AmerenUE's manned "Storm Trailer" concept provides a well-managed, specific, and reserved inventory of commonly used restoration materials that can be staged close to affected area(s).

AmerenUE has innovatively implemented the "storm trailer" utility leading practice. The AmerenUE storm trailers contain specific restoration material neatly organized in specially designed 53-foot over-the-road trailers. There are inventory levels determined for the storm trailers[129] and a "crew" is designated to manage "a storm trailer. The "crew" is staffed by experienced storeroom employees augmented by employees from AmerenUE's power plants,[130] thus expanding the capabilities of Supply Chain Operations. These crews were trained to recognize distribution materials through an Overhead Line Familiarization Program. To support the reordering of materials each Storm Trailer is equipped with laptops that can access AmerenUE's materials management system over a wireless network.[131] Together the storm trailers, dedicated inventory levels, specifically trained and designated staffing and access to the materials management system forms a very innovative package. Exhibit 14-2 and Exhibit 14-3 shows these Storm Trailers. As shown in Exhibit 14-2 the cross arms are conveniently stored in a special rack under the trailer, leaving valuable interior space for small stock items.

[127] KEMA Interviews HS06, HS08, MK09
[128] KEMA Interviews HS02, HS06, HS08, HS15
[129] KEMA Interview HS06
[130] KEMA Interviews HS06, HS08
[131] KEMA Interview HS06

Exhibit 14-2: Storm Trailer

Exhibit 14-3: Inside of a Storm Trailer

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14.3.3 "EMPRV", the Materials Management Information System (MMIS) replacement, is a concern for Supply Chain Operations because it is slower than MMIS, which already requires the use of paper to support materials selection and order status.

This conclusion regarding the MMIS is supported by the following two findings.

14.3.3.1 MMIS has now been replaced by a new materials system (EMPRV), which concerns Supply Chain Operations because it is slower than MMIS. AmerenUE has not investigated the limitations of EMPRV under storm restoration conditions, to determine the impact on timely receipt and delivery of materials.

Supply Chain Operations has expressed their concerns over EMPRV's slow response time to the IT organization, which has achieved some changes. EMPRV is still considered slower than MMIS by many within Supply Chain Operations.[132] An example includes long delays to assemble material status reports.

If EMPRV is significantly slower than MMIS during storm conditions, AmerenUE's Supply Chain Operations performance could affect restoration efficiency. Because the paper methodology is used to provide rapid service, it is a critical link to the EMPRV system. AmerenUE should develop a program to investigate the EMPRV performance concerns.

14.3.3.2 The MMIS was augmented by paper forms/reports to minimize the process time for both material selection and order status.

Because of concerns over the response time between MMIS and Oracle and handheld devices used for the pick function, a paper based methodology was developed and used in both inventory control and the storeroom.[133] The paper methodology allowed more rapid supply and then the information was entered into the MMIS. This accommodation was viewed positively by Supply Chain Operations.

132 KEMA Interviews HS08, HS14, HS15
133 KEMA Interviews HS06, HS08, HS14, HS15, response to KEMA Data Request

14.3.4 During the first two storms, Standards Department employees were used as field checkers, which had an impact on information needed for substitutions when approved materials were not available. However, for the third storm Standards ensured that adequate support was available.

Standards personnel, who have strong knowledge about the distribution system, were wisely designated to perform the field checker role.[134] However, when pre-qualified materials and/or suppliers are unavailable during a storm, Purchasing must obtain approvals for substitute materials from the Standards Department to maintain system integrity. While no clear examples were cited of materials delays, Supply Chain Operations expressed concerns and Standards provided support as needed during the first two storms. In response to Supply Chain Operations' needs, Standards ensured coverage was provided during the third storm.[135]

14.4 Recommendations

14.4.1 Develop and perform a realistic test for EMPRV.

EMPRV needs to work well during a restoration effort. Further, the tool should minimize the need for the use of paper except in the most extreme conditions where communications has been interrupted. Consider the following recommended actions:

- Determine the needs of supply chain stakeholders within and external to AmerenUE,
- Develop a series of realistic test scenarios for EMPRV, including unrelated loading on the client server and a backcast of the three storms,
- Run the test scenarios under realistic conditions,
- Evaluate the test results, and
- Determine if changes are required and make changes.

[134] KEMA Interviews HS14, HS15
[135] KEMA Interviews HS14, HS15

15. Support Logistics

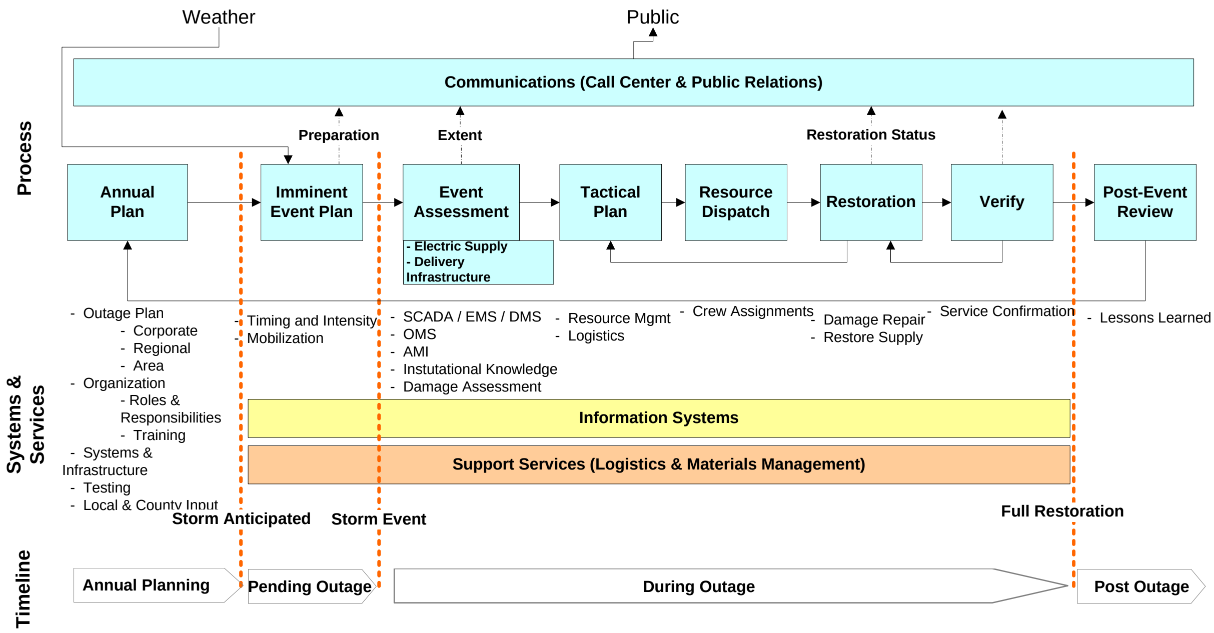

Exhibit 15-1: Outage Management Process – Support Logistics

15.1 Industry Practices

The typical utility must be prepared to provide support such as food and lodging for both its own employees while working long outage shifts and outside restoration crews. This requirement is complicated by the typical 16-18 hour shifts used during the early phases of restoration, which leave little time for needed rest and travel to accommodations.

For efficiency, many utilities arrange catering services that deliver lunches to crews at their work locations and provide breakfast and dinner at the beginning and end of the workday. This alleviates the need for crews to travel from the work site two or three times per day. The hotel/motel accommodations also require creativity, as the parking lots must be able to accommodate a large line trucks and other vehicles. In some circumstances, local hotel/motels cannot be used if they are still without power. A well-designed support logistics program avoids undue use of facilities that the utility's customers may also need such as hotel/motel rooms and restaurants.

15.2 AmerenUE Practices

AmerenUE provided the expected food and lodging, but also provided shuttle vans to move crews from their lodging to staging areas, security for Company facilities and vehicles parked overnight, and contracted for staging areas for foreign crews and vehicles. Notably, AmerenUE contracted for a mobile laundry facility and employees volunteered to process line workers' clothing to maintain the pace of the restoration.

15.3 Conclusions

15.3.1 To meet the unexpected needs to effectively lodge, provision, and support foreign contractors and mutual aid crews, AmerenUE developed cost effective support logistics methods. While a number of employees have experience during storms, AmerenUE has not documented its support logistics process for Level III storms.

In August 2005 AmerenUE centralized storm support logistics.[136] For the July 2006 storm AmerenUE used two college dormitories to provide lodging for over 700 foreign crew members.[137] This innovative concept reduced costs and eliminated competition for lodging with AmerenUE's customers. AmerenUE arranged for buffet breakfasts and dinners to be catered at the lodging sites to manage costs and eliminate transit time to restaurants. Box lunches were distributed before daily dispatch to eliminate crew time lost by traveling to and waiting to be served in restaurants.

During the winter storms, the dormitories were not available and AmerenUE shifted its focus to geographically select accommodations that reduced transit and meal time.[138] As necessary, AmerenUE provided buses to transfer crews from staging areas if the lodging did not have adequate parking space for work vehicles and provided security at the staging areas and lodging to protect line crews' work vehicles.

Over 200 AmerenUE employees volunteered to assist with support logistics and provide local knowledge for foreign crews. AmerenUE contracted for a mobile

[136] KEMA Interview MK12
[137] KEMA Interview MK12
[138] KEMA Interview MK12

laundry facility and AmerenUE employees volunteered to process line workers' clothing to maintain the pace of the restoration.[139]

However, AmerenUE has not documented the process it used during Level III storms. This leaves AmerenUE vulnerable to a lower level of performance if the designated employee is unavailable.

15.3.2 To ensure safety and maximize its available work force, AmerenUE provided lodging to its own linemen if their home was without power.

Upon request, AmerenUE provided each lineman and his/her family one room if their home was without power.[140] This accommodation was provided to ensure adequate rest for the employee and to eliminate their concerns about their family's safety.

15.3.3 AmerenUE has not developed a rapid method to transfer the crew information available at the EOC to the support logistics function. Although AmerenUE has long term plans to use the capabilities of Resources on Demand it has not yet developed a plan to implement or test the software's ability to manage the support logistics function under storm restoration conditions.

Information was transferred by conferences among the relevant AmerenUE employees. The status of support logistics was maintained on spreadsheets with data manually entered. Minor problems including specific lodging requirements by crew and foreman and the timeliness of this information transfer occurred. At present AmerenUE will continue to use spreadsheets for those functions.[141]

AmerenUE will begin the implementation of version 3.0 of the software program "Resources on Demand", which is designed to track the resources available to the EOC and manage the support logistics function, however at this time implementation has not begun to extend the capabilities to support logistics.[142] AmerenUE participated in the development of the changes to the software program for versions 2.5 and 3.0 and has plans to implement the tie between crew management and the support logistics capabilities of the program at some undetermined point in the future.

[139] KEMA Interview HS12, KEMA Data Request MK12-0X
[140] KEMA Interview MK12
[141] KEMA Interviews MK12, HS12
[142] KEMA Interview HS12

15.4 Recommendations

15.4.1 Develop an implementation plan for Resources on Demand (3.0) to support the support logistics function and all contractors and mutual aid crews.

Document all the work that has gone into managing the logistics processes supporting the restoration process. Specifically, AmerenUE should:

- Document the current support logistics process,
- Determine the needs of support logistics stakeholders within and external to AmerenUE,
- Determine the capabilities of Resources on Demand,
- Map the needs compared to the capabilities,
- Implement the support logistics function on Resources on Demand,
- Develop a series of realistic test scenarios, including unrelated loading on the client server and a backcast of the three storms,
- Run the test scenarios under realistic conditions,
- Evaluate the test results,
- Make appropriate adjustments to the support logistics Resources on Demand implementation,
- Retest and evaluate, and
- Document the support logistics function under Resources on Demand.

16. Appendices

16.1 List of Exhibits

16.2 Comparative Data of Line Design and Pole Loading

COMPANY CODE	A	B	C	D	E	F	G
No. of customers	4,700,000	310,000	520,000	2,202,625	650,000	5,271,365	4,400,000
Customer class distribution							
Residential	34%	60%	60%	91%	60%	88%	88%
Commercial	46%	35%	20%	8%	20%	9%	11%
Industrial	20%	15%	20%	1%	20%	1%	1%
Percent OH/UG	64/36	60/40	70/30	71/29	67.5/32.5	80/20	83/17
Pole loading/design criteria	CA GO 95	NESC	NESC Gr B	NESC	NESC	CA GO 95	NESC Hvy Ldg
Max wind speed for design	100 mph	85 mph over 60 '	-	-	60 mph	56 mph	NESC
(wood, steel, concrete, composite)	w, s, composite	w,c,s,comp	w,s,comp	w	w,c	w	w, com
Setting depths of poles	Generally 10%+2 feet w/ 6' min.						
Typical span length (in feet)							
Feeders	200	250	200-300	200	200	150-300	138
Laterals	200	200	200-300	200-300	100	150-300	155
Software used for pole calcs	In-house	IDF-PRO	In-house,PLS	Unknown	O-CALC	In-house	In-house
Size of OH wire							
Feeders	336 ACSR	336 & 795	477	636 Al	336 Al	715 AA	336 AAC
Laterals	1/0 ACSR	#2	#2	1/0 ACSR	#2 AAAC	#4 ACSR	#4 & 1/0 ACSR
Use tree wire or spacer cable	Yes 1/0 ACSR	No	No	Yes,336&636	336/ 2/0 /#2	4/0 1/0	Yes
Type of insulators for storm prone areas	Porc & poly-clamp	Porc & poly	-	-	Porc-tie type	porc&poly/tie/clamp	n/a
Use different hardware to mount insulators	No	No	No	No	No	No	No
Framing used in storm areas	c-arm, delta	c-arm, vert	-	c-arm	c-arm,vert, delta	c-arm, delta	n/a
Any extra structural design for storm areas	Storm guys, washers	side guys	no	no	storm guys	no	no
Special UG design for storm areas	No	Bog shoes	No	No	No	Submersible	No
Special design for environ. Sensitive areas	No	Yes	No	No	Ye	Yes	Yes
Use any break away devices	No	No	No	No	No	No	s/l pole bases
Use special wire to reduce wind load	No	No	T2-2 (4/0) dplx	No	No	No	No
Any other special products for storm loading	No	No	No	No	No	No	PLP dampers
Equip used to install heavy poles (>5K lbs)							
Investigating new construction/materials	No	No	No	No	Trng on pole calcs	No	No

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