Final Report on the Investigation of Wind and Ice Storm Preparedness and Restoration of the Ameren Illinois Companies

Presented to the:

Illinois Commerce Commission

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August 15, 2008

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Executive Summary

After storms in the summer and early winter of 2006 caused many, lengthy service interruptions in the territory served by the three Ameren companies in Illinois, the Illinois Commerce Commission (ICC) asked for an investigation to determine whether those companies:

- Appropriately planned, designed, constructed, inspected, and maintained their electricity delivery systems
- Adequately planned, prepared, and executed service restoration efforts following the July 2006 windstorms and the November/December 2006 ice storm.

In late August 2007, the ICC and The Liberty Consulting Group (Liberty) executed a contract for that investigation. This report provides the results of Phase 1 of Liberty's investigation. Phase 2 consists of Liberty's verification of Ameren's implementation of the recommendations in this report.

The three Ameren companies in Illinois are the former Central Illinois Public Service Company (including the former Union Electric territories in Alton and East St. Louis), the former Central Illinois Light Company, and the former Illinois Power Company. In this report, Liberty refers to these companies as Ameren-CIPS, Ameren-CILCO, and Ameren-IP. Liberty found that while some practices from the legacy companies exist, Ameren in Illinois operates as one electric utility. Liberty refers to that utility as Ameren-IL. Ameren-IL receives services from the corporate parent, Ameren, which also owns and operates the former Union Electric Company in Missouri.

This report contains some positive findings and many opportunities for improvement regarding Ameren-IL's electric delivery system and the response to the 2006 storms. The report contains nearly 160 recommendations for improvement. A few of those recommendations refer to initiatives that Ameren-IL has undertaken since the 2006 storms. Liberty included those recommendations as a means to track Ameren-IL's implementation of those initiatives in Phase 2 of the investigation.

Despite the large number of areas in which Ameren-IL can improve, Liberty's overall conclusions are that Ameren-IL acceptably planned, designed, constructed, and maintained its electric delivery systems, and that it worked very hard to restore its customers' service following the 2006 storms.

The interference of vegetation with overhead electric facilities caused much of the storm damage. Ameren-IL could not have reasonably avoided some of this damage. However, improvements to vegetation management practices, such as ensuring that contractors do a better job trimming and removing trees, will improve service reliability and lessen the consequences of future storms. In addition, prior to the 2006 storms, Ameren-IL did not systematically inspect all of its electric poles for strength. It is likely that weak poles contributed to the negative effects of the storms.

Ameren-IL experienced significant failures in its call center telephony systems during the extremely high volume of calls received during 2006 storms. These problems contributed to customer dissatisfaction with Ameren-IL's performance during the storms.

Liberty organized its work and the contents of this report in the following areas:

- Storm Description and Analysis
- Emergency Planning
- Restoration Performance
- Transmission & Distribution Planning, Design, Protection, and Construction
- Maintenance, Inspection, and System Conditions

Storm Description and Analysis

High winds and thunderstorms on July 19 and 21, 2006, and a snow and ice storm at the end of November 2006 caused damage to the poles, wires, and other parts of the system that delivers electric power to Ameren-IL's customers.

The onset of the July 19 storm came with little warning and early storm reports contained conflicting predictions of the coming severity. A second storm on July 21 complicated and extended Ameren-IL's restoration work. In total, the July storms interrupted more customers, caused more damage, and took longer to restore than recent, documented storms. Ameren-IL personnel repeatedly said that the storms were the worst in their experience. Thus, the storms presented challenges that came without the benefit of actual experiences. The widespread nature of the storms and the extent of the storm damage significantly affected the amount of time Ameren-IL took to restore service to all customers.

Starting in the evening on November 30, 2006, another storm came to the Ameren-IL service territory. This one came with more warning, but it also brought icing conditions that are particularly hazardous to power lines and trees near power lines. This storm interrupted even more customers than did the July storm. It also caused more damage to the system that delivers electricity, over 370,000 customers were without power, and the cold and icy conditions affected the speed of power restoration.

Liberty found that making better use of weather intelligence and tools could help Ameren-IL to prepare better for future storms. In addition, improved analysis of weather and its effects on the electric delivery system could help Ameren-IL to mitigate the consequences of future storms.

Ameren-IL's Outage Analysis System (OAS) records and tracks service interruptions, assists in managing service restoration, and records outage causes and problems. The system works well in normal day-to-day operations. However, when there are literally hundreds of thousands of customers without service such as occurred during the 2006 storms, the system does not provide accurate information. This caused inaccuracies in Ameren-IL's internal and external reports on the effects of the 2006 storms. It also results in some inaccuracy in Ameren-IL's regular reporting of service reliability.

Emergency Planning

All utilities have experience in responding to common outages. However, major outage events bring more and greater challenges for which utilities need to be prepared. Comprehensive

emergency plans address all aspects of the response process beginning with pre-event activities, cover all aspects of the restoration, and describe activities that should occur after restoration. Emergency plans also address major outage events other than those related to storms.

Ameren-IL recognized the importance of emergency plans and committed considerable effort and resources to developing and maintaining them. These plans included the corporate Electric Emergency Restoration Plan (EERP), a corporate communications emergency plan, a distribution dispatch emergency plan, and a plan for each of Ameren-IL's operating divisions.

Liberty found that Ameren-IL's emergency plans were deficient in some areas, and identified many items that Ameren-IL could improve. Plan deficiencies and a lack of familiarity with and use of the plans had a negative effect on the Ameren restoration effort in the 2006 storms. Liberty also found that Ameren-IL's various emergency plans were not coordinated and consistent, Ameren-IL was inconsistent in emergency plan training, and Ameren-IL did not use post-event critiques consistently and effectively.

Restoration Performance

Liberty found that Ameren-IL's workforce during the July storms was too small given the severity and extent of the storm damage. Several factors beyond Ameren-IL's control contributed to the small workforce. The initial weather reports were conflicting, other utilities in the area were experiencing severe heat and needed their own workforce, and Ameren-IL had not experienced a storm of this magnitude in recent years. Nevertheless, Liberty concluded that Ameren-IL should have been more aggressive and proactive in mobilizing outside resources to assist in the July storms.

Ameren-IL's process to develop and offer estimated restoration times was non-existent during the 2006 storms. This was a key reason why customers were highly dissatisfied with Ameren's storm response. In addition, Ameren-IL failed to identify "critical care customers" or "critical infrastructures" in its Outage Analysis System prior to the July or November/December 2006 storms, making it difficult for field personnel to prioritize restoration efforts appropriately.

Ameren-IL's staffing at the call centers during the storms was insufficient to handle the volume of calls received. Liberty found that Ameren's high-volume, outage-overflow service could not cope with the high volume of calls received during the 2006 storms. As a result, there were many blocked customer calls, including many emergency calls reporting downed wires. The Ameren-IL call centers had no emergency storm plan in place and were unable to ramp up staffing as quickly as needed during the 2006 storms to respond to customer calls.

Ameren-IL's safety management and performance during the 2006 storm restorations was very good.

Liberty's analysis of the total restoration times showed that Ameren-IL's restoration from the July storms was too long but that the length of the restoration to the November/December 2006 storm was reasonable. Two other important findings related to the restoration process in the field were that (1) Ameren-IL's field workforce did not report the status of the restoration and update

the Outage Analysis System in a timely and accurate manner during the storms, and (2) Ameren-IL did not have enough help in the deployment and coordination of the large number of outside workers brought in to assist in the two 2006 major outage restorations. The decision by Ameren-IL to replace the existing radio systems with one system that allows communications between all legacy companies will correct one constraint that existed during the 2006 restoration efforts.

Liberty found that Ameren-IL's post-event ramp-down from the storms went reasonably well. Ameren-IL needs to formalize some of the procedures and guidance available for this phase of the restoration. It also needs to do a better job at acquiring and tracking improvement opportunities from post-event critiques.

Transmission & Distribution Planning, Design, Protection, and Construction

Liberty found that Ameren-IL's planning processes, load forecasting, and analyses of the capability and stability of the electric delivery system were generally acceptable and in line with industry practices. Liberty recommends that Ameren-IL make some changes in its use of weather data for load forecasting, and determine whether it is adequately prepared for an accident that causes a total loss of a substation.

Ameren-IL would benefit from greater standardization in practices across the three Illinois companies and from uniformity in standards and manuals. Liberty believes that Ameren-IL plans to standardize and eliminate inconsistencies.

Ameren-IL's standards for system protection were generally adequate. The lightning protection provided for older and smaller substations and some older transmission lines was not adequate.

In general, Ameren-IL's T&D system planning, construction, and protection did not contribute to the significance of the 2006 storms. The way that Ameren-IL planned and designed the distribution system affected the consequences of the 2006 storms, but alternative planning criteria or design configurations are not practical. The fact that some tap lines off the main distribution system did not contain fuses likely made the effects of the 2006 storms worse. Liberty determined that the July 2006 storms were so severe that they may have created some areas in which environmental conditions exceeded the conservative design basis of the electric delivery system. The November/December 2006 storm did not exceed design basis conditions.

Maintenance, Inspection, and System Conditions

The organization of Ameren-IL's inspection and maintenance work was complex and presented unique management challenges. Ameren-IL managed its inspection and maintenance work like one electric utility receiving support from corporate organizations. Ameren-IL's service territory contained seven distribution divisions, three substation areas, and two transmission areas. However, it also contained differing cultures, methods, and standards from the legacy Ameren companies and differing work rules from seven union agreements. Responsibilities for important parts of the electric delivery system, the transmission system and substations, were with an organization that did not report to the head of Ameren-IL.

Ameren-IL adequately staffed its distribution divisions and substation and relay areas with linemen, substation electricians, technicians, and contractors. However, Ameren-IL may need to increase its workforce because recent improvements in inspections methods will likely increase workloads. The staffing of substation maintenance engineers and relay engineers was not adequate to provide an acceptable amount in-the-field technical guidance to the workforces.

Ameren-IL's substation vegetation-management standards were reasonable and fully implemented. Ameren-IL's distribution and sub-transmission vegetation-management standards were also reasonable, but its transmission clearance standards were confusing and difficult to implement. Liberty observed distribution system vegetation-management problems related to mid-cycle trimming, trimming along back-lot lines, and tree removals. Ameren-IL needs to inspect more of the contractors' work to ensure that they implement Ameren-IL's standards.

With some exceptions, the overall condition of Ameren-IL's electric delivery system was reasonably good. Liberty did not observe an unusually large number of items needing repair. With the exception of ungrounded guy wires in the Ameren-IP area, the number of issues related to compliance with the National Electrical Safety Code was not large or atypical. The number of condition issues noted on main lines was typical of aged distribution systems. On the transmission system, there were no specific, systemic condition issues and it was apparent that Ameren-IL had adequately maintained the system. The minor condition issues found at Ameren-IL's substations were small in number.

There were exceptions to the generally good system conditions. Weaknesses in maintenance practices adversely affected conditions in Ameren-IL's substations, particularly noticed by low oil levels, bad equipment paint conditions, and the protection provided against outages caused by animals and lightning. Ameren-IL's inspection and repair practices had not maintained the condition of distribution tap lines in consistently good condition. The poles, conductors, and equipment on the tap circuits were more aged and under-maintained than those found on the mainline circuits. Ameren-IL's distribution circuits also needed more protection from outages caused by animals and lightning.

Ameren-IL's failure to inspect distribution poles, deficiencies in lightning protection on the distribution system, substation circuit breaker maintenance, vegetation practices on parts of the distribution system, and maintenance that permitted poor conditions of some distribution tap lines all contributed to the consequences of the storms.

After 2006, Ameren-IL implemented changes and improvements in its inspection and maintenance practices, including centralized management of distribution and sub-transmission line-patrol inspections, special inspections for National Electrical Safety Code compliance, and regular distribution pole inspections. Inspection and maintenance should also benefit from new local labor union agreements and Ameren-IL's monthly monitoring of maintenance and reliability work performance.

I. Introduction

A. The Storms in 2006

On July 19, 2006, a band of thunderstorms formed across northern Illinois and propagated southwest across west-central Illinois and eastern Missouri. The thunderstorm complex produced straight-line winds or 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 miles per hour (mph). Areas of damage across Illinois suggested that wind speeds could have approached 90 mph. There were two tornado tracks in southwest Illinois near the towns of Bunker Hill and Edwardsville. There were reports of power outages affecting 500,000 customers.

Another complex of severe thunderstorms formed across central Missouri during the morning of July 21, 2006. This cluster of thunderstorms pushed across the St. Louis metropolitan area, producing another path of wind damage from central Missouri to central Illinois. The strong circulation of storms produced several tornadoes. This led to many additional power outages and affected restoration efforts from the July 19 storm damage. Some customers who just had their electric service restored from the previous storm were once again without power and the total number of customers affected again rose above 500,000.

An early season winter storm produced significant amounts of snow and ice across much of the middle of the country on November 30 and December 1, 2006. Over a foot of snow fell from Oklahoma to southeastern Wisconsin, and accumulations of sleet and freezing rain in excess of 2 inches were common across eastern Missouri and western Illinois. The precipitation changed over to all snow during the evening hours of November 30 over central and northeast Missouri as well as west-central Illinois.

The combination of accumulated ice on trees and power lines and gusty northwest winds produced widespread downed trees and power outages. Over 500,000 households and businesses were without power from the St. Louis metropolitan area into central Illinois. The freezing rain and sleet affected many locations in central Illinois west of Interstate-57. Eleven counties in central Illinois reported ice ranging from ¼ inch to 2 inches thick, with the thickest ice around Decatur, Taylorville, Clinton, and Mount Pulaski. Eight counties reported heavy sleet ranging in depth from ½ to 2 inches. The heaviest snow occurred along and west of the Illinois River, where snow accumulations were 8 to 16 inches. The result included numerous traffic accidents and downed power lines.

B. The Companies

St. Louis-based Ameren Corporation is among the nation's largest investor-owned electric and gas utilities, with approximately $17 billion in assets. The largest electric utility in Missouri and the second largest in Illinois, Ameren companies provide energy services to 2.3 million electric and 900,000 natural gas customers throughout its 64,000 square-mile territory. Created by the year-end 1997 merger of Union Electric Company and Central Illinois Public Service Company,

the company grew in 2003 with the acquisition of Central Illinois Light Company and again in 2004 with the acquisition of Illinois Power Company.

Ameren is the parent of Ameren-CILCO, based in Peoria, Ameren-CIPS, based in Springfield, and Ameren-IP, based in Decatur. Ameren-CILCO provides electricity to approximately 215,000 customers in 19 counties, serving towns in east and central Illinois. Founded in 1913 through a series of mergers involving seven existing gas and electric companies, Ameren-CILCO provides gas and electric services to Peoria and 26 surrounding communities. Ameren-CILCO's distribution facilities consist of 109 substations that supply 307 distribution circuits and about 7,850 miles of line. Approximately 74 percent of these miles are overhead, and 26 percent are underground. Ameren-CILCO operates and maintains 14 transmission and switching substations, and 34 industrial/wholesale substations.

Ameren-CIPS provides electric service in 70 counties throughout a 20,500 square-mile area. Founded in 1902, Ameren-CIPS today serves nearly 400,000 retail electric customers in 576 communities with a service territory that includes more than 7 percent of the state's population and 35 percent of its surface area—including Quincy and East St. Louis to the west, and Mattoon and Marion to the east and south. Ameren-CIPS' electric distribution system consists of approximately 12,000 miles of overhead conductor and 1,400 miles of underground circuits. The previous Ameren-UE-Illinois electric system, now a part of Ameren-CIPS, includes approximately 1,400 distribution circuit-miles. Ameren-CIPS has 1,129 electric distribution circuits.

Founded in 1923, Ameren-IP provides electric service to about 625,000 electric customers—an aggregate population of 1.4 million—in 313 incorporated municipalities across 15,000 square miles of central, east central, and southern Illinois. About 89 percent of Ameren-IP's customers are residential. Ameren-IP provides service to nine cities with populations greater than 30,000, including Danville, Decatur, Belleville, Bloomington-Normal, Champaign-Urbana, Galesburg, and Granite City. Approximately 88 percent of Ameren-IP's electric distribution system is overhead, with the remaining 12 percent being underground. Ameren-IP has 885 electric distribution circuits.

C. The Investigation

The Illinois Commerce Commission (ICC or Commission) asked for an investigation to determine whether each Ameren utility in Illinois:

1. Appropriately planned, designed, constructed, inspected, and maintained their electricity delivery systems.
2. Adequately planned, prepared, and executed service restoration efforts following July 2006 windstorms and November 2006 ice storm.

The ICC wanted the investigation to focus first on the utilities' electricity delivery system conditions and the utilities' policies, practices, and actions as they existed just prior to the storms and as they occurred during the storms. The ICC required that the investigation recognize any changes that Ameren implemented or is proposing for the future, but that they should not become

the basis for omitting a full investigation and full reporting of the previously existing conditions, policies, practices, and actions or for omitting recommendations for improvement.

The ICC specified that the end-result of the investigation would be one comprehensive written report with separate findings and recommendations for each of the three utilities. The report must also include the investigations' conclusions, the above described determinations, detailed recommendations for improvement that each utility can implement and that the ICC can verify, and a timetable for utility implementation of the recommendations.

On August 29, 2007, the ICC Staff and The Liberty Consulting Group (Liberty) executed a contract for the investigation. In early September, representatives of the ICC Staff, Liberty, and Ameren met to discuss expectations and plans for the investigation. Liberty submitted its 122 initial data requests to Ameren. Over the course of the investigation, Liberty submitted and Ameren responded to nearly 800 requests for information. Liberty interviewed Ameren personnel and inspected Ameren's facilities. Liberty tracked these interviews and inspections in 180 total requests.

Ameren made an introductory presentation to the Liberty team on October 2 in Decatur. During that presentation, the president of Ameren-Illinois indicated that Ameren would cooperate with Liberty's investigation and that he wanted Liberty's advice on areas in which Ameren could improve its performance. Over the next nine months, Ameren responded to data requests promptly and completely and made its employees and facilities available to Liberty. Ameren created a cooperative and open environment for Liberty's work.

To respond to the requirements of the ICC's Request for Proposals, Liberty prepared a detailed work plan for the investigation. The plan included investigations in the following areas:

- Storm Description and Analysis
- Emergency Planning
- Restoration Performance
- Transmission & Distribution Planning, Design, Protection, and Construction
- Maintenance, Inspection, and System Conditions

After this introduction, the chapters in the report follow this same organization.

D. Ameren-IL

Liberty uses the term Ameren-IL to mean all three of the Ameren companies in Illinois and to mean the consolidated plans, efforts, and work by the entity that encompasses the three companies. In many ways, Ameren-IL operated as one utility that shared some services and received support from the Ameren Corporation. Ameren-IL distribution divisions and its transmission and substation areas all cross the boundaries of the three companies. Ameren-IL has one President and CEO, and two vice presidents of regional operations who each have responsibilities that cover the entire Illinois footprint.[1]

[1] Response to Data Request #123.

Ameren-IL has informed its employees about changing the name of the business segment that makes up the Illinois utilities.[2] Ameren-IL has also expressed the goal of continuing to standardize practices across the entire Illinois service territory.[3] Liberty concurs that there can be many advantages to furthering the assimilation of the three companies and implementing the best practices of each, over the Illinois service territory.

The ICC required that Liberty make recommendations for improvement that each utility could implement. However, Liberty found that because of Ameren-IL's organization, it was most appropriate to direct all of the recommendations toward Ameren-IL. Liberty's report describes the differences in practices that remained from the three companies in 2006 and in the present. The implementation of some of Liberty's recommendations will require changes that affect Ameren in its entirety. For example, aspects of emergency planning are common to both Illinois and Missouri. Nevertheless, Liberty directs its recommendations at Ameren-IL because the ICC has authority over Ameren-IL.

In assimilating the three companies, one of the challenges faced by Ameren-IL was three different sets of standards and policies for construction, maintenance, and inspection of the electric delivery systems. In 2006, Ameren-IL had efforts underway to bring standardization across its Illinois service territory. Later chapters of this report discuss these efforts. However, there was no quality assurance program to help ensure that Ameren-IL applied consistency and common solutions.

In May 2007, Ameren-IL launched its Electric Delivery Quality Assurance (EDQA) program.[4] Ameren-IL said that the objectives of the EDQA included ensuring field compliance with the National Electrical Safety Code (NESC) and with Ameren construction standards. Ameren-IL also aimed the EDQA at facilitating a consistent application of identified best practices and common solutions across all Illinois operating divisions.

This initiative resulted in a Liberty conclusion and recommendation that did not specifically fit in any of the remaining chapters of this report.

Conclusions

1. Ameren-IL did not have a quality assurance program that would help ensure that it applied consistency, common solutions, and best practices to its electric delivery systems. (Recommendation I-1)

Particularly because three separate utility companies make up Ameren-IL, there was a need to improve service reliability by applying consistent standards and practices across the Illinois footprint. An effective quality assurance program that applies to all three companies and all six service divisions would help ensure that Ameren-IL meets this need. Ameren-IL said that in May 2007, it established such a program called the Electric Delivery Quality Assurance (EDQA)

[2] Response to Data Request #796.
[3] Interview #180, June 4, 2008.
[4] Response to Data Request #299.

program. The specific focus of the EDQA was to verify that line construction personnel executed the work in the field in accordance with applicable plans, standards, and codes.[5] There should be a similar focus on maintenance and inspection.

Recommendations

I-1 Establish an effective quality assurance program that is applicable to all of Ameren-IL and that ensures consistency in construction, maintenance, inspection, design, and planning of the electric delivery systems.

Ameren-IL said that it established a quality assurance program in May 2007. This occurred after the timeframe of Liberty's investigation and Liberty did not review the program's effectiveness. Ameren-IL said that a focus of the program was line construction. This is a reasonable and important heart of a quality assurance program. However, the program's applicability to maintenance, inspection, and design could yield significant benefits. In its comments on the draft of this report, Ameren-IL indicated that it accepted this recommendation and would establish a formalized QA/QC process in areas such as transmission line design, construction projects, vegetation management, and transmission system design and planning. Within one year of the date of this report, Ameren-IL should be able to demonstrate significant progress in implementing an effective and extensive quality assurance program.

E. Recommendations

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[5] Response to Data Request #299.

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Several of Liberty's recommendations propose that Ameren-IL submit reports to the ICC. Those recommendations are II-4, IV-44, and IV-45.

II. The Storms

A. Objectives

This chapter provides a description of the storms that occurred in Ameren-IL's service territory in 2006 and that were the genesis of the ICC's request for an independent investigation. Liberty's objectives for the work reported in this chapter were to:

- Provide a complete and factual description of the storms
- Characterize the severity and magnitude of the storms in comparison to other storm events in the Ameren-IL service territory
- Evaluate the accuracy of the Companies' service interruption information.

This chapter addresses the following items and questions included in the ICC's Request for Proposals for this investigation:

- **4.3.2.5.1** The dates and times of the storms
- **4.3.2.5.2** Service interruptions
- **4.3.2.5.3** Causes of service interruptions
- **4.3.2.5.4** An explanation of the damage to the electricity delivery systems from the storms.

In addition, Liberty's work reported in this chapter addresses in part or provided input to work reported in other chapters of the report for:

- **4.3.2.5.18** Physical loading of support structures
- **4.3.2.5.19** Broken poles
- **4.3.2.5.20** Substation equipment outages

B. Background

Weather has a significant effect on electric service performance regardless of a utility's service territory. Storm events have a wide range of severity, but generally cause significant deviations from day-to-day electric reliability as reported by service interruption indices. In Midwestern states, July storms are typically thunderstorms that have severe weather phenomenon including high winds, lightning, hail, tornados, derechos,[1] and heavy rain. Storms that occur in the winter months include severe weather such as heavy ice, sleet, and wet snow accumulations, high winds, extreme cold, dangerous wind chill, blowing snow, and blizzards.[2]

Significant storms pose unique challenges of scale and coordination to electric utilities. In some cases, storms exceed typical utility preparation due to their size or severity; however, best practices serve to expedite most storm response and customer restorations. This chapter presents a factual description of the 2006 storms by quantifying the weather parameters, including how

[1] A destructive windstorm associated with a line of severe thunderstorms and caused by winds blowing in a straight line, rather than the rotary winds of a tornado.
[2] A "blizzard" has winds over 35 mph with snow and blowing snow reducing visibility to near zero. www.nws.noaa.gov/om/bochures/wntrstm.htm

quickly the storm developed and the resultant damage to Ameren-IL's facilities. It presents weather parameters such as wind speed, lightning activity, storm direction, as well as the facility damage correlations to describe the extent to which the storms challenged the design of facilities and the capability of Ameren-IL's storm processes. The chapter compares the storms to others in Ameren's experience. Historical weather data contained in this section indicates that severe weather is common in Ameren-IL's service territory. Thunderstorms occur more frequently, however the Midwest climate includes severe weather in all seasons. Analysis of historical data indicates that storms of comparable severity are likely to occur again in Ameren's Illinois service territory.

This chapter also provides an assessment of the accuracy of the service interruption information. It is important for electric utilities to have reasonably accurate interruption information because it serves such a vital role for internal and external processes. Externally, a utility needs service interruption information for communications with its customers. Regulators, municipal officials, and mass media need an accurate account of the number of customers and the geographic footprint of electric outages. Internally, utilities need accurate information to direct storm response actions, to prioritize resources, and to address root causes and mitigation actions for specific facilities.

C. Chapter Summary

Weather can have a significant effect on the reliability of a utility's electric service. In 2006, the Ameren-IL utilities experienced storms that caused interruptions of electric service to many of their customers. More specifically, wind and thunderstorms on July 19 and 21, and a snow and ice storm at the end of November caused damage to the poles, wires, and other parts of the system that delivers electric power to Ameren-IL's customers. Some customers were without power for days. This chapter describes those 2006 storms and the damage to the electric delivery systems. Later chapters in this report describe and evaluate the work done to restore electric service.

Prior to July 19, the National Weather Service (NWS) had not predicted storms to occur in the Ameren-IL service territory until July 20. It reported unstable air in the morning of July 19 and the first service interruptions did not occur until after 2 p.m. The storm brought three tornados, high winds, and significant lightning activity, with the most intense hour of the storm occurring between 7 p.m. and 8 p.m. on July 19. The wind observed during the storm (with speeds in the 50 to 70 miles per hour range) can damage chimneys, break branches off trees, and push over shallow-rooted trees. Trees falling on overhead electric lines and poles can interrupt electric service. During restoration, a second severe storm came into the service territory on July 21. Over 300,000 customers of the Ameren-IL companies had service interrupted. The effect on the distribution system was significant, with over 500 damaged poles. An appendix to this chapter provides photographs taken just after the July storms.

The July 2006 storms were significant, but not particularly unusual by comparison with severe weather that occurred in Illinois during the past twenty years. However, the July 2006 storms interrupted more customers, caused more damage, and took longer to restore than recent, documented storms. Ameren personnel repeatedly said that the storms were the worst in their experience. Thus, the storms presented new challenges to the utilities that came without the

benefit of actual experiences. While the storms in particular areas may not have seemed severe to customers in those areas, the widespread nature of the storms and the extent of the storm damage significantly affected the amount of time Ameren-IL took to restore service to all customers.

Starting in the evening on November 30, 2006, another storm came to the Ameren-IL service territory. This one came with more warning, but it also brought icing conditions that are particularly hazardous to power lines and trees near power lines. This storm interrupted even more customers than did the July storm. It also caused more damage to the system that delivers electricity, damaging 1,300 poles and downing 3,000 wires. Over 370,000 customers were without power and the cold and icy conditions affected the speed of power restoration.

Liberty found that the onset of the July 19 storm came with little warning and that early storm reports contained conflicting predictions of the coming severity. Nevertheless, Ameren-IL could have been more aggressive in getting and analyzing the weather information available. Ameren-IL could have been more adaptive to a rapidly changing weather situation. Such efforts in the future could permit Ameren-IL to implement emergency plans and request assistance from other utilities earlier in the course of storm development than it did during the July 2006 storms.

Liberty also found that Ameren-IL's reports to the public and to the ICC may have underestimated the number of customers without power, but certainly underestimated the number of customer calls. Ameren relies on primarily on calls from customers to learn where there are power outages. In the November storm, many of these customer calls did not get through because of problems with Ameren-IL's communications systems. (Chapter IV of this report, Restoration Performance, describes the problems with the communications systems.)

D. Findings and Analysis – the July 2006 Storms

This section contains the primary findings, analysis, and detailed descriptions of the July 2006 storms. Later chapters in Liberty's report discuss storm preparation, restoration, and communications. Liberty organized this section in the order of the three main objectives identified above: storm description, storm comparison, and storm information.

1. Storm Description

This section provides a description and timeline of the July 2006 storm including:

- weather conditions prior to the storm
- weather forecasts for the July 2006 storm
- a description of the development of the storm
- descriptions of actual weather observations
- summary descriptions of storm outages and areas affected
- storm severity details
- facility damage summaries
- summaries of customer outages
- outage cause summaries

a. Prior Conditions

The Midwest was in the midst of a summer heat wave, which was not unusual for this region. Temperatures had been in the 90s; the National Weather Service (NWS) expected these temperatures to continue on July 19, 2006, with heat indexes expected in the range of 100-105°F in central Illinois, and as high as 114°F in St. Louis with continued hot and humid conditions.[3] The NWS did not predict storms to occur until Thursday (July 20) for St. Louis and central Illinois.[4] However, unstable air was evident west of the Mississippi River from Minnesota to Missouri on the morning of July 19. Observations included isolated high winds of 80 mph in Jefferson County, MO at 8:25 a.m. (CDT).[5]

The NWS[6] observed and tracked a more organized storm and severe weather damage farther north at 8:50 a.m. on Wednesday, July 19, 2006, in Southeastern Minnesota and Northeastern Iowa.[7] The track of this storm continued to the southeast across the Mississippi River into Carroll County, Illinois at approximately 1:40 p.m.[8] Observed damage included downed power lines, downed tree branches of 4-5 inch diameter, farm structure damage, crop damage, and estimated wind speeds of 50 mph.[9] The storm track continued to the southeast toward the Ameren-IL service territory. At 1:56 p.m., July 19, the NWS weather center in Lincoln, Illinois (KILX) issued a severe thunderstorm watch for seven counties in Northern and Western Central Illinois effective until 8 p.m. that evening. The warning area geographic applicability, *i.e.*, "watchbox," included Stark, Knox, Marshall, Tazewell, Peoria, Marshall, Woodford, and McLean counties, which applied to three cities in Ameren-IL's service territory: Galesburg, Peoria, and Bloomington.[10] Maps and diagrams presented below show the locations of these counties and cities.

b. Ameren Pre-Storm Conditions

Ameren had a subscription weather-service contract with Surface Systems Inc. (SSI) that included weather data on streaming video available through the Internet and e-mail.[11] In addition, Ameren personnel had access to public weather sources such as the Weather Channel on cable television, AccuWeather®, and local television and radio weather broadcasts. (Liberty observed monitors carrying the Weather Channel at the Emergency Operations Center (EOC) in St. Louis and the Distribution Dispatch Center in Decatur.[12]) In addition to a morning forecast, SSI provided Ameren personnel notification of NWS[13] warning and watch "alerts" via automatic

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[3] NOAA archives for July 19, http://www.crh.noaa.gov/.. Liberty retrieved information about weather warnings, watches, and observations from multiple searches of the National Weather Service database, http://hurricane.ncdc.noaa.gov/.pls/plhas/HAS.FileAppSelect?datasetname=9957ANX. NWS forecasts: 190835, 190900
[4] NOAA archives for July 19, http://www.crh.noaa.gov/.
[5] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.
[6] National Weather Service.
[7] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.
[8] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.
[9] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.
[10] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 191856.
[11] Interview #13, October 3, 2007, and response to Data Request #125.
[12] Interview #13, October 3, 2007, and Interview #100, November 14, 2007.
[13] National Weather Service.

paging.[14] This notification went to more than ten Ameren people on a distribution list that Ameren was responsible for keeping up to date.[15] Those people could, however, disable the receipt of the alerts if they considered the alerts a nuisance.[16]

NWS[17] warnings are statements of higher severity than NWS watches. Watches have more lead-time; the NWS bases them on the presence of conditions of imminent severe weather. Warnings have less lead time and are based on conditions, observed severe weather imagery (radar), and ground-truth observations—actual occurrences of severe weather (*e.g.*, tornados, hail, damages) at specific locations as reported by NWS weather personnel at regional centers and regional emergency personnel such as those with fire, police, or rescue services.

Unlike some utilities, Ameren did not contract with a weather modeling service (damage prediction model), and did not consider this service significantly useful beyond basic weather subscription services.[18] This type of service translates weather forecast information into business intelligence and can include estimates of customer outages and damages.

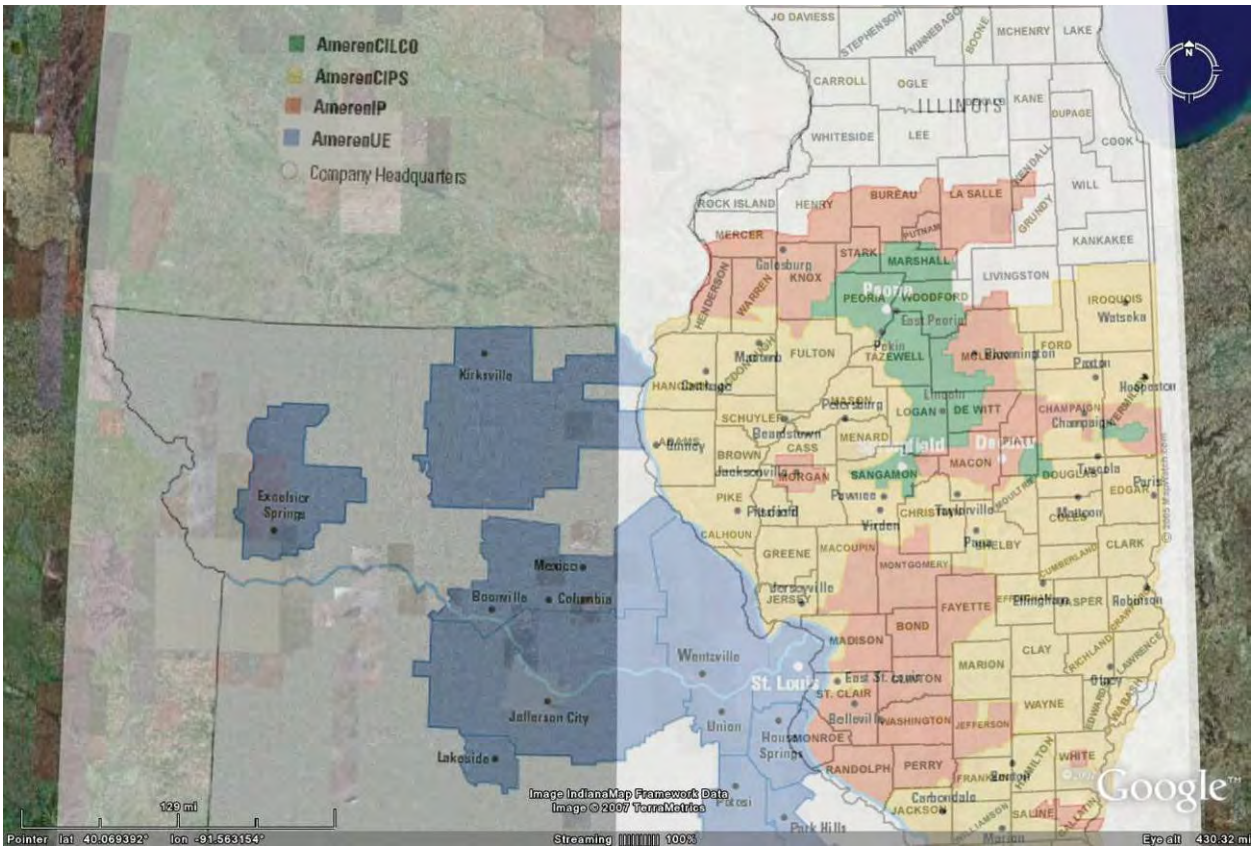
Ameren's Electric Emergency Restoration Plan (EERP) provided the corporate policy and procedures for corporate response to significant events and major storms. This plan included three designated storm categories based on scale and severity. (Liberty discusses the EERP and other pre-storm planning in a later chapter of this report.)

On July 19, the Emergency Operations Center manager contacted Surface Systems Inc. (SSI) by telephone to discuss SSI's daily forecast. He recalled the report as not unusual, with the possibility of afternoon thunderstorms as was the typical pattern on hot weather afternoons.[19]

c. The Storm Enters Ameren-IL Service Territory

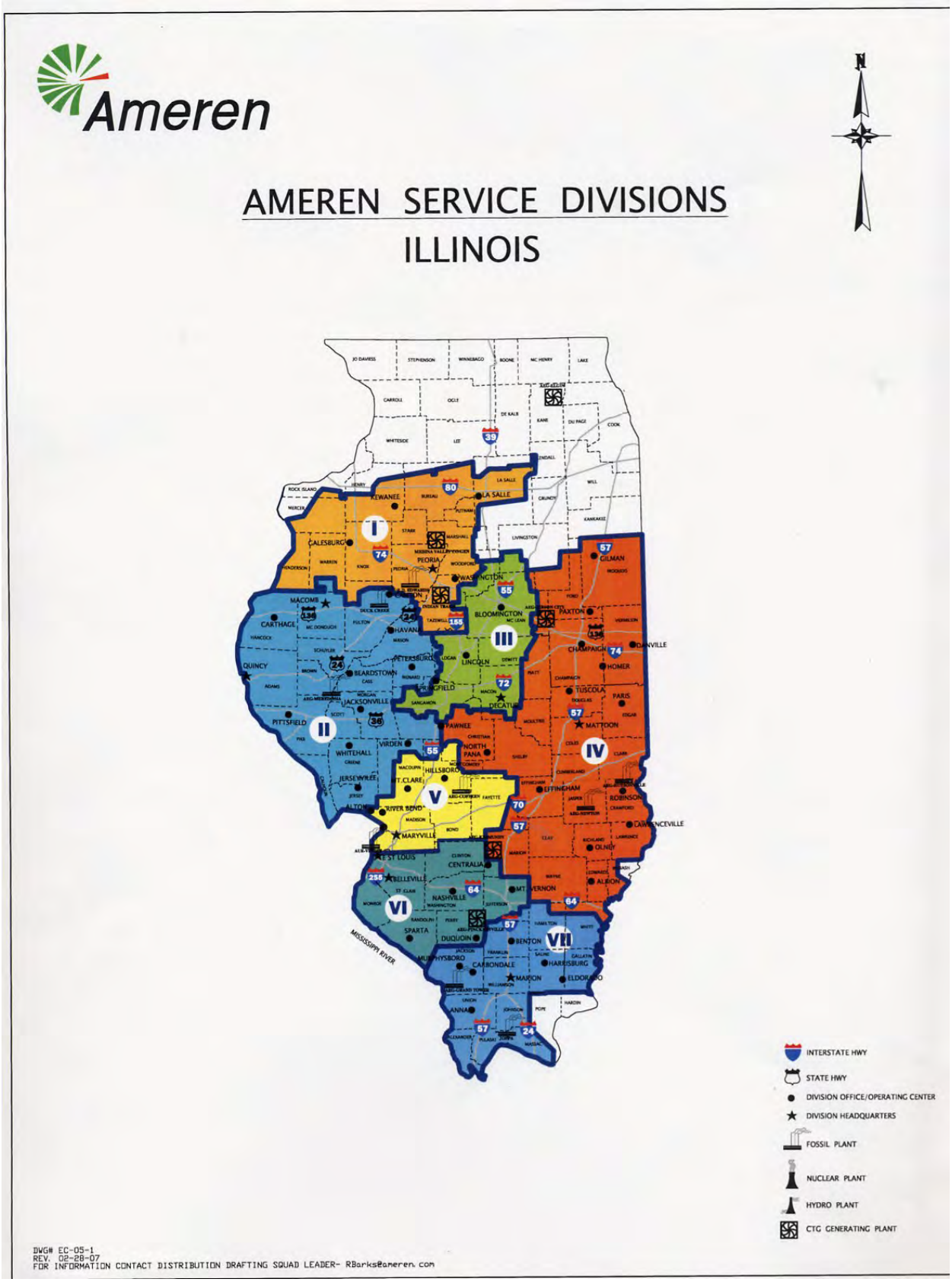
At approximately 2:15 p.m. on July 19, the NWS[20] reported storm damage in Ameren-IL's northern most service territory (Ameren-IP, now designated as Ameren-IL's Division I, near Cambridge, Illinois (in Henry County, see map below) including a downed 5" tree.[21]

[14] Interview #13, October 3, 2007, Interview #106, November 29, 2007, and response to Data Request #357.
[15] Response to Data Request #127, and Interview #40, November 6, 2007.
[16] Interview #106, November 29, 2007.
[17] National Weather Service.
[18] Response to Data Request #149.
[19] Interview #40, November 6, 2007.
[20] National Weather Service.
[21] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.



A map on the next page shows Ameren-IL's service Divisions.[22] Liberty presents much of the information in this section by Ameren-IL because the service territories of the legacy companies are not geographically distinct as shown on the map shown above.

[22] Response to Data Request #123.


Ameren
AMEREN SERVICE DIVISIONS
ILLINOIS
N
I
II
III
IV
V
VI
VII
KEWANEE
LA SALLE
CALESBURG
PEORIA
WASHINGTON
MACOMB
CARTHAGE
QUINCY
BEARDSTOWN
HAVANA
PETERSBURG
LINCOLN
BLOOMINGTON
PAXTON
GILMAN
CHAMPAIGN
DANVILLE
HOMER
TUSCOLA
PARIS
MATTOON
DECATUR
SPRINGFIELD
JACKSONVILLE
PITTSFIELD
WHITEHALL
VIRDEN
JERSEYVILLE
ALTON
RIVER BEND
MARYVILLE
ST. CLARE
HILLSBORO
NORTH PANA
EFFINGHAM
ROBINSON
LAWRENCEVILLE
OLNEY
ALBION
CENTRALIA
MT. VERNON
BELLEVILLE
NASHVILLE
SPARTA
DUQUOIN
BENTON
MURPHYSBORO
CARBONDALE
HARRISBURG
MARION
ELDORADO
ANNA
MISSISSIPPI RIVER
INTERSTATE HWY
STATE HWY
DIVISION OFFICE/OPERATING CENTER
DIVISION HEADQUARTERS
FOSSIL PLANT
NUCLEAR PLANT
HYDRO PLANT
CTG GENERATING PLANT
DWG# EC-05-1
REV. 02-28-07
FOR INFORMATION CONTACT DISTRIBUTION DRAFTING SQUAD LEADER- RBarks@ameren.com

At 2:27 p.m., NWS[23] in Lincoln, IL (KILX) issued a severe thunderstorm warning for Knox and Stark Counties based on Doppler radar. This included severe thunderstorms and destructive 70 mph winds on a line from Kewanee to Galesburg, IL, moving southeast at 35 mph.[24] NWS warnings cited power lines down in Morrison, Illinois at 2:30 p.m.,[25] and in Galesburg, IL at 2:34 p.m.[26]

Ameren-IL's first reported customer outage was at 2:23 p.m. in the Galesburg Operating Area of Division I.[27] A customer service representative (call taker) entered the interruption data into Ameren's Outage Analysis System (OAS). (Ameren's Outage Analysis System retains service interruption information, maintenance requests, and service man requests.)[28]

The first reported facility damage was in Division I at 2:38 p.m. for broken trees limbs.[29] An additional 13 outages in Division I followed the first reported outage within the next 20 minutes, including an entire circuit, partial circuits, and individual customer service outages due to broken tree limbs, tree contacts, and overhead equipment malfunctions.[30] NWS[31] issued a severe weather statement at 2:57 p.m. for Knox and Stark Counties of Illinois with a severe thunderstorm warning and winds in excess of 70 mph.[32]

At the Distribution Dispatch Center in Decatur, Illinois, the Distribution Dispatch Organization (DDO) recognized that a storm had begun and dispatched operating personnel (trouble men) to provide the initial response and assess the outages. In addition, because Decatur DDO's shift changes occurred at 3 p.m., staffing changes and shift carryovers (extensions) occurred to retain personnel for the ongoing storm response.[33] Division I also retained construction crews in Ameren-CILCO and Ameren-IP areas.[34]

The Emergency Operations Center Manager in St. Louis was in his office and noticed the storm move from Iowa to Illinois followed by increasing customer outages in Peoria at approximately 3 p.m. He attributed this to a "typical small scale weather pattern," which was within the capability of the division.[35] Data in the Outage Analysis System indicate that at 3:00 p.m., there were approximately 1,000 customers with service interruptions.[36] Ameren-IL's Emergency Operations Center Manager and the Decatur Distribution Dispatch Operations Manager held discussions during the day, however they could not recall the exact times.[37] The normal quitting time for

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[23] National Weather Service.
[24] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 191927.
[25] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.
[26] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations for 20060719.
[27] Responses to Data Requests #135 and #265; OAS order # 062007511.
[28] Interview #37, November 2, 2007.
[29] Response to Data Request #265.
[30] Response to Data Request #265.
[31] National Weather Service.
[32] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 191957.
[33] Interview #102, November 15, 2007.
[34] Interview #115, December 13, 2007, and response to Data Request #424.
[35] Interview #40, November 6, 2007.
[36] Response to Data Request #265.
[37] Interview #40, November 6, 2007, and Interview #102, November 15, 2007.

Ameren-IL personnel varied by company and area, however shift turnovers and day shifts were ending between 3:00 and 4:00 p.m.[38]

The NWS[39] continued to issue thunderstorm warnings for several Illinois counties. It issued four separate weather statements for severe thunderstorms between 3:03 p.m. and 3:31 p.m. for a geographic area bounded by Peoria County to the north, Marshall County to the east, Woodford County to the south, and Fulton County to the west.[40] At 3:37 p.m., the NWS issued a severe thunderstorm watch for 28 Illinois counties on a swath that extended from southeast of Peoria to the Illinois-Indiana border.[41]

Storm outages also began in Ameren-IL's northeastern-most service territory, Division IV, with outages south of Champaign at 3:15 p.m.,[42] however, these outages were scattered and the storm did not affect significantly Division IV.

The storm continued its track to the southeast toward Peoria. Peoria is within Division I, which includes properties of Ameren-CILCO and Ameren-IP. The former CILCO legacy company areas of Division I are dispatched by the Peoria Distribution Dispatch office. The remainder of the Division operations (former IP areas) are dispatched from the Decatur Distribution Dispatch office. Both of these distribution dispatch offices are subsets of a single Ameren-Illinois Distribution Dispatch Operation. The southeastern edge of the storm front crossed over into Peoria's operating area between 3:15 and 3:22 p.m. (from Stark to Marshall County).[43] Damages to distribution facilities began in the Peoria area at 3:21 p.m., with primary (distribution voltage) wires[44] down.[45]

The NWS[46] issued a severe thunderstorm warning at 3:42 p.m. for areas to the south of Peoria including Peoria, Marshall, Tazewell, Woodford, Fulton, and Mason counties.[47] It added LaSalle County at 3:45 p.m.[48]

The NWS reported damage observations northeast of Peoria in Woodford County near Metamora, Illinois at 3:42 p.m., with 6" trees down, winds estimated at 60-70 mph, and 1.23 inches of rain within 20 minutes.[49] NWS ground-truth damage observations noted trees down across the city of Peoria at 3:50 p.m.[50]The storm's frontal boundary began to turn southwest from its previous southeast track and began to intensify after this point (although outages and

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[38] Interview #114, December 13, 2007.
[39] National Weather Service.
[40] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statements: 192003, 192015, 192023, 192031.
[41] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192037.
[42] Response to Data Request #265.
[43] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations 20060719.
[44] "primary wires" as those that carry distribution voltages between 4,000 volts and 15,000 volts.
[45] Responses to Data Requests #138 and #265, OAS order # 06201A904.
[46] National Weather Service.
[47] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192043.
[48] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192046.
[49] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations 20060719.
[50] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations 20060719.

subsequent NWS[51] damage observations occurred later behind the frontal boundary at locations farther north and east). The NWS observed the southwesterly track with 60 mph wind speeds reported at 3:53 p.m. in Smithfield, 40 miles southwest of Peoria.[52]

At 3:53 p.m., the southern edge of the storm entered into Division II, which is bounded roughly by Macomb to the north, the Mississippi River to the west, Alton to the south, and Canton to the east. Storm outages began to occur for tree contact to customer service wires in Canton (30 miles southwest of Peoria), although the bulk of outages were still occurring in the Peoria and Galesburg areas.[53] At 3:55 p.m., the NWS[54] reported that at the WPEO radio station in East Peoria estimated wind speeds were 65 mph.[55]

At 3:56 p.m., the NWS[56] ground-truth observations noted the first tornado sighting of the storm in Fulton County, near Canton.[57] However, the NWS damage and ground-truth observations were not in real-time and SSI[58] did not provide them to Ameren. Ameren-IL personnel said that SSI reported significant weather changes to Ameren by telephone.[59] At 4:00 p.m., there were approximately 11,000 Ameren-IL customers interrupted, primarily located in Division I.[60] At 4:01 p.m., lightning caused the failure of a 138kv substation switch at the Hennepin Power Plant, causing an interruption to the Princeton Municipal Electric service.[61]

At 4:01 p.m., the NWS[62] allowed an earlier thunderstorm warning to expire based on Doppler radar indicating that the storm had passed out of Knox and Fulton Counties.[63] However, at 4:11 p.m., the NWS issued a new severe thunderstorm warning for Fulton, Peoria, Marshall, Tazewell, Mason, and Woodford counties capable of producing winds in excess of 70 mph.[64]

Ameren-IL's Emergency Operations Center manager indicated that, at 4:00 p.m., Ameren System Operations called Springfield about the active storm within its area. Springfield indicated that it had the resources to handle the situation and that severe weather warnings existed locally. The manager recalled no other specifics.[65] Ameren personnel's recollections were that their people placed a call to Surface Systems Inc. (SSI) sometime after 4 or 5 p.m. However, it is unclear who made the contact, the exact time, and what information SSI provided to Ameren at this point.[66] Ameren personnel recalled that SSI's forecast was for a weakening storm that would

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[51] National Weather Service.
[52] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations 20060719.
[53] Responses to Data Requests #135, #138, and #265; OAS order # 062008271.
[54] National Weather Service.
[55] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observation 20060719.
[56] National Weather Service.
[57] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observations 20060719.
[58] Surface Systems Inc.
[59] Interview #106, November 29, 2007, and Interview #116, December 17, 2007.
[60] Response to Data Request #265.
[61] Response to Data Request #139.
[62] National Weather Service.
[63] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192101.
[64] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192112.
[65] Interview #102, November 15, 2007.
[66] Responses to Data Requests #123-B and #358, Interviews #13, October 3, 2007, #40, November 6, 2007, #102, November 15, 2007, and #106, November 29, 2007.

fizzle out near Springfield, Illinois; however, neither Ameren-IL nor SSI could provide documentation to corroborate this.[67] Nevertheless, SSI's pager alerts containing NWS severe weather statements should have alerted Ameren personnel via e-mail and pager of the continuing threat of severe weather in areas south of Peoria at 4:00 p.m.

At 4:14 p.m., the NWS[68] issued a cancellation notice of a severe thunderstorm watch for 5 Illinois counties in north central Illinois (for counties to the north of Ameren-IL's service territory), however the watch continued in 13 other counties in the Ameren-IL service territory and to the east of Ameren-IL's territory.[69]

At 4:15 p.m., the NWS[70] issued its first tornado warning based on Doppler radar that detected a potential tornado signature four miles southwest of Canton, moving southeast at 5 mph.[71] At 4:23 p.m., the NWS issued a severe thunderstorm warning for nine counties with geographic coordinates that stretched from McDonough county on the west, Woodford county to the north, Ford county to the east, and Logan and Cass counties to the south. NWS Doppler radar showed severe thunderstorms capable of producing destructive winds in excess of 70 mph and moving southeast at 40 mph.[72] This geographic footprint extended across Divisions I through IV and into Commonwealth Edison's service territory at the storm's most northeast point.

At 4:35 p.m., customers reported the first storm interruptions in the Ameren-CIPS' Four Rivers Region, in Division II.[73] Tree limbs interrupted a circuit emanating from the Havana substation at 4:38 p.m.;[74] the outages marked the leading southern edge of main body of the storm. At 4:41 p.m. near Canton, police and fire personnel requested Ameren-IL service men for a broken pole during thunderstorm conditions.[75]

At 4:42 p.m., the NWS[76] issued a second tornado warning for Mason County near Havana (directly south of the first detected location near Canton). Doppler radar indicated it was moving south at 25 mph.[77] At 4:47 p.m., the NWS issued a warning for ten counties for a line of severe thunderstorms that stretched from Beardstown to Lincoln to Lexington, capable of producing destructive winds in excess of 70 mph and moving southeast at 35 mph.[78] The storm continued to damage Ameren-IL facilities with reports of broken primary wires[79] near Lincoln at 4:49 p.m.[80] By 5:00 p.m., approximately 25,000 Ameren-IL customers were interrupted, primarily located in

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[67] Responses to Data Requests #357, #426-429, and Interview #116, December 17, 2006. Note: DTN acquired SSI Inc in July 2006; DTN provided the noted interviews and data responses.
[68] National Weather Service.
[69] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192114.
[70] National Weather Service.
[71] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192115.
[72] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192124.
[73] Response to Data Request #135, OAS order # 062009875.
[74] Response to Data Request #135, OAS order # 062009804.
[75] Response to Data Request #138, OAS order # 062009091.
[76] National Weather Service.
[77] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192142.
[78] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192148.
[79] "primary wires" as those that carry distribution voltages between 4,000 volts and 15,000 volts.
[80] Response to Data Request #137, OAS order # 062009201.

Divisions I, II, and III; service wire outages were just beginning to appear in Divisions V and VI.[81]

At 4:55 p.m., the NWS issued another severe thunderstorm warning for DeWitt, Macon, Scott, Morgan, Sangamon, and Christian counties for thunderstorms continuing to move south at 40 mph.[82] Ameren's account of the storm indicates that Ameren contacted SSI[83] at 5:00 p.m.[84]At 5:10 p.m., the NWS cleared the severe thunderstorm for Woodford and Tazewell counties but continued the warning in effect for eight counties including Schuyler and Cass counties to the west of Springfield.[85] At 5:11 p.m., a trained spotter observed a second tornado near Cantrall, Illinois (approximately 10 miles due north of Springfield).[86]

d. The Storm Approaching St. Louis

The NWS[87] in St. Louis (KLSX) was also tracking storm activity that was moving from south-central Missouri towards St. Louis at 3:44 p.m.[88] The NWS short term forecast at 4:50 p.m. called for a line of strong to severe thunderstorms to move south into southwest parts of Illinois late that afternoon and early in the evening. The NWS anticipated the leading edge of this to reach Greene, northern Maucopin, and northern Montgomery counties around 6 p.m.[89] At 5:45 p.m., the NWS in St. Louis issued a severe thunderstorm watch for 16 Illinois counties until 11 p.m.; this watch also included 11 counties in Missouri.[90]

The storm meanwhile continued to damage Ameren-IL facilities as broken tree limbs downed and broke Ameren-IL wires from Beardstown to Petersburg, Illinois at 5:13 p.m.[91] Data in the Outage Analysis System included broken poles in Ameren-CILCO's Eastern operating area at this same time.[92]

Meanwhile at 5:25 p.m., the NWS[93] (KILX-Lincoln) issued the second tornado warning in Ameren-IL's service territory for Sangamon county as detected by Doppler radar 4 miles northeast of Springfield and moving southeast at 35 mph. It reported wind damage 3 miles southwest of Riverton.[94] At 5:28 p.m., the NWS issued a severe thunderstorm warning for six counties from Scott county on the west to Macon county on the east and moving south at 40 mph.[95] At 5:33 p.m., the NWS issued a severe thunderstorm warning for eastern DeWitt and

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[81] Response to Data Request #265.
[82] NOAA archives for July 19, http:// www.crh.noaa.gov/ . NWS statement 192156
[83] Surface Systems Inc.
[84] Response to Data Request #123.
[85] NOAA archives for July 19, http:// www.crh.noaa.gov/. NWS statement 192210.
[86] NOAA archives for July 19, http:// www.crh.noaa.gov/. Ground truth observation 20060719.
[87] National Weather Service.
[88] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192044.
[89] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192150.
[90] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192245.
[91] Response to Data Request #137, OAS order #s: 062009434, 062009438.
[92] Response to Data Request #138, OAS order # 062009441.
[93] National Weather Service.
[94] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192226.
[95] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192229.

northern Piatt counties for winds in excess of 60 mph and moving southeast at 20 mph.[96] At 5:49 p.m., the NWS issued a continuation of the severe thunderstorm warning for six counties, as Doppler radar continued to detect winds in excess of 70 mph and a line of thunderstorms moving south at 40 mph and capable of producing penny-size hail.[97]

The storm continued to damage Ameren-IL facilities as overhead facility failures and tree-related damage resulted in 54 wire-down Outage Analysis System orders from 5:15 through 6:00 p.m. The damage was occurring from Kewanee in northernmost Division I to Sparta in southern Division VI and from west to east from Jacksonville to Decatur respectively.[98] At 5:27 p.m., another transmission outage occurred for causes unknown on 138kV[99] Line 1422, Havana–East Springfield, causing an interruption to Turris Coal's service.[100] By 6:00 p.m., Ameren-IL's data indicated approximately 38,000 customers with service interruptions, located in Divisions I through VI.[101]

Ameren-IL reported for 6:00 p.m. that the "Storm intensifies and moves south and west – hits Alton and northern St. Charles County."[102] Ameren personnel paged the Ameren Emergency Operations Center Manager of the increasing storm intensity and outages in Alton and St. Louis.[103] On the way to the EOC, he conducted telephone calls with other Ameren Emergency Operations Center personnel.

The first Ameren conference call occurred and the Electric Emergency Restoration Plan (EERP) initiated at 6:40 p.m., at which point crew call-outs began.[104] The Emergency Operations Center team members arrived at the General Office Building at approximately 7:15 p.m. and Ameren activated its Emergency Operations Center.[105] At this time, 420 circuits were already out, approximately 88 percent of those were in St. Louis,[106] and the General Office Building in St. Louis was on emergency generator power.[107]

In that same hour, at 6:01 p.m., the NWS[108] cancelled the severe thunderstorm warning for Piatt and DeWitt counties (the counties west of Champaign county) while keeping the watch in effect until 8 p.m.[109] At 6:23 p.m., the NWS issued a continuation of the thunderstorm warning for six counties from Scott to the west to Shelby on the east due to Doppler detection of a line of severe thunderstorms and winds in excess of 60 mph and moving southeast. [110] At 6:41 p.m., the NWS issued a severe thunderstorm warning for Christian and Shelby counties, while canceling the

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[96] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192233.
[97] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192249.
[98] Response to Data Request #137.
[99] "kV" means kilovolts, or 1,000 volts. For example, 138kV means 138,000 volts.
[100] Response to Data Request #139.
[101] Response to Data Request #265.
[102] Response to Data Request #123-B page 15.
[103] Interview #102, November 15, 2007.
[104] Response to Data Request #123-B page 15.
[105] Response to Data Request #123-B page 15.
[106] Response to Data Request #424-A, (360/410 Feeder lockouts)
[107] Interview #13, October 3, 2007.
[108] National Weather Service.
[109] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192301.
[110] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192323.

warning for counties to their north due to Doppler radar detection of severe thunderstorms in a line from Morrisonville to Owaneco producing damaging winds in excess of 60 mph and moving southeast at 30 mph.[111] At 6:50 p.m., a third tornado touchdown occurred 1 mile north of Bunker Hill, Illinois, near the intersection of Illinois highways 159 and 138. Law enforcement personnel observed the tornado over an open field. The damage track was less than 1/5 mile in length.[112] A post-event statement by the NWS estimated the sighting at 7:05 p.m. as relayed by 911 dispatchers that fire/rescue crews observed this heading south along Illinois highway 159.[113]

Data in the Outage Analysis System were consistent with Ameren-IL's storm account of the increased storm intensity after 6:00 p.m.[114] The number of outages from 6:00 to 7:00 p.m. nearly tripled the previous hourly rate, and resulted in another 36,000 outages located primarily in Division V.[115] A transmission structure failure at 6:46 p.m., on the 138kV Line 1452, indicated the increased intensity of the storm.[116] Distribution facility damages from 6:00 to 7:00 p.m. also reflected the increased intensity. Data in the Outage Analysis System showed 83 Ameren-IL distribution wire-down instances in Divisions I, II, III, and V.[117] Data in the Outage Analysis System contained an additional 12 instances of pole damage in this period from Peoria in the north to Maryville in the south and from Jerseyville in the west to Kincaid Lake and Hillsboro in the east.[118]

The next hour was the most intense of the storm front of July 19, as another 109,000 Ameren-IL customers were interrupted primarily in Divisions V and VI (largely Ameren-IP service territory) between 7:00 and 8:00 p.m.[119] At 7:02 p.m., a transmission structure was destroyed on 345kV Line 4551, Roxford-Coffeen (it interrupted no customers); and two other 138kV lines incurred broken shield wires in the next twenty minutes (Line 1502, Wood River-Roxford, and Line 1492, Cahokia, Centerville-Turkey Hill).[120] Distribution facility damages increased as well with 70 wire-down instances reported[121] and another 20 broken or downed pole instances reported primarily in Divisions V and VI.[122] The NWS[123] also indicated in a public information statement on July 21 that law enforcement and the public observed a tornado (presumably the third one mentioned near Bunker Hill) at 7:25 p.m. as it touched down briefly in an open field.[124]

Across the Mississippi River in Missouri, NWS[125] ground-truth observations reported the fourth tornado of this storm at 7:40 p.m., approximately 10 miles west of St. Louis in Manchester, MO,

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[111] NOAA archives for July 19, http://www.crh.noaa.gov/. NWS statement 192341.
[112] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observation 20060719.
[113] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observation 20060719.
[114] Response to Data Request #123-B page 15.
[115] Response to Data Request #265.
[116] Response to Data Request #139.
[117] Response to Data Request #137.
[118] Response to Data Request #138.
[119] Response to Data Request #265.
[120] Response to Data Request #139.
[121] Response to Data Request #137.
[122] Response to Data Request #138.
[123] National Weather Service.
[124] NOAA archives for July 19, http://www.crh.noaa.gov/.
[125] National Weather Service.

with trees observed thrown into power lines.[126] In addition damage observations at 7:45 p.m. reported windows blown out of a house and two to three foot diameter trees down in Pacific, MO, approximately 30 miles southwest of St. Louis.[127]

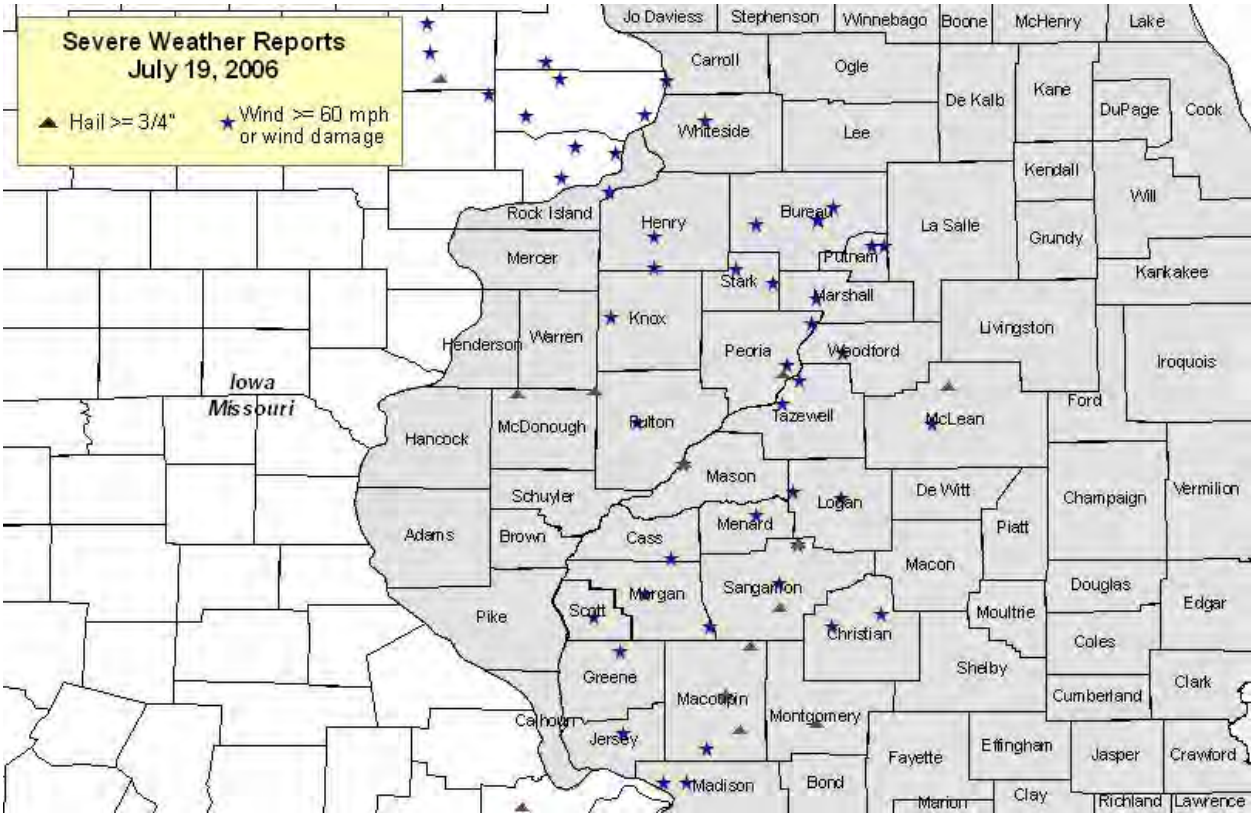
The July 19 storm resulted in more damage to Missouri infrastructure than to infrastructure in Illinois. As the storm moved across the Mississippi River into Missouri, it caused more damage, resulting in interruptions to another 29,000 customers in Divisions V and VI from 8:00 to 9:00 p.m.[128] Facility damages continued during this hour with another 67 wire downs and 17 broken pole instances.[129] The storm intensity continued to decrease as Ameren-IL incurred another 5,300, 4,600, and 3,200 customer interruptions in the remaining three hours of July 19.[130]

e. July 19 Illinois Storm Maps

This section provides visual overviews to complement the previous narrative description of storm activity in Ameren-IL's service territory. These diagrams include the presentation of archival weather data and Ameren-IL interruption data in overlay formats. They provide a visual presentation of the correlation of the storm's severe weather phenomenon and Ameren-IL facility outages and damages. The overlays provide correlation of the timing and locations of outages to severe weather. These diagrams also provide a retrospective summary of the timing and accuracy of predictive weather data available for Ameren-IL's service territory.

[126] NOAA archives for July 19, http://www.crh.noaa.gov/.
[127] NOAA archives for July 19, http://www.crh.noaa.gov/. Ground truth observation 20060719.
[128] Response to Data Request #265.
[129] Responses to Data Requests #137 and #138.
[130] Response to Data Request #265.

National Weather Service Severe Weather Reports – July 19, 2006

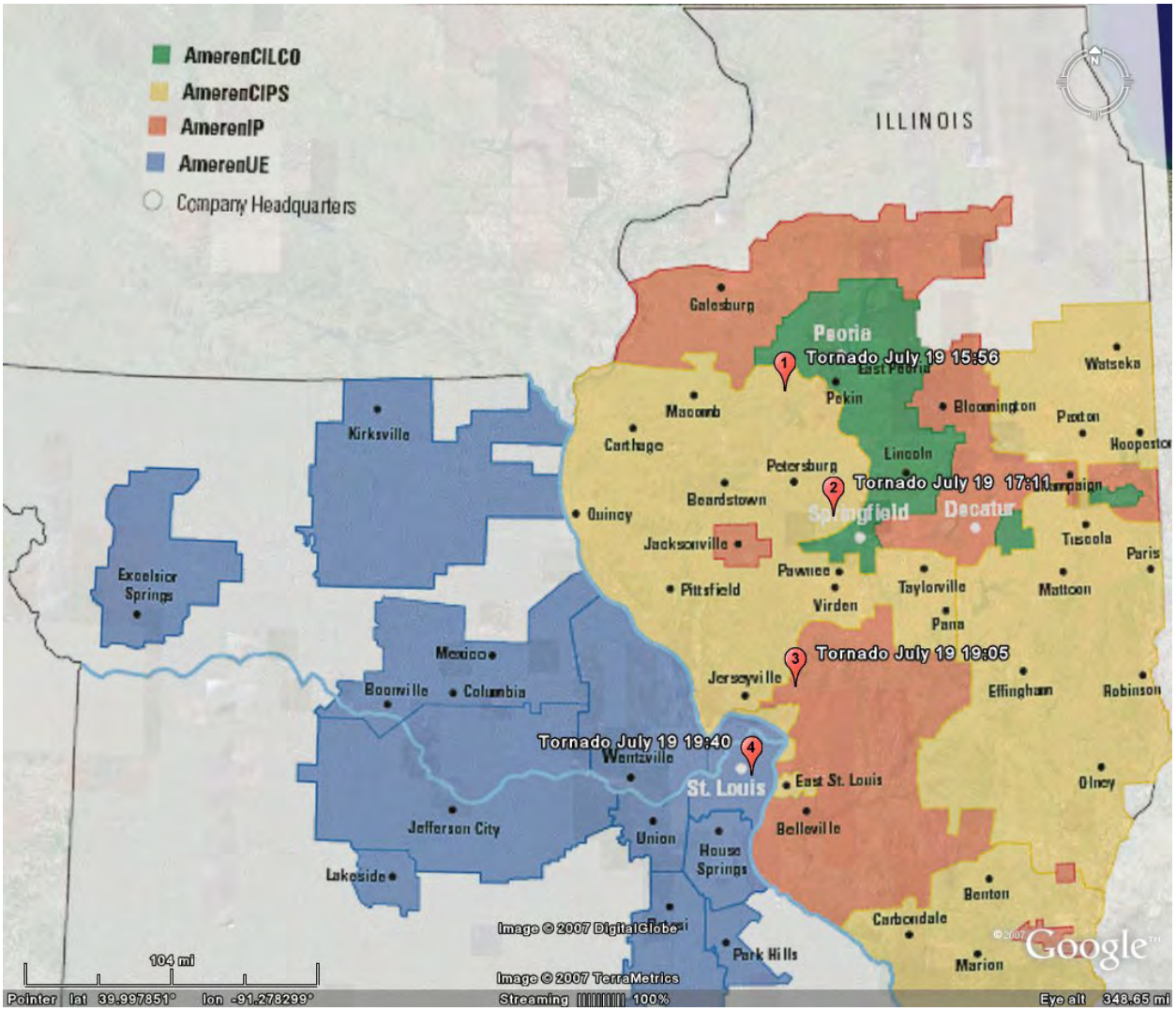


The diagram above provides a summary of NWS[131] ground-truth observations of severe weather reported for July 19, 2006.[132]

Observations on July 19 also included tornados. There were three tornado observations in approximately three hours along the storm path from the time the storm first entered Ameren-IL's service territory as shown by the following diagram.[133] There was a fourth tornado observation in Missouri. The diagram sequentially numbers the tornado icons. The location and timing of Ameren-IL outages correlates well with the track of the severe weather depicted.

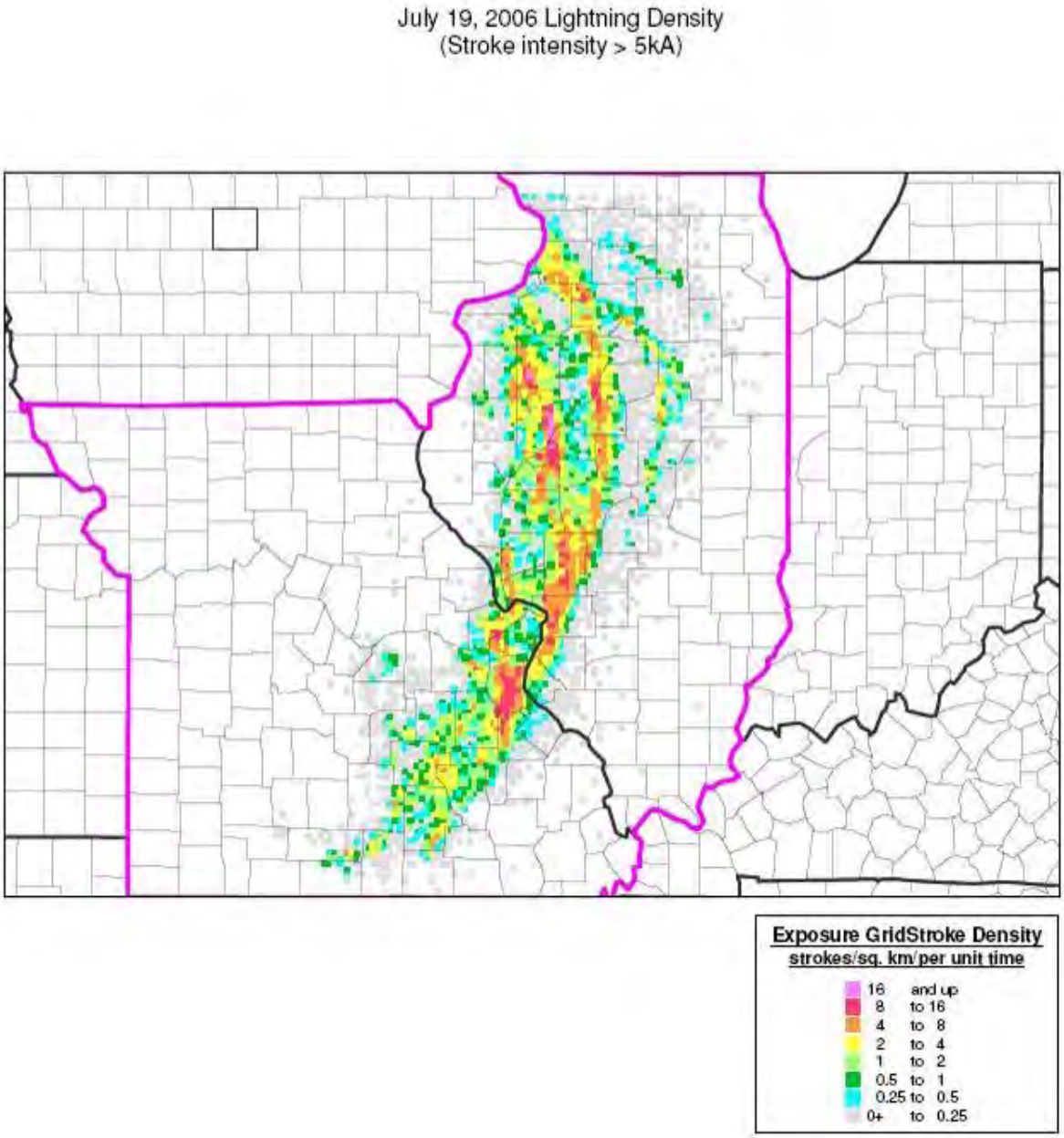
[131] National Weather Service.
[132] NOAA archives for July 19, http://www.crh.noaa.gov/.
[133] NOAA archives for July 19, http://www.crh.noaa.gov/.

National Weather Service Tornado Sightings – July 19, 2006



The next diagram below is a map of lightning density on July 19.[134] Lightning is another severe weather phenomenon. The diagram includes only lightning strokes of a minimum electrical strength, measured in kilo-Amps (>5 kA). The diagram's color variations indicate varying geographic density levels of lightning activity (strokes/square kilometer/per unit time). The lightning density is representative of the location and severity of the storm. The location of Ameren-IL's outages correlates well with the lightning density map.

[134] Response to Data Request #361.

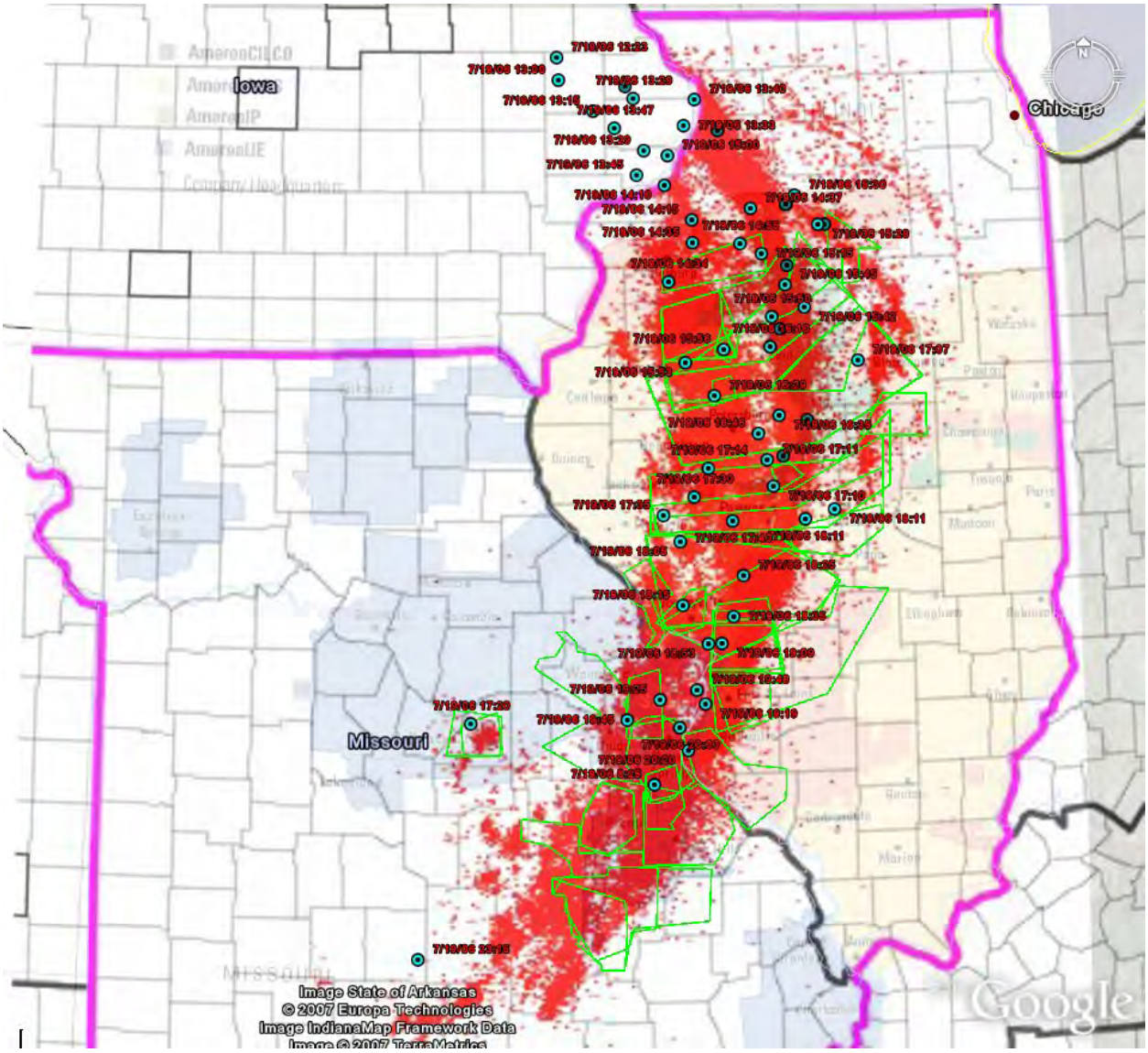


In the figure below there are three elements in the overlay: NWS[135] watchboxes (green polygons), recorded lightning strikes (small red dots), and NWS ground-truth observations (blue/black bullets with time/date text). Each green polygon outlines the geographic perimeter for each of the NWS watch and warning statements issued for July 19, referred to as "watchboxes." Each NWS watch (or warning) contains longitude and latitude coordinates (in addition to specific geographic descriptive text, *e.g.*, counties, towns, etc.) that defines the "boxed" area of applicability for the watch or warning.

[135] National Weather Service.

The lightning density (red color density) and ground-truth observations illustrate the location and timing of the storm intensity. The watchbox overlay illustrates the accuracy and range of the advanced weather data (NWS watches on this day) to predict the actual storm track. The location and timing of Ameren-IL's outages correlate well with the track of the severe weather data in this diagram.

NWS Watchbox, Lightning Activity, and Ground-Truth Observations – July 19, 2006

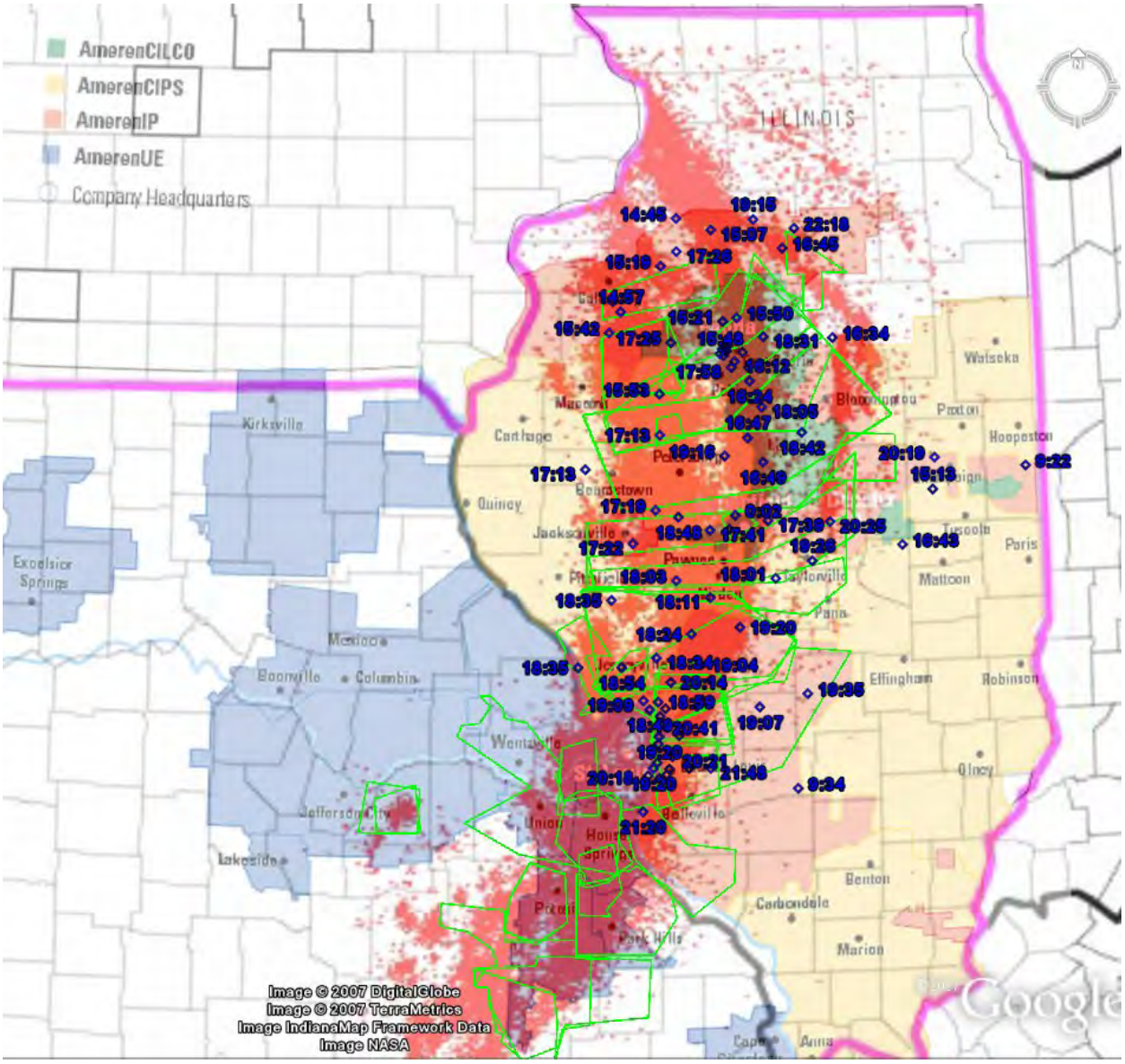


There are three elements in the overlay below: NWS[136] watchboxes (green polygons), lightning strokes (red dots), and Ameren-IL outage "first calls" (blue diamonds with time stamp text). This last element is data from the Outage Analysis System of the first outage call in a specific Ameren-IL service center (an Ameren designated geographic area of work assignment). The

[136] National Weather Service.

location and timing of Ameren-IL's outages also correlate well with the track of the severe weather data in this diagram.

NWS Watchbox, Lightning Activity, and Ameren Outage "First Calls" – July 19, 2006



f. July 2006 Storm Description –"First Round" Summary

In summary, the NWS[137] morning forecasts for July 19, 2006 did not expect this storm to arrive until July 20. Extreme heat and humidity conditions contributed to prediction uncertainty. Ameren personnel were aware of the unpredictability of thunderstorms in their service territory.[138] However, morning storms began in adjacent states and then headed into Ameren's

[137] National Weather Service.
[138] Interview #13 October 3, 2007; IR 40 November 6, 2007.

northern Illinois service territory. The weather changed by mid-day July 19 in northern Illinois and severe weather watches and warnings began at 1:56 PM in Ameren's northwestern Illinois service territory.

The storm tracked mainly north to south in a narrow band. Its westerly track beginning near Peoria is uncharacteristic of most storm directions.[139] The NWS[140] issued twelve watches/warnings from 1:56 p.m. until the time Ameren initiated its Electric Emergency Restoration Plan. SSI[141] provided all of these notices to Ameren via pager alert notification.[142] Between the time of the first NWS severe weather watch and the Electric Emergency Restoration Plan initiation three tornados, severe wind damages, and approximately 74,000[143] customer interruptions occurred in Ameren-IL's service territory. While the average lead time between NWS watch and warnings and the time of "first call" outages in any one Ameren service center's was only 49-83 minutes,[144] the overall lead time for Ameren-IL from the first severe weather watch until it initiated the Electric Emergency Restoration Plan at 6:40 PM was approximately 4.75 hours.

g. Interruption Summary and Damage Report – July 19

Ameren's photographic evidence of its damaged facilities was limited. Although there was an Ameren photographic team working in Illinois after the storm, their primary objective was to capture Ameren personnel engaged in restoration activities, thus there were few forensic photographs of damaged facilities.[145] Appendix II-A contains a few Ameren photographs of damaged facilities. In addition, the appendix contains publicly available pictures from the NWS[146] website.

By the end of July 19, the storm had interrupted 225,000 Ameren-IL customers[147] with "sustained" outages. A sustained outage requires manual restoration of service. Most of the customer interruptions were attributable to storm damage and outages on distribution facilities (15,000 volts and below).[148] However, approximately 53,000 sustained customer interruptions were attributable to sub-transmission facilities (34,000 and 69,000 volts).[149] Approximately 33,000 of those occurred in Divisions V and VI, where the storm intensity was most heavily concentrated.[150] There were two wholesale customers interrupted due to sustained outages on six transmission lines (138,000 and 345,000 volts); however, transmission events did not affect any distribution customers.[151]

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[139] Interview #116, December 17, 2007.
[140] National Weather Service.
[141] Surface Systems Inc.
[142] Interview #116, December 17, 2007, and Responses to Data Requests #427 and #428.
[143] Response to Data Request #265.
[144] 95 percent confidence band of time difference between NWS watch and first outage within a service center within the watchbox.
[145] Response to Data Request #354.
[146] National Weather Service.
[147] Response to Data Request #265.
[148] "kV" means kilovolts, or 1,000 volts.
[149] Response to Data Request #265.
[150] Response to Data Request #265.
[151] Response to Data Request #139.

Ameren-IL's restoration efforts began on July 19 as an extended day for personnel in Division I.[152] Division I and II crews worked throughout the night of July 19.[153] Ameren-IL personnel restored the majority of the affected customers in Division I.[154] The main restoration effort did not begin until after the storm struck St. Louis. Ameren-IL requested field checkers to report to work on the morning of July 20 to begin field assessment of outages.[155] Division III field checkers worked all night in Springfield and Lincoln.[156] Ameren-IL moved construction crews during the night from Bloomington to Decatur.[157] Division IV sent its people to help in other areas.[158]

Ameren issued its first press release about the storm at 6:00 a.m. on July 20. It indicated that the storm interrupted more than 500,000 Ameren customers, and approximately 450,000 Ameren customers remained without service, while Ameren had restored over 100,000 customers.[159] The release said that it was not possible to offer estimated restoration times (ERTs) given the nature of the damage.[160] Emergency Operations Center conference calls began on July 20, with updates occurring at 8 a.m. and 4 p.m. each day.[161]

Data in the Outage Analysis System indicated that Ameren-IL had restored power to approximately 60,000 of its customers on July 19.[162] Data in the Outage Analysis System also indicated that by 8 a.m. on July 20, Ameren-IL restored another 36,000, but the storm interrupted an additional 26,000 customers in the same period and before Ameren-IL provided the first briefings to the ICC Staff at 8:30 a.m.[163] In general, this oscillation pattern of Outage Analysis System activity, *i.e.*, substantial customer restoration progress negated by new Outage Analysis System interruption orders, was characteristic of restoration efforts in-progress and resulted in an overall decrease in the remaining customers without service.

A later section of this report discusses this Outage Analysis System storm oscillation pattern (called "re-ordering"[164]) in more detail. In brief, the pattern occurred when operations personnel restored portions of circuits, closed Outage Analysis System orders, and created new Outage Analysis System interruption orders for the remaining customers without service.[165]

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[152] Interview #102, November 15, 2007.
[153] Response to Data Request #424.
[154] Response to Data Request #265, Interview #102, November 15, 2007.
[155] Interview #13, October 3, 2007.
[156] Response to Data Request #424.
[157] Response to Data Request #424.
[158] Response to Data Request #424.
[159] Response to Data Request #366.
[160] Response to Data Request #366.
[161] Response to Data Request #424.
[162] Response to Data Request #265.
[163] Responses to Data Requests #265 and #122, Interview #107, November 30, 2007.
[164] Liberty chose the term "re-ordering" because some customer interruptions grouped within a single outage order are often re-assigned to a new outage order at closeout. In this process, customers may be required to confirm their outage status via automated telephone technology or re-initiate reporting of the original loss of service, resulting in a duplication of their original interruption report or a portion of the original outage order. Information loss and restoration delays are inherent to this re-ordering process.
[165] Interview #102, November 15, 2007; Interview #120, 1/15/08; Interview #170, 4/28/08; Interview #172, 5/7/08.

The table below summarizes the Outage Analysis System interruption and restoration status as of July 20, 8 a.m.[166]

	Location of Customers by Ameren-IL Division							
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**Total**
Customers Interrupted on 7/19/06	24,764	9,576	10,870	237	116,695	62,364	371	224,877
Customers Restored on 7/19/06	20,144	8,465	7,839	222	10,487	12,161	371	59,689
Customers Interrupted on 7/20/06 prior to 8 a.m.	1,519	242	310	606	13,282	10,074	124	26,159
Customers Restored on 7/20/06 prior to 8 a.m.	3,749	1,088	1,466	381	21,041	7,671	119	35,516
Remaining Customers without Service 7/20/06 8 a.m.	2,390	265	1,875	240	98,449	52,606	5	155,831

Ameren's Regulatory Affairs personnel communicated the first estimates of the storm impact to the ICC Energy Division Staff by telephone and subsequently provided to ICC staff (including the ICC's Consumer Services Division) by e-mail later that morning. It included the affected customers and expected restorations for each of the jurisdictional entities per the requirements of Illinois Administrative Code.[167] Ameren had notified the Illinois Emergency Management (IEMA) offices at 9:19 p.m. July 19.[168]

The table below provides a summary of the initial number of affected customers provided to the ICC by e-mail notice.[169]

Company	Ameren-CILCO	Ameren-CIPS	Ameren-IP	Ameren-IL Total
Affected Customers	23,000	67,023	46,000	136,023

The facility damage for the July 19 storm was significant, but the assessment was not complete by the time Ameren-IL made the initial ICC report in the morning of July 20. The assessment would not be complete, based on Outage Analysis System data, for another 24 hours, as Ameren-IL personnel, daylight, and customer calls helped to identify the additional instances of facility damage.[170] The table below summarizes the Outage Analysis System orders for damaged facilities as of July 21 at 8:00 a.m.[171] The table shows the minimum damaged facilities because a single order can include multiple poles and wires.

[166] Response to Data Request #265.
[167] Interview #107, November 30, 2007, Response to Data Request #122.
[168] Response to Data Request #422.
[169] Response to Data Request #122.
[170] Responses to Data Requests #137 and #138.
[171] Responses to Data Requests #137 and #138.

Facility Damage Type	Time Period					
	July 19	July20 Midnight to 8 a.m.	Subtotal Thru July 20 8 a.m.	July 20 8a.m.-Midnight	July 21 Midnight to 8 a.m.	Total thru July 21 8 a.m.
Damaged Wires	476	154	630	472	33	1,135
Damaged Poles	115	38	153	101	10	264

Ameren initiated mutual assistance requests[172] on July 19 at 9 p.m.[173] A later chapter of this report discusses the results of those requests. Assessment and restoration activity continued throughout July 20. Ameren-IL pressed field crews into 16-hour shifts.[174] The table below reflects the restoration efforts of July 19 and July 20 in Illinois.[175] Divisions V and VI incurred the most amount of newly reported outages as assessment efforts reached the hardest hit areas.

Location of Customers by Ameren-IL Division

	I	II	III	IV	V	VI	VII	Total
Customers Interrupted on 7/19/06	24,764	9,576	10,870	237	116,695	62,364	371	224,877
Customers Restored on 7/19/06	20,144	8,465	7,839	222	10,487	12,161	371	59,689
Customers Interrupted on 7/20/06	2,978	936	1,415	6,181	31,910	22,876	134	66,430
Customers Restored on 7/20/06	7,535	2,045	3,792	5,450	45,347	29,043	134	93,346
Remaining Customers Without Service (Close of 7/20)	63	2	654	746	92,771	44,036	0	138,272

Ameren issued a second press release at 4:00 p.m. on July 20. It said that the estimate for initial total interrupted Ameren customers was still at more than 500,000, approximately 400,000 Ameren customers remained without service, and over 160,000 Ameren customers had power restored. Estimated restoration times provided in this release stated that it would be at least 72 hours for most customers and that it could be longer for some. Ameren indicated it would provide specific customer restoration times as soon as possible.[176] Despite the company's efforts, Ameren's Emergency Operations Center Director was concerned with the lack of progress in the numbers of customers that remained without service.[177]

The extreme heat continued in the Midwest on July 20 and into July 21. The heat challenged restoration crews and logistics coordination with exhaustion and hydration concerns. The

[172] Requests for help from other electric utilities.
[173] Response to Data Request #123-B.
[174] Response to Data Request # 8-B, page 20.
[175] Response to Data Request #265.
[176] Response to Data Request #366.
[177] Response to Data Request #424.

NWS[178] weather statements indicated that small thunderstorms continued on July 20 and that it allowed the summer heat advisories to expire for the evening of July 20, as it expected cooler temperatures to follow behind a storm front on July 21.[179] Temperatures ranged from the 90s in Jacksonville and Springfield to 82°F in Danville.[180]

h. The Second Round of the Storm

As the restoration effort entered the second day, Friday, July 21, the NWS[181] was tracking the approach of another storm front into the Ameren service territory. This "second round" of the storm would approach from the northwest, near Columbia, Missouri, and continue through the St. Louis metropolitan area and across into East St. Louis, Illinois.[182] The forecast predicted that the storm would bring some relief from the extreme heat.[183] NWS ground-truth observations noted the start of the storm's second round at 8:30 a.m. near Boonville, Missouri in the Ameren-UE (Union Electric) service territory.[184] The Emergency Operations Center Manager in St. Louis was aware of the approaching storm at approximately 8 a.m. that day and of the 80 mph winds and 100°F heat in Columbia, Missouri.[185]

At 10:30 a.m. on July 21, NWS[186] ground-truth observations reported several large trees and limbs down in Batchtown, IL (approximately 30 miles northwest of St. Louis), as the northeastern front of the storm crossed the Mississippi River.[187] In the next 40 minutes, several ground-truth observations cited damages to trees and power lines in Missouri's St. Louis metropolitan area, including cars being blown around near Interstate 270.[188] As the main body of the storm crossed into Illinois, the storm increased in intensity as shown in charts on the following pages of the report. Observations included numerous instances of building damage, tree damage, and golf-ball-size hail in St. Clair, Clinton, and Madison counties.[189]

The storm continued its track to the east-southeast (parallel to and north of Interstate I-64) across Divisions V and VI, which were the hardest hit areas in the first round of the July storm. At 12:15 p.m., a trained NWS[190] spotter observed a tornado in an open field in Washington County near Hoyleton, IL.[191] The NWS later mapped severe straight-line winds, microbursts, and tornados (5) along this corridor from Troy to Irvington.[192] At 2:10 p.m., the storm was nearing its end in Illinois near Harrisburg (Division VII).[193]

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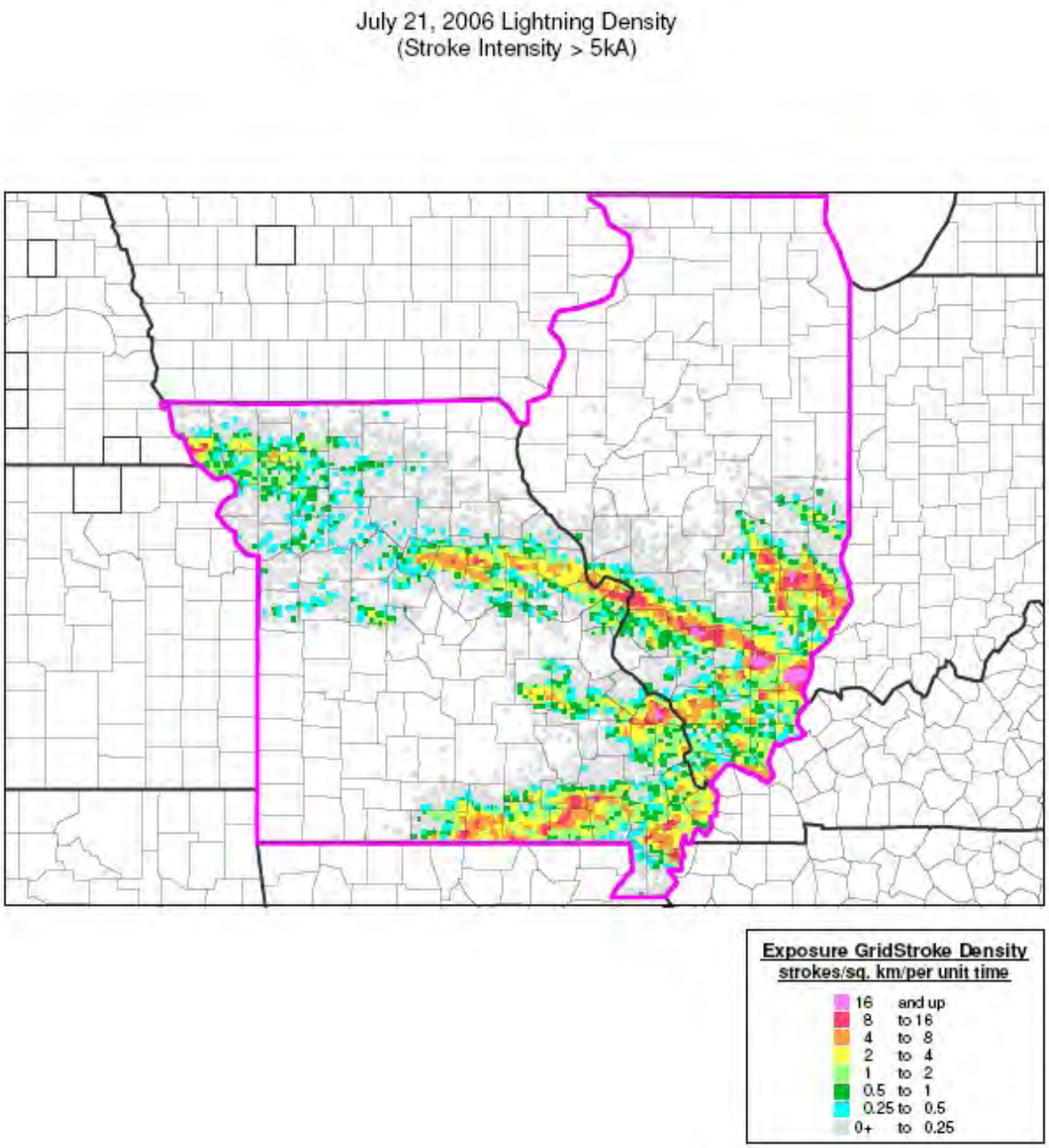
[178] National Weather Service.
[179] NOAA archives for July 21, http://www.crh.noaa.gov/.
[180] NOAA archives for July 21, http://www.crh.noaa.gov/.
[181] National Weather Service.
[182] NOAA archives for July 21, http://www.crh.noaa.gov/. KLSX forecast 11:59 pm 7/20, NWS statement 210459.
[183] NOAA archives for July 21, http://www.crh.noaa.gov/. NWS statement 210459.
[184] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.
[185] Interview #13, October 3, 2007.
[186] National Weather Service.
[187] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.
[188] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.
[189] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.
[190] National Weather Service.
[191] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.
[192] Response to Data Request #8-B, page 6.
[193] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.

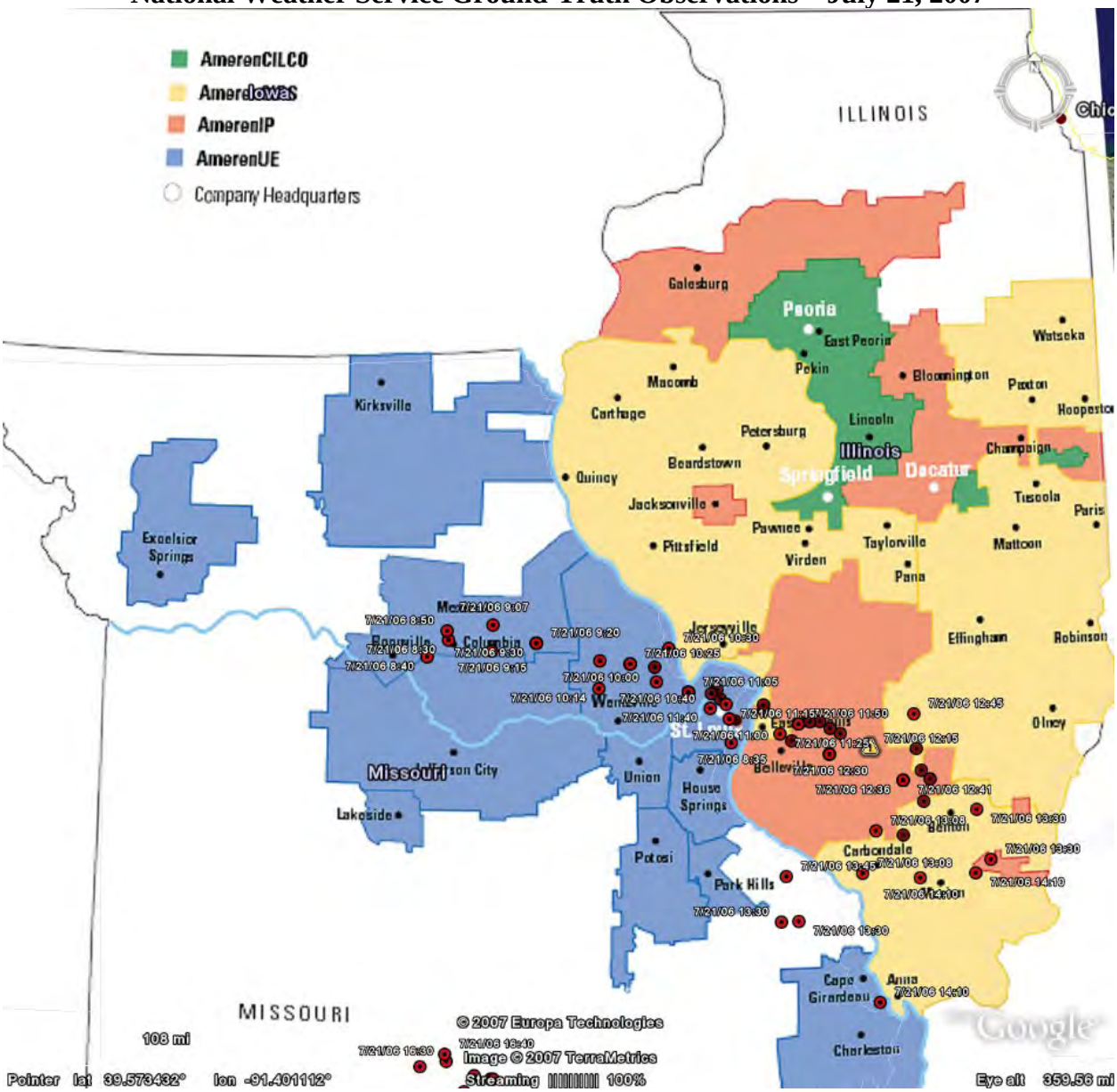
The storm's track is evident from the lightning stroke density map below.[194]



In addition, the ground-truth observations map below corroborates the track of the storm.[195] The diagram marks observations by red/black bullet icons with white time/date text. The yellow triangular icon indicates tornado observations. The placement of the icons corresponds to the longitude/latitude coordinates of the observation.

[194] Response to Data Request #362.
[195] NOAA archives for July 21, http://www.crh.noaa.gov/. Ground truth observation 20060721.

National Weather Service Ground-Truth Observations – July 21, 2007



When the storm passed, Ameren-IL needed additional restoration work to address the new interruptions. The second round of the storm affected primarily Ameren-IP and Ameren-CIPS customers. At the end of this round, the storm interrupted 43 additional sub-transmission circuits.[196]

The table below summarizes the interruption orders on July 21 and the resulting impact from the second round of the storm.[197] Additional thunderstorms occurred south of I-70 later in the evening of July 21, resulting in increased order volumes in Divisions V, VI, and VII.[198] Note that

[196] Response to Data Request #123-B.
[197] Response to Data Request #265.
[198] NOAA archives for July 21, http://www.crh.noaa.gov/. NWS statement 212205.

the total number of customers interrupted shown in this table is greater than tables presented later in this section because it includes all Outage Analysis System order types to illustrate the hourly detail of the storm's effect on each division. Later in the report, tables show reduced customer totals because of the exclusion of non-storm order types (maintenance outages and service-man request orders).

Hourly Customer Interruptions – July 21
Location of Customers by Ameren-IL Division

Hour	I	II	III	IV	V	VI	VII	Total
0	110		1	23	7	3	0	144
1	1,348			141	4	2	1	1,496
2				26	3	1,547		1,576
3	10				3	61		74
4				41		7		48
5	1	30	2	4	952	841	3	1,833
6	8		1	6	526	904		1,445
7	8	2	5	7	127	626	4	779
8	11	13	7	21	1,262	673	4	1,991
9	39	9	8	13	239	115	2	425
10	37	102	11	18	151	78	1	398
11	6	24	2	13	14,043	15,856	6	29,950
12	11	2	4	13	5,250	14,683	5,112	25,075
13	64	9	14	8	3,515	9,184	8,541	21,335
14	12	1	5	10	816	1,138	130	2,112
15	19	10	10	5	1,499	1,188	28	2,759
16	20	19	27	4	378	1,610	106	2,164
17	1,195	21	4	1	152	2,032	58	3,463
18	10	13	54	17	1,632	111	13	1,850
19	931	1	18	74	2,624	698	701	5,047
20	404	3	9	584	276	1,895	131	3,302
21	3		1	14	98	670	4	790
22	3		1	3	1,021	486	18	1,532
23		2	1	1	331	1,461	4	1,800
Total	4,250	261	185	1,047	34,909	55,869	14,867	111,388

i. July 2006 Storm Restoration – OAS Summary

Liberty discusses storm restoration in detail in a later chapter of this report. That chapter of the report discusses unique challenges to restoration faced by the Ameren-IL companies. In this section, Liberty addresses restoration by OAS (Outage Analysis System) order type. Data in the following tables show restoration activity.[199] These tables indicate that Ameren-IL properly prioritized restoration work. This can be observed from the restoration by order type in each Division and overall (Ameren-IL). The interruption orders with the most customers per order are

[199] Response to Data Request #265.

generally the first orders completed, *e.g.*, ST (sub-transmission) orders and FO (feeder orders). Lower priority orders, such as SO (service orders) and TO (transformer orders) are the last to be restored. This is consistent with Ameren personnel accounts.[200] The first table below provides the definition of Ameren-IL Outage Analysis System order types.

OAS Order Type Table [201]		*(Representative only[202])*
OAS Order Type	**Description & Facility Translation**	**Range: Customers/Order**
SO	Single Outage (Service Wire)	1-10
TO	Transformer Outage (Distribution type)	2-20
DO	Device Outage (Fuse; circuit section)	10-500
GO	Grouped Outage (Multiple devices)	100-1000
FO	Feeder Outage (Entire circuit)	500-2000
ST	Sub-Transmission (Distribution Supply)	1500-4500
Additional OAS Order Type Information		
Significant numbers exist in storm data		
MO	Maintenance Outage (Scheduled)	1-100
SR	Service Request (wires down or service down but no lights out)	1-100

The first table below summarizes the total customers interrupted by associated Order Type, daily, and for each Division.[203] These summaries are limited to "lights out" orders, which exclude SR and MO orders.[204] The second table summarizes the total customers restored by associated Order Type, daily, and for each Division.[205] The surge in new interruptions on July 21 shows the effect of the second round of the July storm. Overall, Ameren-IL restored the highest priority orders, *i.e.*, greatest number of customers/order, first and the lowest priority orders last. These tables also show a good correlation with the weather severity by geographic area. The number of customers interrupted correlates closely with the areas having the most severe weather observations.

[200] Interview #13, October 3, 2007, and Interview #102, November 15, 2007.
[201] Response to Data Request #257.
[202] Response to Data Request #265.
[203] Response to Data Request #265.
[204] Response to Data Request #436.
[205] Response to Data Request #265.

July 2006 Storm Summary of Interrupted Customers by Date and Order Type

July Date	Order Type	Division I	II	III	IV	V	VI	VII	Total
19	DO	6,336	4,730	3,556	216	11,820	3,301	21	29,980
	FO	11,181	1,959	2,932		50,253	14,119	343	80,787
	GO	1,451	120	1,825	1	26,068	30,447	3	59,915
	SO	84	72	45	9	135	133	3	481
	ST	5,438	2,496	2,417		28,161	14,298		52,810
	TO	274	199	95	11	258	66	1	904
19 Total		24,764	9,576	10,870	237	116,695	62,364	371	224,877
20	DO	1,413	542	988	1,922	7,739	2,568		15,172
	FO	858	311		2,187	15,006	9,103	114	27,579
	GO	554		311	1,926	4,375	8,420		15,586
	SO	35	43	29	10	240	224	2	583
	ST				9	4,005	2,187		6,201
	TO	118	40	87	127	545	374	18	1,309
20 Total		2,978	936	1,415	6,181	31,910	22,876	134	66,430
21	DO	966	184	87	365	6,436	14,881	2,058	24,977
	FO	1,754			367	14,511	20,017	4,332	40,981
	GO	397			163	7,486	8,387	3,233	19,666
	SO	15	9	14	15	204	356	70	683
	ST					2,417	8,751	4,929	16,097
	TO	36	2	7	40	228	415	87	815
21 Total		3,168	195	108	950	31,282	52,807	14,709	103,219
22	DO	184	1	141	67	5,103	1,652	522	7,670
	FO					3,118	1,898		5,016
	GO	4				1,685	3,461		5,150
	SO	12	6	10	4	91	113	24	260
	ST				68				68
	TO	39	4	1	27	153	104	18	346
22 Total		239	11	152	166	10,150	7,228	564	18,510
23	DO	474	29	260		2,193	1,612		4,568
	FO		316			2,408	1,040		3,764
	GO				78	826	1,898	49	2,851
	SO	4	3	4	1	83	68	3	166
	ST						2,097		2,097
	TO	11	4	1	9	174	126	22	347
23 Total		489	352	265	88	5,684	6,841	74	13,793
24	DO	255	361	17	187	1,813	1,142	104	3,879
	FO				729	600	620		1,949
	GO				28	233	1,526	4	1,791
	SO	11	6	4	5	164	122	8	320
	ST						538		538
	TO	13	5	17	8	138	218	4	403
24 Total		279	372	38	957	2,948	4,166	120	8,880
25	DO	87	94	133	24	770	589		1,697
	FO					181	837		1,018
	GO	230		2			123	24	379
	SO	14	6	4	10	142	119	4	299
	ST	2,032							2,032
	TO	31	2	1	23	90	162	14	323
25 Total		2,394	102	140	57	1,183	1,830	42	5,748
26	DO	535	141	576	1,083	943	645	140	4,063
	FO		50		786		953	841	2,630
	GO	322		114		260	40	96	832
	SO	5	8	8	10	132	144	7	314
	TO	65	3	19	59	157	166	25	494
26 Total		927	202	717	1,938	1,492	1,948	1,109	8,333
27	DO	611	78	364	824	212	88	942	3,119
	FO				1,034			241	1,275
	GO	1,933	7	60	22	32	38		2,092
	SO	9	3	8	16	92	79	3	210
	ST				3,700		2,098		5,798
	TO	45	7	24	98	44	99		317
27 Total		2,598	95	456	5,694	380	2,402	1,186	12,811
28	DO	210	21	535	65	211	461	1	1,504
	FO		527	355	1,880		2,178		4,940
	GO			12	3				15
	SO	10	7	14	15	64	58	5	173
	ST					6,102	1,840		7,942
	TO	21	16	46	22	24	21	1	151
28 Total		241	571	962	1,985	6,401	4,558	7	14,725
Grand Total		38,077	12,412	15,123	18,253	208,125	167,020	18,316	477,326

July 2006 Storm Summary of Restored Customers by Date and Order Type

July Date	Order Type	Division I	II	III	IV	V	VI	VII	Total
19	DO	3,618	3,746	2,063	203	786	14	21	10,451
	FO	9,663	1,959	2,540		359	2,582	343	17,446
	GO	1,291	77	777		4,317	673	3	7,138
	SO	26	39	6	8	6	3	3	91
	ST	5,438	2,496	2,417		4,982	8,889		24,222
	TO	108	148	36	11	37		1	341
19 Total		20,144	8,465	7,839	222	10,487	12,161	371	59,689
20	DO	4,096	1,526	1,902	1,927	6,896	1,241		17,588
	FO	2,376	311	392	1,469	24,299	9,881	114	38,842
	GO	695	43	1,358	1,927	4,504	17,736		26,263
	SO	91	74	38	11	43	55	2	314
	ST				9	9,531	94		9,634
	TO	277	91	102	107	74	36	18	705
20 Total		7,535	2,045	3,792	5,450	45,347	29,043	134	93,346
21	DO	993	184	286	372	3,206	2,228	1,464	8,733
	FO	1,754			756	19,661	9,558	4,332	36,061
	GO	416		1	3	12,808	6,576	3,084	22,888
	SO	15	10	19	14	74	89	41	262
	ST					8,707	15,704	4,929	29,340
	TO	36	1	22	59	81	90	40	329
21 Total		3,214	195	328	1,204	44,537	34,245	13,890	97,613
22	DO	191	1	521	68	4,204	4,491	1,116	10,592
	FO				329	19,037	10,048		29,414
	GO				160	239	7,499	149	8,047
	SO	14	7	35	5	79	87	52	279
	ST				68	11,363	549		11,980
	TO	44	5	30	28	213	36	64	420
22 Total		249	13	586	658	35,135	22,710	1,381	60,732
23	DO	474	29	260		4,089	6,973		11,825
	FO		316			6,686	10,226		17,228
	GO	4			78	7,061	7,711	49	14,903
	SO	4	3	4	1	155	168	4	339
	ST						2,097		2,097
	TO	4	4	1	9	369	177	23	587
23 Total		486	352	265	88	18,360	27,352	76	46,979
24	DO	95	361	17	178	4,175	4,463	103	9,392
	FO				729	7,343	1,976		10,048
	GO					7,208	6,595	4	13,807
	SO	11	6	4	5	107	301	8	442
	TO	22	5	17	8	187	294	4	537
24 Total		128	372	38	920	19,020	13,629	119	34,226
25	DO	248	94	77	33	5,113	3,269	1	8,835
	FO					5,246	2,077		7,323
	GO	33		2	28	2,217	4,661	24	6,965
	SO	14	6	4	10	189	228	4	455
	ST	2,032					538		2,570
	TO	20	2	1	22	69	387	14	515
25 Total		2,347	102	84	93	12,834	11,160	43	26,663
26	DO	535	105	567	579	6,686	3,142	97	11,711
	FO		50		786	3,052	1,959	841	6,688
	GO	322				2,237	2,287	96	4,942
	SO	5	6	7	6	322	241	7	594
	TO	75	2	9	32	384	492	25	1,019
26 Total		937	163	583	1,403	12,681	8,121	1,066	24,954
27	DO	599	114	357	934	1,831	652	985	5,472
	FO					394	280	241	915
	GO	2,130	7	174	22	342	602		3,277
	SO	9	5	8	17	282	180	2	503
	ST				3,700		2,098		5,798
	TO	46	7	34	108	333	207		735
27 Total		2,784	133	573	4,781	3,182	4,019	1,228	16,700
28	DO	221	21	607	459	254	399	1	1,962
	FO		527	355	2,867		2,178		5,927
	GO			12	3	32			47
	SO	10	7	15	17	89	55	6	199
	ST					6,102	1,840		7,942
	TO	21	16	35	40	64	32	1	209
28 Total		252	571	1,024	3,386	6,541	4,504	8	16,286
29	DO	1					67		68
	FO				47				47
	SO				1	1	9		11
	TO		1	11					12
29 Total		1	1	11	48	1	76		138
Grand Total		38,077	12,412	15,123	18,253	208,125	167,020	18,316	477,326

j. July 2006 Storm Summary Statistics

The storm damage illustrates a generally consistent correlation with geographic weather severity and the number of Outage Analysis System orders for damaged facilities per Ameren-IL Division. As shown in the table below, the greatest damages occurred in Divisions V and VI, which is where the most severe weather occurred[206].

Facility Damage Type	July 2006 Summary of Damaged Facilities by Ameren Division							
	I	II	III	IV	V	VI	VII	Total
Damaged Wires	266	128	183	84	1,379	1,174	100	3,314
Damaged Poles	46	16	21	18	217	167	20	505

Generally, the design standards of facilities increase with increasing voltage levels and utilities design and maintain greater clearances with increasing facility voltage levels, *e.g.*, transmission facilities are less susceptible to storm damage (for example, falling trees and flying debris) than sub-transmission facilities, and sub-transmission facilities are less susceptible than distribution facilities. This can be attributable to the smaller physical size, *e.g.*, smaller wire size to withstand wind or physical force, and from the close proximity permitted by clearances, *e.g.*, vegetation-maintenance clearance standards, which can result in tree contacts and broken limbs for which higher voltage facilities are beyond harm's reach.

Transmission facilities sustained the least damage of the facility types. The table below provides a summary of transmission outages (sustained only).[207] The least amount of customer interruptions of any of the facility types was attributable to transmission facility damage.

Line	Voltage	Outage Start	Reason	Distribution SubstationsCustomer Impacts	Wholesale Customer Impacts
Hennepin-Princeton-E. Kewanee (L1522)	138kV	7/19/06, 1601hrs.	Substation Problem at Hennepin PP. Failed 138kv switch by lightning	none	Princeton Municipal
Havana-E. Springfield (L1422)	138kV	7/19/06, 1727hrs.	Patrolled - Nothing found	none	Turris Coal
Wood River-Stallings-Madison Industrial (L1452)	138kV	7/19/06, 1846hrs.	Structure down, bad pole	none	none
Roxford-Coffeen (L4551)	345kV	7/19/06, 1902hrs.	Structure destroyed	none	none
Wood River-Roxford (L1502)	138kV	7/19/06, 1904hrs.	Broken Shield wire (steel tower section)	none	none
Cahokia-Centerville-Turkey Hill (L1492)	138kV	7/19/06, 1920hrs.	Not sure, but may have been a broken shield wire	none	none
Mt Vernon 42nd St-Ina (L1322)	138kv	7/21/06 1245hrs	Cause unknown	none	Waltonville Shell, Consol Coal Nason Pt.
W. Frankfort-Pinckneyville-St Johns	230kv	7/23/06 0831hrs	Substation problem- grd switch closed at St. Johns	none	none

For the distribution and sub-transmission facilities a similar susceptibility order exists, therefore distribution facilities of lower voltage, *e.g.*, service wires, single distribution transformer poles, are more susceptible to storm damage than facilities of higher voltage and service, *e.g.*, primary wires and poles are less susceptible than secondary wires, secondary wires are less susceptible

[206] Responses to Data Requests #137 and #138.
[207] Response to Data Request #139.

than service wires.[208] This is due to the facility height, material strengths, and clearance standards of primary facilities compared to secondary facilities. Similarly, secondary wires are less susceptible than service wires even though the wire may actually be of the same material and have nearly the same height, because primary class poles often support secondary wires and secondary wires may get clearance from cyclic trimming of vegetation. Customers maintain the clearances on service wires. The service wire attachment at the dwelling is often the structural weak point relative to the pole connection. As a result, service wires are more susceptible to mechanical damage from intermittent tree contact, falling tree limbs, and flying debris damage than secondary wires. These tables illustrate the correlation of July 2006 severe weather and damaged facilities by examination of the Outage Analysis System Component Code data. These tables provide a consistent correlation between the severe weather exposure and damaged facility types by Service Division.[209]

The tables indicate the expected results: that the most susceptible distribution facilities—service wires—were damaged the least in the Divisions (IV and VII) of light weather severity exposure, while the number of damaged facilities is greatest in the Divisions (V and VI) of most severe weather exposure. The least susceptible distribution facilities—primary wire and poles—follow a similar geographic distribution by Division.

OAS Detail			Location of Damaged Wires for July 2006 Storms by Ameren-IL Division							
Category	Component Code	Damage Code	I	II	III	IV	V	VI	VII	Total
PRI BR	Primary Wire	Broken	12	6	6	2	56	46	5	133
PRI BU	Primary Wire	Burned	2			1	2	5		10
PRI CP	Primary Wire	Clearance Problem	2	2	5	1	19	10	1	40
PRI DN	Primary Wire	Down	7	25	10	5	172	141	16	376
PRI FA	Primary Wire	Failed/Faulted		1			15			16
PRI LO	Primary Wire	Low	2		2		2	8	2	16
PRI LS	Primary Wire	Loose	2				10	2		14
SEC BR	Secondary Wire	Broken	13	1	8	11	16	41	5	95
SEC BU	Secondary Wire	Burned	3		2	3	6	1		15
SEC CP	Secondary Wire	Clearance Problem	2	2	4		16	6		30
SEC DN	Secondary Wire	Down	11	11	12	2	101	78	3	218
SEC FA	Secondary Wire	Failed/Faulted	1				4			5
SEC LO	Secondary Wire	Low	4		3	1	4	3	3	18
SEC LS	Secondary Wire	Loose		1	3	2	6	1	1	14
SEC SH	Secondary Wire	Shorted	1		1		1	1		4
SVC BR	Service Wire	Broken	36	16	26	19	209	204	13	523
SVC BU	Service Wire	Burned	10	3	3	8	8	12	1	45
SVC CP	Service Wire	Clearance Problem	5	3	13		42	4	3	70
SVC DN	Service Wire	Down	94	42	45	12	591	520	38	1,342
SVC FA	Service Wire	Failed/Faulted	2	6	1	2	24	2		37
SVC LO	Service Wire	Low	50	3	32	9	49	64	4	211
SVC LS	Service Wire	Loose	6	6	7	6	23	23	5	76
SVC SH	Service Wire	Shorted	1				3	2		6
		Total	266	128	183	84	1,379	1,174	100	3,314

[208] Primary wires carry electrical current at between 4,000 and 15,000 volts. Secondary wires carry up to 600 volts. Service wires bring low voltage (usually 120 or 240 volts) electric power into homes and businesses.
[209] Response to Data Request #257.

OAS Detail			Location of Damaged Poles for July 2006 Storms by Ameren-IL Division							
Category	Component Code	Damage Code	I	II	III	IV	V	VI	VII	Total
POLEBR	Pole	Broken	37	13	18	15	135	109	16	343
POLEDN	Pole	Down	5	1	2		63	49	2	122
POLEFA	Pole	Failed/Faulted					2	2		4
POLELN	Pole	Leaning	4	2	1	3	17	7	2	36
		Total	46	16	21	18	217	167	20	505

The next four tables show the July 2006 storm damage and cause analysis summary by Ameren-IL company for poles, primary wires, secondary wires, and service wires.[210] The category column is a combination of the Outage Analysis System Component and Damage Codes. These tables provide the causes of damaged facility instances by each of the Ameren-IL companies. The last two letters of the category column show the damage type (refer to tables above of damaged facilities by Division for descriptions of the damage and facility codes). Note that the Ameren-CIPS figures include the Alton and East St. Louis area.

Damaged Poles

Cause	Category	Ameren-CILCO	Ameren-CIPS	Ameren-IP	Total
Animal on Circuit	POLEBR			1	1
Dropped for Safety	POLEBR	1	3	3	7
	POLEDN			1	1
Dropped for Safety Total		1	3	4	8
Loss Other Utility Supply	POLEBR			1	1
	POLELN			1	1
Loss Other Utility Supply Total				2	2
No Cause Found	POLEBR		1	2	3
Other – Explain	POLEBR		6	20	26
	POLEDN		2	4	6
	POLELN			2	2
Other - Explain Total			8	26	34
Overhead Equip. Malfunction	POLEBR	4	10	37	51
	POLEDN	2	1	19	22
	POLELN		1	2	3
Overhead Equip. Malfunction Total		6	12	58	76
Public Vehicle Accident	POLEBR	4	5	1	10
Structure Fire	POLEBR			1	1
Tree Contact	POLEBR		3	10	13
	POLEDN		5	5	10
	POLELN			1	1
Tree Contact Total			8	16	24
Tree Limb Broken	POLEBR	1	28	24	53
	POLEDN		14	10	24
Tree Limb Broken Total		1	42	34	77
Total		12	79	145	236

[210] Responses to Data Requests #137, #138, and #265.

Damaged Primary Wires

Cause	Category	Ameren-CILCO	Ameren-CIPS	Ameren-IP	Total
Animal on Circuit	PRI BR			1	1
Loss Other Utility Supply	PRI FA			9	9
No Cause Found	PRI CP			1	1
	PRI DN			2	2
No Cause Found Total				3	3
Other – Explain	PRI BR		1	9	10
	PRI BU			1	1
	PRI CP		1	1	2
	PRI DN	1	4	5	10
	PRI LO			1	1
Other - Explain Total		1	6	17	24
Overhead Equip. Malfunction	PRI BR	2	2	4	8
	PRI BU			1	1
	PRI DN	1	6	37	44
	PRI LO			1	1
Overhead Equip. Malfunction Total		3	8	43	54
Tree Contact	PRI BR	2	9	8	19
	PRI BU			1	1
	PRI CP		2	1	3
	PRI DN	1	25	17	43
	PRI LO			1	1
	PRI LS		1		1
Tree Contact Total		3	37	28	68
Tree Limb Broken	PRI BR	1	5	17	23
	PRI BU		1		1
	PRI CP	4	3		7
	PRI DN	1	46	25	72
	PRI FA		1		1
	PRI LO		1		1
	PRI LS			1	1
Tree Limb Broken Total		6	57	43	106
Total		13	108	144	265

Damaged Secondary Wires

Cause	Category	Ameren-CILCO	Ameren-CIPS	Ameren-IP	Total
No Cause Found	SEC BR			1	1
	SEC LO		1		1
	SEC SH		1		1
No Cause Found Total			2	1	3
Other - Explain	SEC BR	2	1	2	5
	SEC DN	2		7	9
Other - Explain Total		4	1	9	14
Overhead Equip. Malfunction	SEC BR	2		6	8
	SEC BU		1	1	2
	SEC DN	3	3	13	19
	SEC LS		1	4	5
	SEC SH			1	1
Overhead Equip. Malfunction Total		5	5	25	35
Tree Contact	SEC BR		4	9	13
	SEC BU		1		1
	SEC CP			2	2
	SEC DN		3	15	18
	SEC LO		1		1
	SEC LS			1	1
	SEC SH	1			1
Tree Contact Total		1	9	27	37
Tree Limb Broken	SEC BR	1	9	5	15
	SEC BU	1		1	2
	SEC CP		2	2	4
	SEC DN	4	26	14	44
	SEC FA			1	1
	SEC LO	1		2	3
	SEC LS		1		1
Tree Limb Broken Total		7	38	25	70
Underground Equip. Malfunction	SEC BU				1
	SEC FA			1	1
Underground Equip. Malfunction Total			1	1	2
Total		17	56	88	161

Damaged Service Wires

Cause	Category	Ameren-CILCO	Ameren-CIPS	Ameren-IP	Total
Customer Equip. Problem	SVC BR		1		1
	SVC DN	1	1	1	3
Customer Equip Problem Total		1	2	1	4
Loss Of Ameren Transmission	SVC DN			2	2
Loss Other Utility Supply	SVC CP			2	2
	SVC DN			1	1
	SVC FA			6	6
Loss Other Utility Supply Total				9	9
No Cause Found	SVC BR		2		2
	SVC DN	1		2	3
	SVC FA			1	1
	SVC LO			1	1
No Cause Found Total		1	2	4	7
Other – Explain	SVC BR		3	33	36
	SVC BU			2	2
	SVC DN	2	5	22	29
	SVC FA			1	1
	SVC LO	1		2	3
Other - Explain Total		3	8	60	71
Overhead Equip. Malfunction	SVC BR	3	12	24	39
	SVC BU	3	3	3	9
	SVC CP			2	2
	SVC DN	4	16	56	76
	SVC LO	2	1	1	4
	SVC LS		4	4	8
	SVC SH			3	3
Overhead Equip. Malfunction Total		12	36	93	141
Public Vehicle Accident	SVC BR	1			1
	SVC DN		2		2
Public Vehicle Accident Total		1	2		3
Structure Fire	SVC BU			1	1
Tree Contact	SVC BR	1	39	37	77
	SVC BU		1	2	3
	SVC CP		1	2	3
	SVC DN		70	102	172
	SVC LO	1	24	2	27
	SVC LS		2	3	5
Tree Contact Total		2	137	148	287
Tree Limb Broken	SVC BR	12	46	44	102
	SVC BU	1	1	5	7
	SVC CP		1	3	4
	SVC DN	42	221	123	386
	SVC FA	1		4	5
	SVC LO	6	3	11	20
	SVC LS		2	2	4
	SVC SH			1	1
Tree Limb Broken Total		62	274	193	529
Tree Trimmers	SVC CP			1	1
Total		82	461	512	1,055

Ameren-IL provided a summary of materials used to complete the restoration in a report to the ICC. The table below provides that information.[211] The summary of material used in the restoration is consistent with the Outage Analysis System data for damaged facilities. For example, the total number of poles should be of the same order of magnitude as the total damaged pole orders. Single Outage Analysis System orders are often associated with multiple poles, thus the number of poles used is greater than the damaged pole orders but within the same order of magnitude. Primary/secondary wire stock used corresponds to about 1,000 feet primary of wire per order. Service-wire orders, *i.e.*, #2 tri-plex stock material, correspond to about 60 feet service wire per damaged service order, which is consistent with typical lot line distances.

Item	
Poles	848
Transformers	734
Wire & Cable (ft.)	1,000,000
#2 Triplex (ft.)	136,000
100 A Switches	929
Electrical tape	4,162
House knobs	2,663
65 T fuse links	1,205
100 T fuse links	511

The following table shows the July 2006 storm summary of customer interruptions by cause for each of the Illinois companies.[212] Note that the table provides the ICC cause category and the Outage Analysis System cause code.

[211] Responses to Data Requests #8-B and #123-B.
[212] Response to Data Request #265.

Customer Interruptions by Ameren-IL Company – July 2006 Storms

ICC Category	Cause	Ameren-CILCO	Ameren-CIPS	Ameren-IP	Total
Animal Related	Animal on Circuit	260	234	833	1,327
Customer	Customer Equip. Problem	76	56	2,234	2,366
Intentional	Dropped for Safety	3,026	1,249	13,835	18,110
Jurisdictional	Tree Trimmers and Other	177	79	98	354
Loss of Supply	Loss Other Utility Supply		1,333	397	1,730
Other	Other - Explain	4,990	5,851	37,365	48,206
Overhead Equipment	Overhead Equip. Malfunction	2,582	2,712	9,788	15,082
Overload	Overloaded Equipment	10	15	6	31
Public	Damage by Public	3	34	54	91
	Dig-In by Public		504	24	528
	Public Vehicle Accident	1,345	895	6,366	8,606
	Structure Fire	29		190	219
Public Total		1,377	1,433	6,634	9,444
Substation Equipment	Substation Equip. Malfunction		428		428
Transmission Outage	Loss Of Ameren Transmission			315	315
Tree Broken	Tree Limb Broken	1,183	1,298	1,179	3,660
Tree Contact	Tree Contact	295	1,214	454	1,963
Underground Equipment	Underground Equip. Malfunction	920	555	937	2,412
Unknown	No Cause Found	278	1,713	272	2,263
Weather	No Cause Found	16	27,739	22,782	50,537
	Overhead Equip. Malfunction	13,153	27,879	151,603	192,635
	Overloaded Equipment		21	145	166
	Substation Equip. Malfunction	1,201	1,816		3,017
	Tree Contact	4	13,870	18,813	32,687
	Tree Limb Broken	9,183	62,263	32,155	103,601
	Underground Equip. Malfunction	82	103	246	431
Weather Total		23,639	133,691	225,744	383,074
Grand Total		38,813	151,861	300,091	490,765

2. The July 2006 Storm Comparison

a. National Weather Service Comparative Data

Most major storms in the Ameren-IL service territory are thunderstorms with accompanying severe winds.[213] For the past 20 years, the National Weather Service (NWS) recorded wind gust observations in Illinois.[214] About 80 percent of these occurred between mid-April and early September, and were reportable by wind gusts in excess of 50-mph.[215] Individual severe gust observations can occur, but most severe gusts occur in clusters in three or more Illinois counties on a given day.[216] NWS data include nearly 7,000 severe wind gust observations[217] in Illinois that occurred on 853 days in the past 20 years, for an average of 43 severe-weather days per year within the Ameren-IL service area.[218] Of the 853 severe weather days, 317 occurred on consecutive days and 100 severe weather days occurred two days apart, as was the case of the July 2006 storms.[219] On average, severe weather occurs on one in four days between mid-April and early September.

[213] Response to Data Request #122.
[214] http://www.spc.noaa.gov/archive/. Weather monitoring station data.
[215] http://www.spc.noaa.gov/archive/. Weather monitoring station data.
[216] http://www.spc.noaa.gov/archive/. Weather monitoring station data.
[217] Although much of the NWS severe weather data is retrievable for the last 20 years, the data quality deteriorates in earlier years. NWS forecast information is not available prior to 2001. Storm radar images are not retrievable prior to 2000.
[218] http://www.spc.noaa.gov/archive/. Weather monitoring station data.
[219] http://www.spc.noaa.gov/archive

The most significant 10 percent of the severe weather days have characteristics that are relevant to electric utility storm response in Illinois as shown below. The July 2006 storms clearly met each of these four characteristics and 37 of the 853 severe weather days (4 percent) met all four of the thresholds in the table below.[220]

Characteristics of the Most Significant Severe Weather Days	Utility Implication
Occur between April 17 and September 7 [107th to the 250th day of year]	1) Climatic conditions are conducive to thunderstorms and severe winds. Higher risk period of the calendar year in Illinois. 2) Trees are not bare of foliage; higher damage potential.
≥ 21 Observations	Sustained intensity time interval
≥ 15 County Count	Significant swath of service territory exposure
≥ 70 mph Max Gust Speed	Wind severity near or above design threshold

During interviews, several Ameren-IL personnel identified the July 2006 storm as the largest in their experience.[221] The Missouri Public Service Commission's Staff report on Ameren-UE's restoration of this storm provided comparisons to other St. Louis storms.[222] The report characterized the July 19 and 21 storms as "extraordinary in terms of their wind speeds and direction and the fact that they occurred only two days apart." While the direction of the July storms may have been unusual and the severity of the storms was significant, neither the severe wind speed nor the occurrence of sequential severe weather days was unusual for Illinois. Comparisons of this storm to the "Great Cyclone of 1896"[223] may be appropriate for the city of St. Louis, but characterizations of this storm as the "storm of the century" is inconsistent with documented history.

The following table presents weather parameter data for NWS severe weather days during the past nine years on which Ameren-IL provided "major event"[224] reporting to the Illinois Commerce Commission.[225] The NWS recorded weather observations of greater severity[226] and many have occurred without resulting in an Ameren-IL major event because major events result from the combined interaction of weather and utility equipment performance.

[220] http://www.spc.noaa.gov/archive. Weather monitoring station data.
[221] Interview #9, October 8, 2007, Interview #13, October 3, 2007, and Interview #40, November 8, 2007.
[222] Response to Data Request #124.
[223] Missouri PSC Report on the July 2006 storms.
[224] Illinois Administrative Code 411.120 requires electric utilities to report the occurrence of 10,000 customers interrupted for three or more hours as a "major event" with specific ongoing restoration status updates.
[225] http://www.spc.noaa.gov/archive/ and Responses to Data Requests #122, #471, and #491.
[226] http://www.spc.noaa.gov/archive/. e.g., 130 mph wind gust speed was recorded on 6/29/90.

Ameren-IL Major Events			NWS Severe Weather Day Data			
Description			Day of Year in Center Band	Observation Count	County Count	Max Gust
ID	Storm Start Date/Time	Event				
1	6/18/98	Thunderstorm	yes	61	50	78
2	6/29/98	Thunderstorm	yes	68	62	96
3	5/17/99	Thunderstorm	yes	32	31	71
4	4/20/00	Thunderstorm	yes	49	33	74
5	6/10/03	Thunderstorm	yes	30	12	90
6	7/18/03	Thunderstorm	yes	36	21	70
7	5/24/04	Thunderstorm	yes	47	23	78
8	5/30/04	Thunderstorm	yes	115	71	84
9	7/5/2004	Thunderstorm	yes	37	14	80
10	7/13/2004	Thunderstorm	yes	26	19	78
11	8/13/2005	Thunderstorm	yes	17	10	57
12	3/12/2006	Thunderstorm	no	40	20	93
13	4/2/2006	Thunderstorm	no	100	61	73
14	4/14/2006	Thunderstorm	yes	3	3	70
15	5/24/2006	Thunderstorm	yes	75	39	65
16	7/19/2006	Thunderstorm	yes	60	31	80
17	7/21/2006	Thunderstorm	yes	33	17	78

b. Ameren Major Event Comparative Data

Ameren-IL major event reporting data was only available from July 2004 from Ameren and its legacy company archives.[227] As a result, in order to provide additional major event comparison data, Liberty selected eight additional of the most severe NWS severe weather days from the last nine years for which Ameren provided the total number of customers interrupted for each event.[228] During the past nine years, 458 severe weather days occurred in Ameren-IL territory, 28 of which met or exceeded all four of the weather thresholds shown in the previous section table entitled "Characteristics of the Most Significant Severe Weather Days." The table that follows compares the July 2006 storms to other events that Ameren-IL reported to the ICC.[229] All but one[230] of the major events in the table below resulted from severe weather.

[227] Responses to Data Requests #122, #438.
[228] Responses to Data Requests #471, #491. Total customers interrupted was available and provided; although not the exact same basis as the latter events, i.e., on the basis of "peak simultaneous customers interrupted," however Liberty finds this difference insignificant for the purposes of this comparison.
[229] Responses to Data Requests #122 and #438.
[230] Item #12 was a due to a substation equipment failure in cold weather.

Ameren-IL Major Events			Event Parameters						
Description			Total Customers Interrupted					Advance Notice	
ID	Storm Start Date/Time	Event	CILCO	CIPS	IP	Total Days To Restore	Ameren-IL Cust Total	Forecast Lead Time[3] (Hours)	Severe Weather Statement Lead Time[4] (Hours)
1	6/18/98	Thunderstorm	**	2,122	34,577		36,699		
2	6/29/98	Thunderstorm	**	6,648	115,965		122,613		
3	5/17/99	Thunderstorm	**	33,552	8,884		42,436		
4	4/20/00	Thunderstorm	22,666	16,172	22,666		61,504		
5	6/10/03	Thunderstorm	4,865	32,049	61,048		97,962	>12	
6	7/18/03	Thunderstorm	2,563	24,250	12,630		39,443	1.5	6.0
7	5/24/04	Thunderstorm[1]	3,031	42,386	59,532		104,949	>12	0.4
8	5/30/04	Thunderstorm[1]	7,410	53,255	79,808		140,473	>12	0.4
9	7/5/2004	Thunderstorm			28,500	3	28,500	4	0.8
10	7/13/2004	Thunderstorm			55,000	4	55,000	9	0.1
11	11/24/2004	Snowstorm	48,142	37,815	10,000	4	95,957		
12	12/19/2004	Substation Failure			18,638	0	18,638		
13	12/22/2004	Windstorm			4400	1	4,400		
14	8/13/2005	Thunderstorm			18,000	1	18,000	1.5	1.4
15	3/12/2006	Thunderstorm	16,623			4	16,623		
16	4/2/2006	Thunderstorm	4,500	15,000	7,000	3	26,500	>24	0.0
17	4/14/2006	Thunderstorm	9,354			2	9,354	1.5	0.0
18	5/24/2006	Thunderstorm		19,138		1	19,138	11	0.2
19	7/19/2006	Thunderstorm	23,000	75,090	46,000	10	144,090	8	0.5
20	7/21/2006	Thunderstorm		22,000	86,500	8	108,500	>12	1.0
Notes:		1. Storms ending next day 2. ** CILCO data unavailable 3. Interval between the NWS severe weather forecast and the first NWS severe weather statement 4. Interval between the first NWS severe weather statement and ground truth severe weather observation							

Included in the table above are NWS lead times. NWS weather modeling often predicts the arrival of severe weather systems 48 to 24 hours in advance. However, the timing, location, severity, and overall confidence of forecast predictions is not of comparable precision or accuracy as with severe weather statements that are generally issued shortly before actual severe weather and increasingly on the basis of its interpretation of Doppler radar.

NWS has improved its Doppler interpretive accuracy over the years such that ground truth observations confirm the precision and accuracy of NWS severe weather statements by actual severe weather phenomenon within the geographic coordinates of the statement within minutes of the NWS severe weather statement. On July 19, the 5 a.m. NWS forecast cited a 20 percent chance of thunderstorms for that evening in Quincy, IL and a significant storm front beginning on July 20, yet thunderstorms arrived in early afternoon July 19.[231] Thus, in the July 19 storm the NWS provided sufficient advance notice for a forecast that was inaccurate. However, the NWS provided 12 highly accurate severe weather statements with lead times (prior to the actual first outage call by service area) [232] of approximately one hour.

[231] http://www.spc.noaa.gov/archive. NWS forecast statement 200115.
[232] http://www.spc.noaa.gov/archive. Based upon the first Ameren outages in a service area within a NWS watchbox.

The most recent major storm—prior to the July 2006 storm—occurred on April 2, 2006, in which a storm interrupted 150,000 Ameren customers (combined Illinois and Missouri).[233] The total number of customers for Ameren Corporation is relevant to Illinois storm restorations due to the use of shared corporate resources.[234] The July 2006 storm related major event was the largest in recent Ameren-IL history.[235] Ameren-CILCO, however, experienced a worse storm related major event in 2004 based on peak number of interrupted customers.[236] In addition, Ameren-IP experienced a worse storm related major event in 1998. Ameren-CILCO customer totals are not available in all cases to compare the entire Ameren-IL customer total as shown in the table prior to year 2000. However, the table indicates that comparable storm related major events have occurred recently across Ameren's composite legacy company footprint.

c. Restoration Duration Data

An Edison Electric Institute report suggests that, "One of the best indicators of the severity of a storm is the peak number of customers who lose power during the storm and who are without power at the same time."[237] The ICC reporting requirements do not explicitly require the peak number of customers affected.[238] During major storms, Ameren-IL regularly provides to the ICC an instantaneous number of customers out during the storm, i.e. the number currently out at some point in time. At the conclusion of a storm, Ameren-IL also provides the peak number of customers out during the course of the event. However, for comparing this storm with historical events, Liberty used the numbers provided by each company in Illinois reported for the ICC notice requirement, *i.e.*, "An estimate of the number of customers the interruptions affect."

The four tables below show the July 2006 storm summary of customer restorations for each Ameren-IL company.[239] Note that the data for these tables includes the duplication of customers associated with SR (Service Man Request) orders. These are non-outage orders. Ameren-IL creates a "lights out" order for these instances to track formally the customer outage and the aggregation of customer interruptions for the outage. Ameren-IL retains SR orders separately to ensure public safety for damaged facility instances, and must close these orders separately. The July 2006 storm included over 10,000 SR orders.[240]

Overall, the tables below provide another comparison of the severity of the storm and individual company restorations. In addition, the difference between the peak number of customers out of power and the total customers restored is apparent by inspection of the tables below compared to the Ameren-IL Major Events Summary table above.

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[233] Response to Data Request #122.
[234] Responses to Data Requests #122, #424, and #422,
[235] Response to Data Request #122.
[236] Responses to Data Requests #122, #265, and #432.
[237] EEI's *Utility Storm Restoration Response*, January 2004, page 4.
[238] Illinois Administrative Code Section 411.120, Notice & Reporting Requirements.
[239] Response to Data Request #432.
[240] Response to Data Request #265.

All Ameren-IL Companies

Date/Time	Days	Customers Restored per day	Total Customers Restored	Percent Restored per day	Cummulative Percent Restored
07/20/06 18h	1	148,719	148,719	28%	28%
07/21/06 18h	2	59,234	207,953	11%	39%
07/22/06 18h	3	125,555	333,508	23%	62%
07/23/06 18h	4	53,220	386,728	10%	72%
07/24/06 18h	5	44,571	431,299	8%	80%
07/25/06 18h	6	30,689	461,988	6%	86%
07/26/06 18h	7	34,912	496,900	6%	92%
07/27/06 18h	8	19,608	516,508	4%	96%
07/28/06 18h	9	18,014	534,522	3%	99%
07/29/06 18h	10	4,771	539,293	1%	100%

Ameren-CILCO

Date/Time	Days	Customers Restored per day	Total Customers Restored	Percent Restored per day	Cummulative Percent Restored
07/20/06 18h	1	31,402	31,402	76%	76%
07/21/06 18h	2	3,495	34,897	8%	84%
07/22/06 18h	3	2,725	37,622	7%	91%
07/23/06 18h	4	506	38,128	1%	92%
07/24/06 18h	5	127	38,255	0%	92%
07/25/06 18h	6	303	38,558	1%	93%
07/26/06 18h	7	556	39,114	1%	94%
07/27/06 18h	8	1,020	40,134	2%	97%
07/28/06 18h	9	1,132	41,266	3%	99%
07/29/06 18h	10	241	41,507	1%	100%

Ameren-CIPS

Date/Time	Days	Customers Restored per day	Total Customers Restored	Percent Restored per day	Cummulative Percent Restored
07/20/06 18h	1	51,374	51,374	32%	32%
07/21/06 18h	2	22,550	73,924	14%	46%
07/22/06 18h	3	32,999	106,923	21%	67%
07/23/06 18h	4	11,786	118,709	7%	75%
07/24/06 18h	5	10,646	129,355	7%	81%
07/25/06 18h	6	6,381	135,736	4%	85%
07/26/06 18h	7	11,218	146,954	7%	92%
07/27/06 18h	8	6,701	153,655	4%	96%
07/28/06 18h	9	3,295	156,950	2%	99%
07/29/06 18h	10	2,372	159,322	1%	100%

Ameren-IP

Date/Time	Days	Customers Restored per day	Total Customers Restored	Percent Restored per day	Cummulative Percent Restored
07/20/06 18h	1	65,943	65,943	19%	19%
07/21/06 18h	2	33,189	99,132	10%	29%
07/22/06 18h	3	89,831	188,963	27%	56%
07/23/06 18h	4	40,928	229,891	12%	68%
07/24/06 18h	5	33,798	263,689	10%	78%
07/25/06 18h	6	24,005	287,694	7%	85%
07/26/06 18h	7	23,138	310,832	7%	92%
07/27/06 18h	8	11,887	322,719	4%	95%
07/28/06 18h	9	13,587	336,306	4%	99%
07/29/06 18h	10	2,158	338,464	1%	100%

3. Accuracy of Interruption Data

a. The Outage Analysis System (OAS)

The Outage Analysis System (OAS) is the primary system used by the Ameren-IL companies to create, assess, and retain service interruption information. The system is an on-line, trouble-call system that includes both electric and gas data. It also contains non-interruption data such as requests for service men, maintenance orders, metering orders, and facility locating orders.[241]

[241] Response to Data Request #257.

The Outage Analysis System provides an interface for customer service representatives and operations personnel to enter, dispatch, and closeout customer interruption calls.[242] An outage analyzer module within the system interprets customer interruptions and groups them to the likely electrical facility interrupted. The system does not contain an explicit connectivity model for every customer. A set of relational tables in the Outage Analysis System database provides pseudo-nodes that link customers to transformers, transformers to fuses or other protective electrical devices, and devices to circuits.[243] The analyzer grouping function expedites the electrical diagnosis of the cause of the interruption and localizes the potential failure location. Operations and first responder personnel verify the actual conditions in the field.

The Outage Analysis System's analyzer is hierarchical and assumes a single problem causes the interruption(s). It cannot distinguish instances of multiple or nested circuit failures from a single higher order failure. For example, if a tree fell on a feeder backbone causing an interruption to the entire circuit, the system cannot recognize the presence of additional problems on circuit laterals (tap circuit sections connected to the backbone), individual distribution transformers, or customer service wires. In addition, the system does not recognize abnormal switching configurations of the electrical system on a real time basis.[244] During severe storms, multiple and nested failures occur because of the exposure of distribution facilities to widespread weather conditions. In addition, the timing of customer calls can lag due to technical limitations and customer responsiveness. As a result, the Outage Analysis System grouping function is a "best guess" of sequential input data, which field personnel can later validate.

As operations personnel restore service to portions of a circuit, they close orders and create new orders for the remaining customers without service. In general, this oscillation pattern of Outage Analysis System activity, *i.e.*, substantial customer restoration progress negated by new interruption orders, which Liberty refers to as "re-ordering," is characteristic of restoration efforts in-progress and results in an overall decrease in the remaining customers without service. This re-ordering process is indicative of restoration efforts that may have identified multiple or nested failures. Re-ordering creates differences between the number of customer interruptions apparent during the storm restoration and the retrospective number of customer interruptions after restoration is complete.

Field resources are finite during major storm restoration. Therefore, for expediency, Ameren-IL uses re-ordering after repair of parts of a circuit, *e.g.*, from the substation source to a known open isolation device, since checking all of the circuit's facilities for additional failures is impractical with limited resources. For example, the circuit backbone may only be a few miles long; however, the remaining circuit lateral taps may have hundreds of combined circuit miles. Re-ordering is more expedient and does not require additional field checking resources. In this storm due to the magnitude and severity, field checking and assessment personnel were scarce.[245] In addition, during major storms many personnel are infrequent Outage Analysis System users or

[242] Interview #9, October 4, 2007.
[243] Interview #9, October 4, 2007, and Interview #42, November 6, 2007.
[244] Interview #42, November 6, 2007.
[245] Response to Data Request #424.

have limited experience to accomplish complex Outage Analysis System tasks such as manual order splitting.[246]

In these situations, Ameren-IL personnel can assess the rest of the circuit and close out the Outage Analysis System order using the "How to Split an Outage Order into Two or More Orders" per instructions in the Outage Analysis System manual[247] or restore the order without additional field assessment and initiate "Restoration Verification,"[248] *i.e.*, re-ordering. Thus, Ameren-IL relies on re-ordering for these types of scenarios and employs the auto-callback technology of the Interactive Voice Response (IVR) unit to complete the re-ordering process.

At the close of the Outage Analysis System order, when restoration of an entire circuit or known sections of a circuit are ready for restoration, all customers that are grouped to an interruption order can be tagged by the Outage Analysis System for a phone contact, via outbound Interactive Voice Response, to verify if the customer's power is back on.[249] The Interactive Voice Response (IVR) message prompts the customer to confirm service status via phone keystroke. If the customer is still without electric service, then the customer's phone entry initiates a new interruption order automatically in Outage Analysis System.[250] Generally, the new order contains fewer customers than the original order that Ameren-IL just closed. This cycle completes the re-ordering process.

The effectiveness of the Outage Analysis System analyzer in identifying the customers remaining without service for the reordered interruption is dependent upon the customer interruption status information provided via callback, and the extent of multiple failures remaining, *i.e.*, its accuracy is subject to the same inaccuracy as any other instance. During the 2006 storms, Ameren-IL closed many OAS orders in the evening (at the conclusion of field crew sixteen hour days). As a result, the 10 p.m. curfew policy blocked IVR outbound verifications, and Ameren-IL closed orders without customer verification. These customers had to re-initiate outage reporting the next morning or in following days. This practice lost critical information, delayed restoration efforts, and fomented customer dissatisfaction with Ameren-IL's service.[251]

b. Outage Analysis System and the July Storms

In this storm, the re-ordering phenomenon is evident by the large number of interruption orders that occurred daily even after the storm is over on July 21. Overall, as the restoration progressed the Outage Analysis System numbers had a characteristic daily ebb and flow pattern, or large numbers of order closures and newly created orders daily as the chart below shows.[252]

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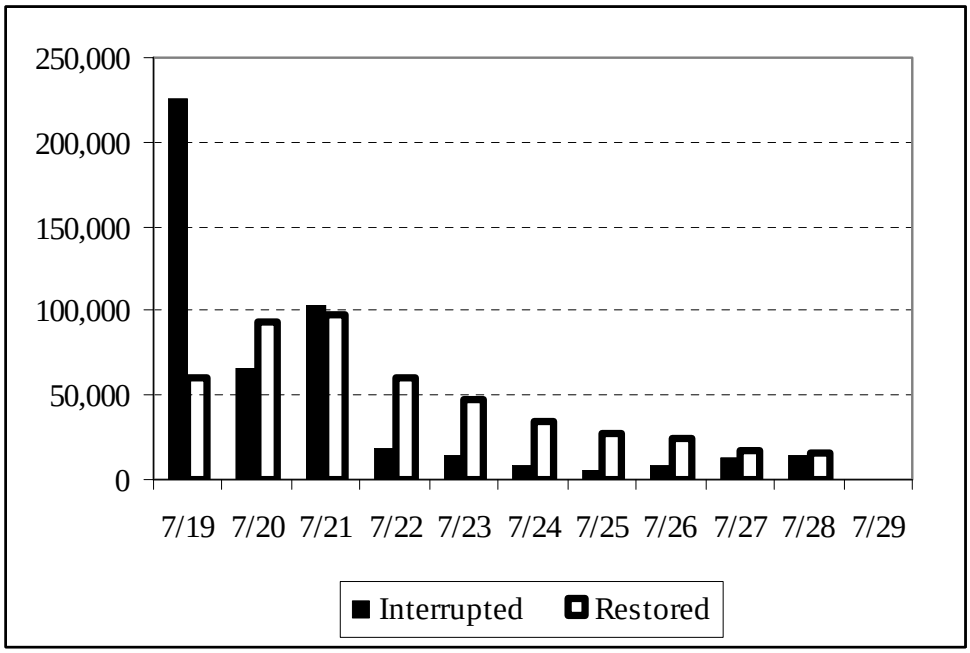
[246] Interview # 114, December 13, 2007, and Interview #37, November 2, 2007.
[247] Response to Data Request #434.
[248] Interview #114, December 13, 2007.
[249] Response to Data Request #633.
[250] Interview #9, October 4, 2007, Interview #42, November 6, 2007, and Interview #102, November 16, 2007; Response to Data Request #634.
[251] Interview #102, November 15, 2007.
[252] Response to Data Request #265.

Ameren-IL OAS Daily Interruptions and Restorations, July 2006



Ameren reported that the total number of unique customer interruptions in Illinois was 302,112 for the July 2006 storms.[253] However, the total number of daily interruptions (and restorations) shown in the chart above is 477,326. The re-ordering process is the primary reason for the difference. Maintenance outages and "normal" outages (from unaffected areas) are also included in with these totals shown above. The total amount of duplication attributable to re-ordering is difficult to quantify precisely because of the two waves of July storm activity. The external reporting of the peak number of customers affected after the second wave on July 21 already included re-ordering duplication from the first wave. Ameren-IL had restored some customers when the storm's second wave caused another outage; however, these instances are indistinguishable from customers simply subject to duplication from re-ordering. Yet, the multiplier effect of approximately 1.5-1.8 shows from the difference between the unique customer total and the total customers restored [depending on whether all order types are included in the comparison, e.g., (477,326)/302,112 vs. (539,293)/302,112][254].

The data in the Outage Analysis System for the July 2006 storms was consistent and stable. Ameren-IL provided multiple data extracts in several data request responses during this portion of the audit. Liberty combined these extracts in a storm database to derive storm data summaries. In other instances, Ameren-IL provided storm data summaries directly in response to specific data requests.[255] The Ameren-IL results were consistent with Liberty's derived results. The basis for summary totals was consistent with independent analyses and those provided by Ameren-IL

[253] Response to Data Request #123.
[254] Responses to Data Requests nos. 265 & 432.
[255] Responses to Data Requests nos. 135-138, 265, 432, 496, 621-626, 735-737.

within responses provided.[256] In addition, Liberty found the referential integrity of the data provided in several data requests to be excellent.[257]

Ameren-IL's method for assigning Outage Analysis System cause codes to ICC annual reporting requirements also appears to be consistent and repeatable.[258] The initial review of the data indicated that Ameren-IL made a reasonable effort to determine the proper cause.[259] Outage Analysis System training manuals contain instructional guides for the assessment of root cause and component relationships.[260] Liberty reports on its evaluation of the methods for determining cause codes by field personnel during storm activity in other chapter of this report. However, Ameren-IL did not enter "Unknown" causes excessively to the detriment of the data integrity.[261]

c. Interruption Causes – July 2006 Storms

Before Ameren-IL can close a service interruption order, personnel must enter a cause code.[262] The principal Outage Analysis System cause codes used during the July 2006 storms were the following:[263]

- Overhead Equipment Malfunction – 42 percent
- Tree Contact and Tree Limb Broken – 29 percent
- No Cause Found – 11 percent
- Other - Explain – 10 percent
- Dropped for Safety – 4 percent
- Public Vehicle Accident – 2 percent
- All other causes – 2 percent

For reporting to the ICC, Ameren-IL must use a different set of interruption cause codes.[264] Ameren-IL uses Outage Analysis System cause codes and weather codes to map interruptions to the ICC-required causes.[265] The principal causes for the July 2006 storms using ICC causes were the following:[266]

- Weather – 78 percent
- Other – 10 percent
- Intentional – 4 percent
- Overhead Equipment – 3 percent
- Public – 2 percent
- Tree Broken and Tree Contact – 1 percent

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[256] Responses to Data Requests #265 and #430, comparative accuracy of total customers affected within 0.5 percent.
[257] Responses to Data Requests #135, #136, #137, #138, #265, #430, #431, and #432.
[258] Response to Data Request #363.
[259] Response to Data Request #265.
[260] Response to Data Request #257.
[261] Response to Data Request #265.
[262] "Edit-check feature" of OAS, Interview #37; November 2, 2007.
[263] Response to Data Request #265.
[264] Illinois Administrative Code, Section 411.20.
[265] Response to Data Request #363.
[266] Response to Data Request #364.

- All other causes – 2 percent

The differences between these two sets of interruption causes is the result of translating the cause and weather codes used by the Outage Analysis System into the cause code definitions adopted by the ICC. It is apparent from the two sets of cause information immediately above that reports to the ICC indicate weather as the main cause, while the Outage Analysis System uses cause codes that do not include weather but captures other information that describes weather conditions. In addition to required reporting, accurate determinations of outage causes can be useful for post-storm analyses of things Ameren-IL could do to prevent or mitigate the effect of future storms. The retrospective assignment of storm mode interruptions attributable to "Weather" is formulaic and lacks correlation of weather severity or substantive root cause determination. While the July 2006 outage data show that Ameren-IL personnel made reasonable efforts to identify the proper cause, having 11 percent of the total number of customers interrupted pinned to "no cause found" demonstrates a need for increased emphasis on determining an accurate cause. In addition, the "other-explain" cause, which accounted for 10 percent of the customer interruptions, requires researching individual outage orders for any meaningful analysis.

4. Accuracy of the Data Provided to the Media and ICC

a. Press Releases

Ameren issued thirteen press releases regarding the July 2006 storms.[267] The timing of the releases was:

- July 20
- July 20
- July 21
- July 21
- July 22
- July 22, 4:30 p.m.
- July 22, 6:00 p.m.
- July 23
- July 23, 4:30 p.m.
- July 24
- July 25
- July 26
- July 28.

All press releases were applicable to both Missouri and Illinois.

Overall, the information provided to the media was timely, and reflected the best information available from the Emergency Operations Center (EOC) and operations personnel. Storm data provided to the media regarding the total number of customers interrupted was commensurate

[267] Response to Data Request #366.

with the accuracy of the Outage Analysis System and the variability of the Outage Analysis System numbers from day to day as discussed in previous sections.

Estimated restoration times (ERTs) are an important aspect of the information provided to the public and customers. The initial press releases were prudently noncommittal on specific ERTs. Within the initial 24 hours of the storm, press releases indicated that ERTs were not less than 72 hours for some customers. Later, they bracketed ERTs as 3 to 7 days. The restoration estimates in press releases on July 23 and 24 were consistent with information Ameren operations provided; however, those estimates proved to be optimistic. After those dates, the releases did not provide ERTs.[268]

The press releases provided an approximate value of the initial total customers interrupted, but they did not update this number to reflect the total known after completion of field assessment. The second round of the storm affected the clarity of the press releases. However, the total impact would have been of interest, relevant to the restoration extensions, and disclosure of the full extent of the Ameren's restoration challenge.[269]

The press releases were not in a consistent format. For example, they cited totals for Ameren as a corporation, while at other times they provided numbers for vague or overlapping geographic customer subsets such as St. Louis metro area customers, St. Louis metro and Illinois customers, Illinois customers, and "customers in the area." Some releases sub-totaled the number of customers restored in overlapping times while others referred to the number restored since a previous press release. This caused the total number of customers restored to exceed the number of customers interrupted.[270]

The press releases provided less coverage of Illinois customer restorations than those for the St. Louis metropolitan area. While it is understandable that Ameren would address its largest population center, customers in Illinois looked to the public media for effect and restoration information and the total number of electric customers in Illinois is about the same as the number in Missouri.[271]

b. ICC Notifications

There were 61 notices provided to the ICC during the July storm for the Illinois companies required by Illinois Administrative Code Section 411.120. The notices generally complied with the requirements for content and consistency. The accuracy of the information was generally consistent with interruption data from Outage Analysis System and with operational personnel assessments.[272] The estimated restoration times were generally overly optimistic as evidenced by multiple revisions of the Ameren-IP and Ameren-CIPS estimated times during storm.[273]

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[268] Response to Data Request #366.
[269] Response to Data Request #366.
[270] Response to Data Request #366.
[271] Ameren 2006 Annual Report.
[272] Responses to Data Requests # 424 and #122.
[273] Response to Data Request #122.

Within the first 24 hours of this storm, on July 20, the notifications estimated the restoration for all Illinois customers for the morning of July 22.[274] The second round of this storm added significant numbers of customer interruptions. The notifications split the ERTs (estimated restoration times) into two groups, with the second round restorations separated in the notices for a later restoration time.[275] However, ERTs for the second round proved to be inaccurate and Ameren-IL had to push them back several times.[276] On Sunday July 23 and the remaining days forward however, the ERT information was consistent with Emergency Operations Center estimates,[277] but ultimately inaccurate. Overall, Ameren-IL extended the restoration times provided to the ICC six times for Ameren-IP customers and five times for Ameren-CIPS customers.[278]

The content of the ICC notices was generally consistent and addressed the required information for the reporting requirement.[279] The notifications reported the total customers affected consistently. Ameren's reporting practice is to report the current level of interrupted customers at the time of the report. Ameren provided additional information to the ICC to establish the initial peak total customers interrupted in subsequent notices if the initial number provided had not peaked at the time of the initial report.[280]

E. Findings and Analysis – the November Storm

1. Storm Description

a. Prior Conditions

The temperatures in Illinois on November 28, 2006, were in the 60s °F. National Weather Service (NWS) forecasts from the Lincoln, Illinois weather center, (KILX), at 10:49 a.m., provided 48 hours of advanced notice of the expected freezing rain, sleet, icing conditions, light to moderate snow accumulations, northwest winds 15-20 mph, and steadily falling temperatures into the 20s °F for central Illinois.[281] The KILX afternoon forecast, at 3:43 p.m., for central Illinois was largely the same as the morning forecast.[282] The 3:53 a.m. November 29 KILX forecast for November 30 called for light snow and freezing rain in the morning with wind gusts of 25-30 mph and snow accumulations of around 1 inch near Peoria, Bloomington, and Springfield, while it expected areas south of Champaign to have accumulations of 2-4 inches.[283]

The temperatures rose in the morning of November 29, 2006, from the low to mid 60s and peaked above 70° in St. Louis; however, temperatures had begun to drop and were already dropping rapidly near Peoria by late morning. The NWS issued the first Winter Storm Watch for

[274] Responses to Data Requests # 424 and #122.
[275] Response to Data Request #122.
[276] Response to Data Request #122.
[277] Responses to Data Requests #366 and # 424.
[278] Response to Data Request #122.
[279] Response to Data Request #122.
[280] Response to Data Request #122.
[281] NWS forecast 281649.
[282] NWS forecast 282143.
[283] NWS forecast 290953.

this storm at 10:45 a.m. on November 29 by adding the watch to the KILX forecast issued earlier that morning.[284] The KILX forecast at 11:10 a.m. on November 29 reflected its recognition of the changing severity of conditions, which called for accumulations of up to seven inches of snow for Peoria, Springfield, Bloomington, and Champaign.[285]

The temperatures across Illinois and St. Louis had already dropped 20 degrees from the peak temperatures of the day by 3:00 p.m. November 29. At 3:00 p.m., the NWS issued a Major Winter Storm Watch for the Midwest starting as rain that evening and transitioning to freezing rain and sleet on Thursday with the possibility of heavy snow overnight into Friday morning December 1. The statement identified that this weather system had the potential to produce significant ice accumulations over portions of central Illinois and accumulations of over a foot of snow to the west of Interstate 55.[286]

At 2:00 a.m. on November 30, the temperatures in Peoria and St. Louis were at or below freezing point. The KILX forecast at 2:02 a.m. November 30 indicated that the Winter Storm Warning was in effect until 12 p.m. December 1 and that rain would continue through the morning hours. Temperatures were already below freezing in Galesburg and would progress to the Illinois River before sunrise. The forecast warned of a glaze of ice to develop on exposed surfaces such as road and power lines, making travel hazardous.[287]

b. The Start of the Storm

The temperatures continued to drop across central Illinois until approximately noon on November 30. Peoria, Decatur, Champaign, and St. Louis were all below freezing at this time. In addition, the relative humidity was near 95 percent in St. Louis, Decatur, and Champaign,[288] a condition that was conducive to icing. Ameren accounts indicate that the division personnel received a weather alert and then Ameren held a conference call of all Illinois managers to discuss the potential for significant icing at 2:30 p.m. on November 30.[289] Temperatures in St. Louis and Decatur hovered at the freezing temperature until evening. On December 1, temperatures in St. Louis, Decatur, Peoria, and Champaign dropped rapidly into the 20s after midnight and into the morning hours.

Ameren issued a press release on November 30 around mid-day to inform customers that Ameren was aware of the NWS[290] major winter storm watch and had begun preparations for potential storm restoration activity.[291]

Ameren personnel's recollections indicated that precipitation alternated between sleet and rain, but the icing began to develop significantly after dark in the evening of November 30 in the St.

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[284] NWS forecast 291645.
[285] NWS forecast 291710.
[286] NWS forecast 292100.
[287] NWS forecast 300802.
[288] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm.
[289] Response to Data Request #123.
[290] National Weather Service.
[291] Responses to Data Requests #366 and #474.

Louis East metropolitan area.[292] Outage Analysis System data indicate that interruptions began to increase at approximately 6:00 p.m.[293] Electric field crews worked extended shifts to address initial outages due to vehicles hitting poles on icy roads.[294] Conditions turned noticeably worse after 7:00 p.m. with the onset of additional rain.[295] At 8:00 p.m. November 30, the staff of the Ameren Emergency Operations Center, managers of contract support, and others decided to call in the electric employees for work at 6 a.m. on December 1 in anticipation of a major restoration.[296]

c. The Winter Storm Hits Ameren-Illinois

The storm interrupted electric service to over 100,000 Ameren-IL customers before 9:00 p.m. November 30.[297] Emergency Operations Center storm logs indicate that the "storm clock" started at 9:00 p.m. on November 30.[298] Ameren opened the Emergency Operation Center at 10:00 p.m. on November 30.[299] Emergency Operations Center storm managers adjusted staffing hours for material stores personnel and sent a mobile material supply trailer ("storm trailer") to the Belleville Operating Center.[300] Ameren managers sent additional storm trailers to the Maryville and Decatur operating centers at 6:00 a.m. December 1.[301] Ameren managers also sent storm trailers to two locations in south St. Louis by sunrise.[302]

The November 30 storm ended with the last bands of snow tapering off near Bloomington at 10:30 a.m. December 1.[303] Snow accumulations stretched along an approximately 150-mile wide swath from central and northeast Oklahoma, across Missouri and Illinois, and into southeastern Wisconsin.[304] Snow accumulations in Illinois were heaviest in west central Illinois near the towns of Liberty, Quincy, and Mount Sterling with accumulations of 10-13 inches.[305] Freezing rain in excess of 2 inches fell across eastern Missouri and western Illinois.[306] Ice accumulated in Illinois parallel and southeast of the snow accumulation band, along a track that was approximately 50 miles wide from Waterloo to Bloomington.[307] Icing hit hard on the communities of Mt. Pulaski, Decatur, and Taylorville.[308]

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[292] Interview #13; October 3, 2007.
[293] Response to Data Request #123.
[294] Interview #13; October 3, 2007.
[295] Interview #13; October 3, 2007.
[296] Response to Data Request #123.
[297] Response to Data Request #123.
[298] Response to Data Request #422.
[299] Response to Data Request #123.
[300] Responses to Data Requests #123 and #422.
[301] Response to Data request #123.
[302] Response to Data Request #422.
[303] NWS short term forecasts 011534 & 011700.
[304] http://www.crh.noaa.gov/lsx/?n=11_30_06.
[305] http://www.crh.noaa.gov/lsx/?n=11_30_06.
[306] http://www.crh.noaa.gov/lsx/?n=11_30_06.
[307] http://www.crh.noaa.gov/lsx/?n=11_30_06.
[308] http://www.crh.noaa.gov/ilx/?n=2006-Dec01.

The Ameren-IL managers held their first EOC storm update conference call at 6:00 a.m.[309] Outage Analysis System data indicate that 379,000 Illinois customers had their service interrupted by 8 a.m. December 1.[310]

Ameren-IL provided its first report to the ICC at 8:30 a.m., indicating that 12,600 CILCO, 38,050 CIPS, and 159,800 IP customers were without electric service.[311] A press release followed at 10:00 a.m. indicating that 220,000 Ameren-IL customers were out of power due to the storm.[312] The reported Ameren-IL customer totals for external notifications were significantly less than the Outage Analysis System retrospective total. In large part, the reason for the difference was an overload of Ameren-IL's communications systems that prevented many customers from being able to report their loss of electric service. (Chapter IV of this report describes the communications problems that occurred during the storms.)

The ice storm included other collateral damages that made Ameren-IL's electric service restoration more difficult. Emergency Operations Center storm logs indicate that there was deteriorated cell phone service at 7:01 a.m., possibly due to call volume loading.[313] In addition, fiber optic telecommunication cables were severed to the south of St. Louis at 7:05 a.m.[314] Ameren Emergency Operations Center managers were informed that the Missouri highway department closed Interstate 70 between Jefferson City and St. Louis at 10:34 a.m. December 1 for the day.[315] No official road closures occurred in Illinois; however, icing conditions in Illinois made roads hazardous for travel.[316] Temperatures peaked in the 20s on December 1, and then dropped across the region.[317] Most areas would not exit sub-freezing temperatures again until December 5.[318]

d. November Storm Maps

This section provides National Weather Service (NWS) images that augment the preceding narrative description sections. Appendix II-B contains photographs of storm conditions and restoration activities.

The photograph below shows a satellite image of the snow cover on December 2, 2006.[319] The extensive track of the storm is visible from northeast Oklahoma to southeast Wisconsin.

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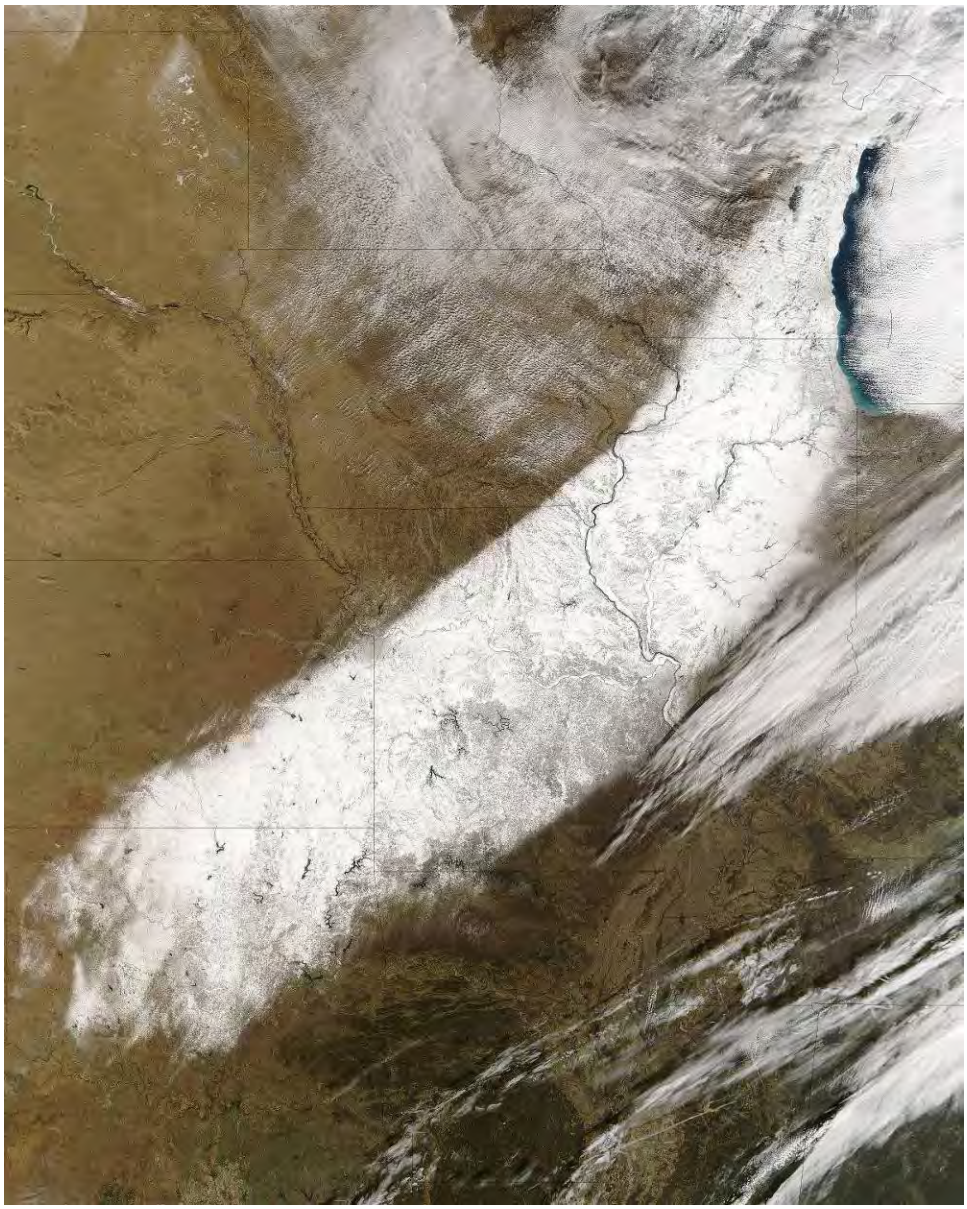
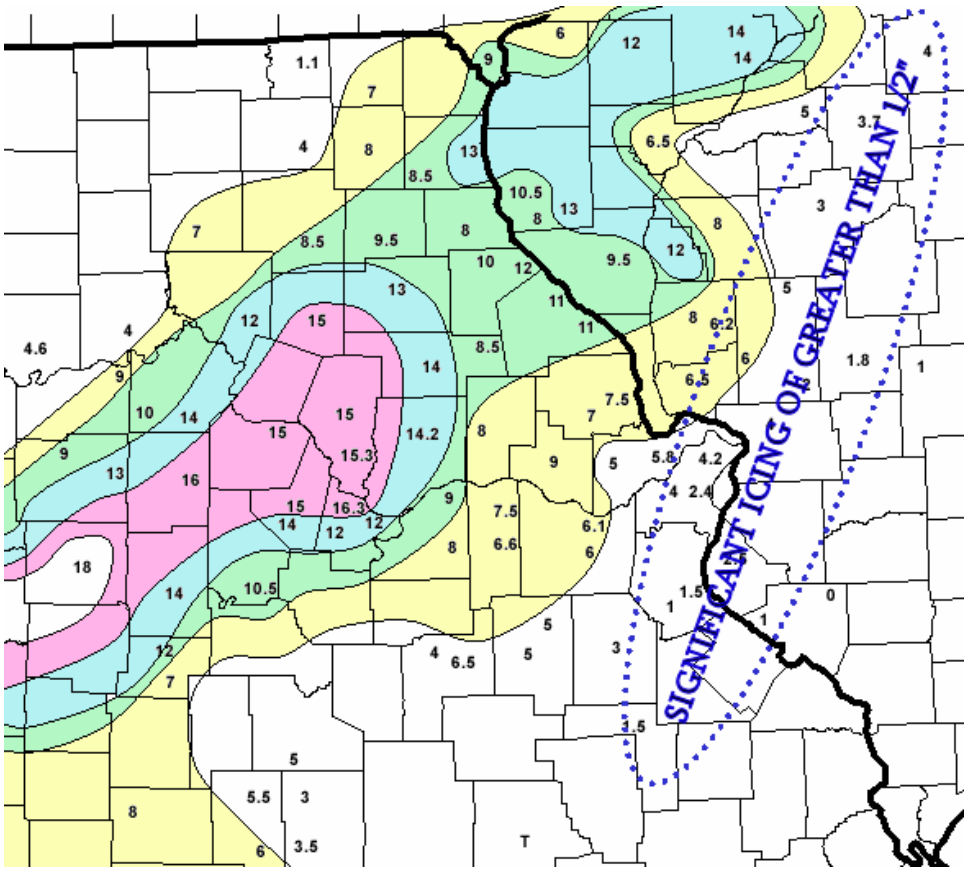
[309] Response to Data Request #123.
[310] Response to Data Request #266.
[311] Responses to Data Requests #122 and #123.
[312] Response to Data Request #366.
[313] Response to Data Request #422.
[314] Response to Data Request #422.
[315] Response to Data Request #422.
[316] Response to Data Request #441 and NWS forecasts 011534 & 011700.
[317] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm.
[318] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm.
[319] http://www.crh.noaa.gov/lsx/?n=11_30_06.



The diagram below displays ice and snow accumulation.[320] The numbers within each county indicate the snow accumulation in inches. The blue-dotted ellipse shows the location of significant icing accumulation, greater than ½″. Many communities from Bloomington southward to Decatur and Springfield reported freezing rain accumulations of one-half to one inch, along with sleet accumulations of about one inch.[321]

[320] http://www.crh.noaa.gov/lsx/?n=11_30_06.
[321] http://www.crh.noaa.gov/ilx/?n=2006-Dec01.



e. Initial Interruption and Damage Report

Ameren-IL operations crews began customer restorations immediately after the storm began. They restored some outages during the night of November 30. Ameren-IL construction crews began the restoration process with the initial conditions indicated by Outage Analysis System data in the tables below as of the morning of December 1.

	Location of Customers by Ameren-IL Division							
	I	II	III	IV	V	VI	VII	Total
Customers Interrupted on 11/30/06	184	9,589	75,553	34,203	82,872	95,183	334	297,918
Customers Restored on 11/30/06	102	5,392	9,082	11,454	4,473	12,744	334	43,581
Customers Interrupted on 12/1/06 prior to 8 a.m.	2,462	9,465	29,315	22,495	66,046	46,759	25	176,567
Customers Restored on 12/1/06 prior to 8 a.m.	238	7,141	6,314	18,539	7,301	12,312	6	51,851
Remaining Customers without Service12/1/06 8 a.m.	2,306	6,521	89,472	26,705	137,144	116,886	19	379,053

Outage Analysis System data indicated that electric facilities ≤ 69,000 volts had sustained damages as the table below shows.[322]

Cumulative Summary of Damaged Facilities as of 8 a.m. 12/1/06								
Damage Type	Division							
	I	II	III	IV	V	VI	VII	Total
Damaged Wires	7	29	158	94	200	397	2	887
Damaged Poles	7	10	43	19	32	50	1	162

In addition to the distribution and sub-transmission facility damages, broken shield wires and structure damage interrupted eight transmission lines for sustained outages.[323] These outages resulted in interruptions to wholesale customers and rural electric associations.[324]

f. Storm Restoration - Outage Analysis System Summary

Ameren-IL's basic approach to restoration is to prioritize the work to first repair the outages that will restore service to the greatest number of associated customers.[325] This is consistent with the Outage Analysis System restoration data below.[326] Ameren-IL restored the sub-transmission and feeder orders first, while it restored service orders (single customer orders) last. The table below summarizes the restoration of customers interrupted by day and division.[327] The order type information in the table is:

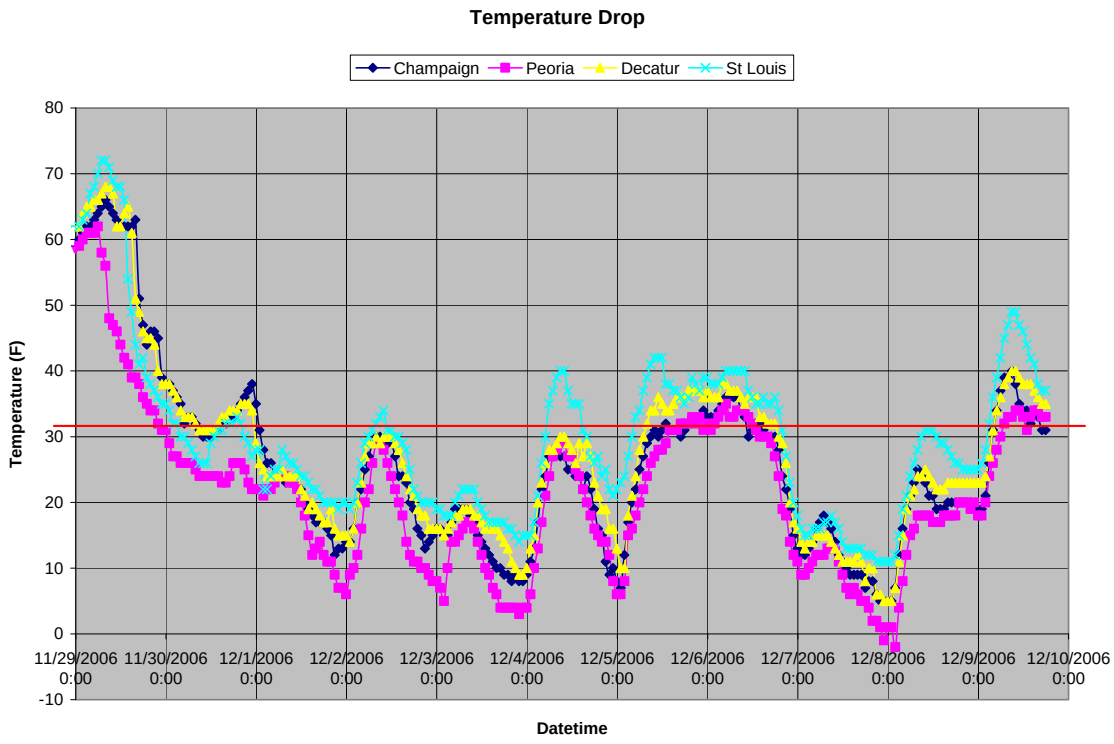
SO Single Outage (Service Wire)
TO Transformer Outage (Distribution type)
DO Device Outage (Fuse; circuit section)
GO Grouped Outage (Multiple devices)
FO Feeder Outage (Entire circuit)
ST Sub-Transmission (Distribution Supply)

[322] Responses to Data Requests #266, #137, and #138.
[323] Distribution is 15,000 volts and below, sub-transmission is 34,000 and 69,000 volts, and transmission is 138,000 and 345,000 volts.
[324] Response to Data Request #139.
[325] Interview #13, October 3, 2007.
[326] Response to Data Request #266.
[327] Response to Data Request #266.

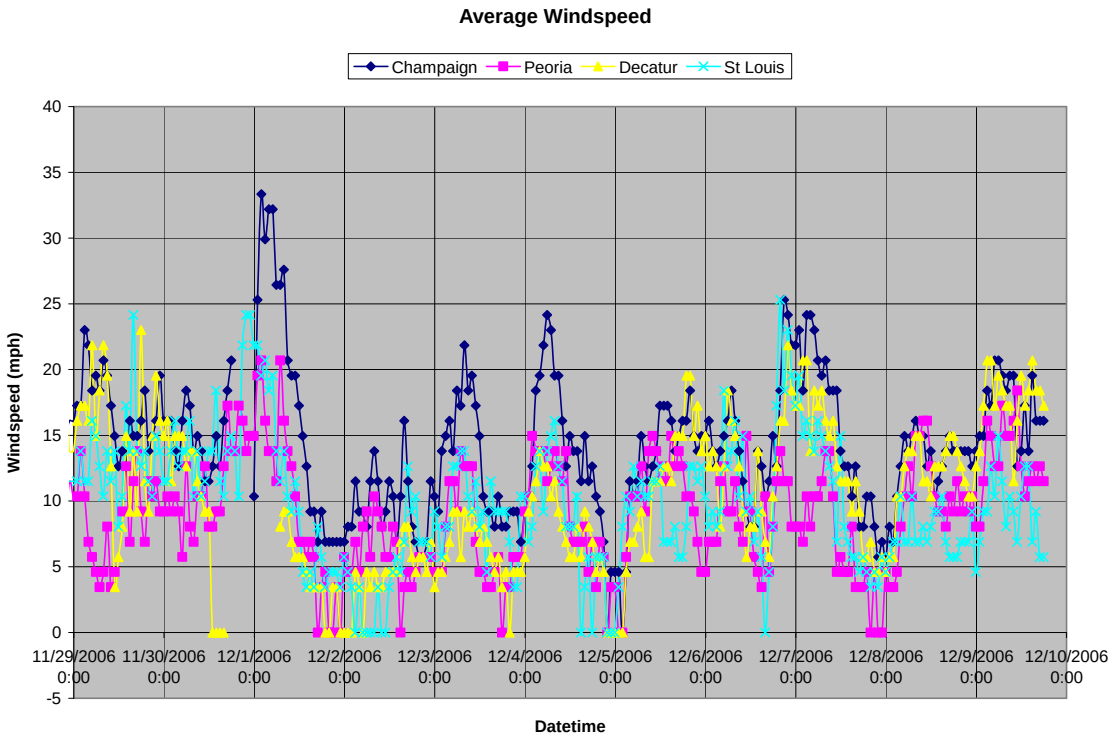
November 2006 Storm Summary of Restored Customers by Date and Order Type									
Total Customers		Division							
Day	Order Type	I	II	III	IV	V	VI	VII	Total
30-Nov	DO	26	104	6	16	433	172	328	1,085
	FO			2,818	64	1,010	1,410		5,302
	GO	24		1,632	2,791	2,051	4,331		10,829
	SO	12	6	13	12	27	12	3	85
	ST		5,268	4,612	8,563	912	6,572		25,927
	TO	14	14	1	8	14	8	3	62
30-Nov		76	5,392	9,082	11,454	4,447	12,505	334	43,290
1-Dec	DO	1,174	1,326	2,760	3,208	3,288	1,416	23	13,195
	FO	534	1,323	9,093	7,944	13,178	17,161		49,233
	GO	1,244	675	6,935	3,593	4,969	3,992		21,408
	SO	12	47	64	84	52	63	7	329
	ST		11,671	2,780	22,149	20,842	31,256		88,698
	TO	7	42	24	88	14	14	6	195
1-Dec		2,971	15,084	21,656	37,066	42,343	53,902	36	173,058
2-Dec	DO	236	1,216	3,897	714	2,794	2,745	754	12,356
	FO	61	548	7,019	1,563	19,890	11,787		40,868
	GO	101	522	5,504	2,163	9,822	8,569	86	26,767
	SO	7	70	42	95	76	87	6	383
	ST		11	3,762	1,334	994			6,101
	TO	8	91	37	209	54	84	1	484
2-Dec		413	2,458	20,261	6,078	33,630	23,272	847	86,959
3-Dec	DO	11	214	5,304	558	5,133	5,193	64	16,477
	FO		442	3,741	2,052	9,454	8,375		24,064
	GO	18	76	6,229	1,035	11,321	10,237		28,916
	SO	2	85	103	43	154	223	4	614
	ST			1			2,214		2,215
	TO	3	64	137	90	205	204		703
3-Dec		34	881	15,515	3,778	26,267	26,446	68	72,989
4-Dec	DO	232	71	2,447	1,582	7,740	9,650	137	21,859
	FO			6,266		8,453	4,813	5	19,537
	GO	73		5,819	1,049	10,641	12,786	3	30,371
	SO	9	22	127	119	307	412	11	1,007
	ST					2,494		2,815	5,309
	TO	20	14	155	36	317	311	12	865
4-Dec		334	107	14,814	2,786	29,952	27,972	2,983	78,948
5-Dec	DO	114	1	1,173	350	8,968	5,103	104	15,813
	FO			2,990		5,165	7,078		15,233
	GO			12,233	1,145	7,448	10,154		30,980
	SO	6	10	215	129	377	582	6	1,325
	ST			881	3,163				4,044
	TO	11	12	237	108	329	659	6	1,362
5-Dec		131	23	17,729	4,895	22,287	23,576	116	68,757
6-Dec	DO	90	1	4,129	82	4,742	5,092	65	14,201
	FO			12,751	731	2,255	2,018		17,755
	GO			5,802	2	9,745	7,204		22,753
	SO	5	7	253	60	398	786	3	1,512
	TO	2	9	426	63	373	660		1,533
6-Dec		97	17	23,361	938	17,513	15,760	68	57,754
7-Dec	DO	42		2,606	155	2,780	4,369		9,952
	FO			8,017		5,520	3,233		16,770
	GO			4,934	2	4,319	3,569	143	12,967
	SO	12	9	311	23	687	771	1	1,814
	TO	15	10	306	2	500	497	2	1,332
7-Dec		69	19	16,174	182	13,806	12,439	146	42,835
8-Dec	DO	15		2,417	59	5,199	755		8,445
	FO			3,084	628	1,465	112		5,289
	GO	1		3,663		3,143	714		7,521
	SO	1	6	539	5	662	488	1	1,702
	ST				929	1	2,296	960	4,186
	TO	9	1	525	12	491	328	7	1,373
8-Dec		26	7	10,228	1,633	10,961	4,693	968	28,516
9-Dec	DO		43			575	8		626
	GO					78			78
	SO			149		197	18		364
	TO			77		121	16		214
9-Dec			43	226		971	42		1,282
10-Dec	SO			1		50	2		53
	TO					13			13
10-Dec				1		63	2		66
11-Dec	SO					8			8
	TO					1			1
11-Dec						9			9
Grand Total		4,151	24,031	149,047	68,810	202,249	200,609	5,566	654,463

g. Storm Restoration Weather Conditions

The temperatures remained below freezing for the majority of the storm restoration, although some initial thaw and re-freeze conditions may have contributed to additional interruptions on December 2 near St. Louis.[328] Wind gust conditions initiated additional dynamic loading failures to trees and facilities, particularly in the St. Louis metro east area in the mornings of December 3 and December 6, as ice laden broken tree limbs brought down additional electric facilities (primarily service lines).[329] The charts below show NWS[330] weather station data for four metropolitan areas in Illinois.[331] A thawing period occurred in most areas between December 5 and 6.[332] Forty one percent of the damaged facility orders in the Outage Analysis System started on or before December 1. The remaining 59 percent of the orders began December 2 or later and, for the most part, are attributable to progressive field assessment and high priority order restoration, *i.e.*, reordering.[333]



[328] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm.
[329] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm, and response to Data Request #266.
[330] National Weather Service.
[331] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm.
[332] NWS weather station data: http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm.
[333] Responses to Data Requests #137 and #138; assumption based upon the order types and start dates.



h. November 2006 Storm Summary Statistics

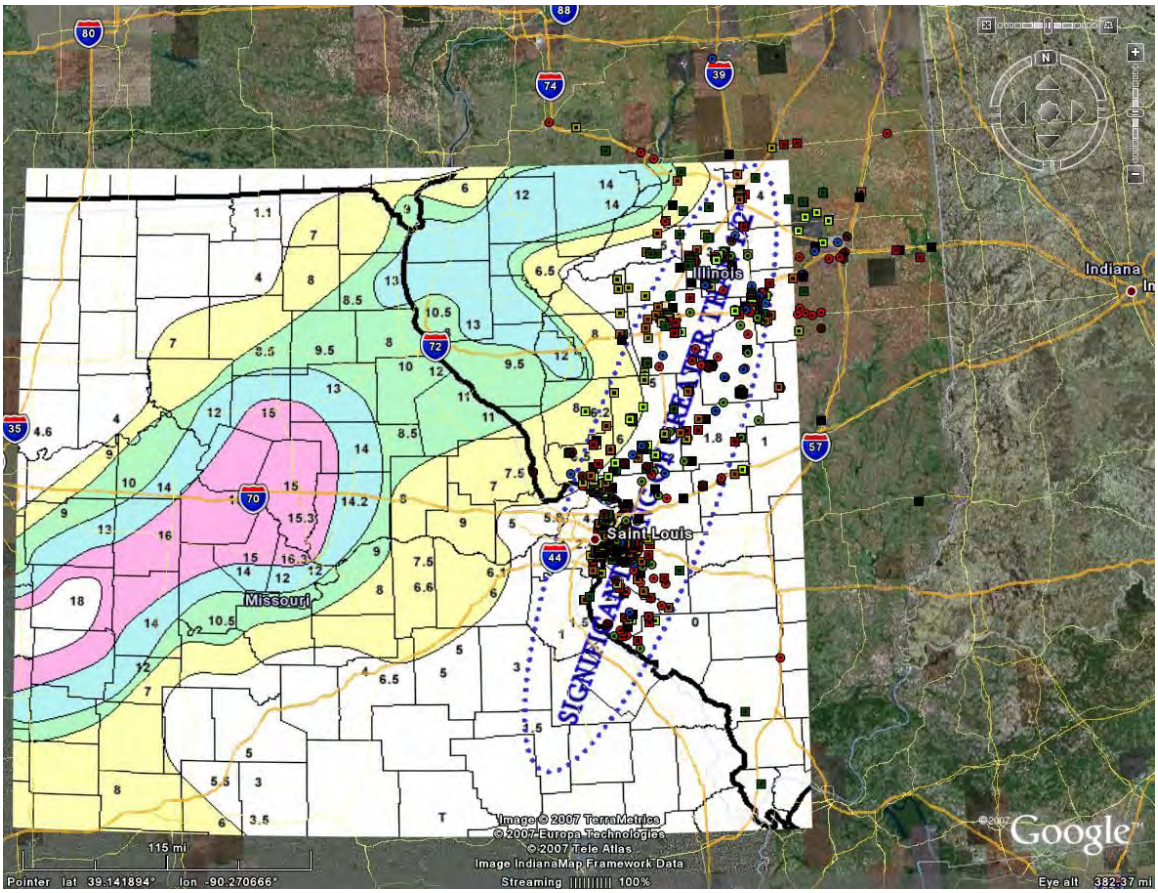
The locations of the most severe weather, the most damage caused by the storm, and the most number of electric service interruptions to Ameren-IL customers coincide. As shown in the table below,[334] the greatest damages to Ameren-IL's electric system occurred in Divisions III and VI, which is where the most severe weather occurred.

November 2006 Storm Cumulative Summary of Damaged Facilities								
Damage Type	Division							
	I	II	III	IV	V	VI	VII	Total
Damaged Wires	20	119	876	337	804	2060	11	4,227
Damaged Poles	10	21	85	27	55	102	3	303

The correlation of icing and damage to Ameren-IL facilities within the first 24 hours of the onset of the storm is visible in the graphic overlay below. The NWS[335] icing ellipse [greater than ½"],[336] shown earlier in this report, has been overlaid on a portion[337] of the damaged facility orders from November 30 and December 1. Locations of the damaged facility outages, shown by multi-colored squares and dots, came from the GPS[338] coordinates of the Outage Analysis

[334] Responses to Data Requests #137, #138, and #266.
[335] National Weather Service.
[336] http://www.crh.noaa.gov/lsx/?n=11_30_06.
[337] Approximately 60 percent of the damaged facility order locations.
[338] GPS is Global Positioning System.

System order.[339] Clustering of the damages is due to the concentration of facilities in the metropolitan areas of St. Louis-East, Springfield, Decatur, Champaign, and Bloomington.



As discussed in more detail in the July 2006 storm section of this report, the design standards of electric utility facilities increase with increasing voltage levels and utilities design and maintain greater clearances with increasing facility voltage levels. During the November storm, transmission[340] facilities sustained the least damage of the facility types. The table below provides a summary of sustained transmission outages.[341] The least amount of customer interruptions of any of the facility types was attributable to transmission facility damage.

[339] Responses to Data Requests #137 and #138.
[340] Transmission includes 138,000 and 345,000-volt facilities. "kV" in the table below indicates thousand volts.
[341] Response to Data Request #139.

Line	Voltage	Outage Start	Reason	Distribution Substations with Customer Impacts	Wholesale Customer Impacts
N. Decatur-Latham-Lanesville (L1342)	138kV	11/30/06, 1645hrs.	Broken shield wire multiple locations caused structure damage	none	E. Lanesville (Soyland), Bordon Chemical
Havana-Danvers (L1352)	138kV	11/30/06, 1853hrs.	Nothing found	Lilly, Danvers, Goodfield Rural	Lilly REA, Danvers REA, Goodfield REA, Goodfield Arco Pipeline
Mason City-Kickapoo-Latham-N. Decatur (L1346)	138kV	11/30/06, 2047hrs.	Broken shield wire multiple locations caused structure damage	none	none
Goose Creek-Rising (L4575)	345kV	11/30/06, 2251hrs.	Broken hardware dropped shield wire	none	none
Brokaw-Gibson City (L1582)	138kV	12/1/06, 0023hrs.	Broken shield wire	none	Brokaw REA
Pana-Mt. Zion-Decatur Rt. 51 (L1462 & B tap)	138kV	12/1/06, 0047hrs.	Broken pole band on main line, broken arms on "B" tap)	Moweaqua E., Moweaqua N., Blue Mound	Mt Auburn Shell, Explorer Pipeline, Shelbyville REA, City of Sullivan, City of Bethany
S. Belleville-Tilden (L1526)	138kV	12/1/06, 0351hrs.	Broken shield wire	Fayetteville Bee Hollow, New Athens	none
Brokaw-Mahomet (L1376)	138kV	12/1/06, 0835hrs.	Nothing found on Line. Substation breaker (34.5kv) failed at N. Leroy sub, closed 138kv ground switch on backup relaying	Mahomet Trf#1, Weedman, Leroy, Southeast Downs	Leroy REA
S. Belleville-Centerville (L1586)	138kV	12/1/06, 1219hrs.	Broken shield wire caused top of pole to break off	Belleville 44th St (Trf#3)	none
Fargo-Edwards-Cat Mapleton (L1394)	138kv	11/30/06 0931hrs	Unknown, no problems found	none	none

For the distribution and sub-transmission facilities a similar susceptibility order exists, therefore distribution facilities of lower voltage, *e.g.*, service wires, single distribution transformer poles, are more susceptible to storm damage than facilities of higher voltage and service, *e.g.*, primary wires and poles are less susceptible than secondary wires, secondary wires are less susceptible than service wires.[342] This is due to the facility height, material strengths, and clearance standards of primary facilities compared to secondary facilities.

Similarly, secondary wires are less susceptible than service wires even though the wire may actually be of the same material and have nearly the same height, because primary class poles

[342] Primary wires carry electrical current at between 4,000 and 15,000 volts. Secondary wires carry up to 600 volts. Service wires bring low voltage (usually 120 or 240 volts) electric power into homes and businesses.

often support secondary wires and secondary wires may get clearance from cyclic trimming of vegetation. Secondary wiring does not exist in many rural areas due to the distance between customers. In metropolitan areas, secondary wiring is beneath the primary wires, which may provide limited mechanical shielding from overhead hazards. In cases where hazards damage both primary and secondary wiring, the Outage Analysis System coded the order as primary wire damage.

It is the customer's responsibility to maintain clearance on service wires. The customer-owned and maintained service wire attachment at the dwelling is often the structural weak point relative to the pole connection. As a result, service wires are more susceptible to mechanical damage from intermittent tree contact, falling tree limbs, and flying debris damage than secondary wires.

The tables below illustrate the correlation of November 2006 severe weather and damaged facilities by examination of the Outage Analysis System Component Code data. These tables show a consistent correlation between the severe weather exposure and damaged facility types by Service Division.[343] The tables also indicate the expected results: that the most susceptible distribution facilities—service wires—were damaged the least in the Divisions (I and VII) in areas furthest from the severe weather and icing, while the number of damaged facilities is greatest in the Divisions (III and VI) of most severe weather exposure. The least susceptible distribution facilities—primary wire and poles—follow a similar geographic distribution by Division.[344]

[343] Response to Data Request #257.
[344] Response to Data Requests #137, #138, #266

November 2006 Storm Damaged Pole Detail			Division							
Category	Component Code	Damage Code	I	II	III	IV	V	VI	VII	Total
POLEBR	Pole	Broken	9	18	57	18	30	77	3	212
POLEDN	Pole	Burned	1	1	28	9	13	17		69
POLEFA	Pole	Failed Faulted					2			2
POLELN	Pole	Leaning		2			10	8		20
		Totals	10	21	85	27	55	102	3	303

November 2006 Storm Damaged Wire Detail			Division							
Category	Component Code	Damage Code	I	II	III	IV	V	VI	VII	Total
PRI BR	Primary Wire	Broken	1	7	12	13	7	56		96
PRI BU	Primary Wire	Burned			2					2
PRI CP	Primary Wire	Clearance Problem			4			4	1	9
PRI DN	Primary Wire	Down	1	9	103	20	70	192		395
PRI FA	Primary Wire	Failed/Faulted	1			1	8		1	11
PRI LO	Primary Wire	Low	1	1	1		2	3		8
PRI LS	Primary Wire	Loose					1			1
PRI SH	Primary Wire	Shorted					1	5		6
SEC BR	Secondary Wire	Broken	1	2	14	7	3	34	1	62
SEC BU	Secondary Wire	Burned	2	1	1	3	3			10
SEC CP	Secondary Wire	Clearance Problem			7		2	2		11
SEC DN	Secondary Wire	Down	1	2	53	5	55	108		224
SEC FA	Secondary Wire	Failed/Faulted		2		1	2	4		9
SEC LO	Secondary Wire	Low		1			2	4		7
SEC LS	Secondary Wire	Loose			3	1		2		6
SEC SH	Secondary Wire	Shorted				1	1	3		5
SVC BR	Service Wire	Broken	3	25	109	98	134	321	3	693
SVC BU	Service Wire	Burned	2		6	5	2	3		18
SVC CP	Service Wire	Clearance Problem			12		7	2		21
SVC DN	Service Wire	Down	3	64	534	145	460	1259		2,465
SVC FA	Service Wire	Failed/Faulted	1	1	1	25	21	2	4	55
SVC LO	Service Wire	Low	2	3	10	6	15	28		64
SVC LS	Service Wire	Loose	1	1	4	5	6	22	1	40
SVC SH	Service Wire	Shorted				1	2	6		9
		Totals	20	119	876	337	804	2060	11	4,227

The next four tables show the November 2006 storm damage and cause analysis summary by each Ameren-IL company for poles, primary wires, secondary wires, and service wires.[345] The category column is a combination of the Outage Analysis System Component and Damage Codes. These tables provide the causes of damaged facility instances by each of the Ameren-IL companies. The last two letters of the category column show the damage type (refer to tables above of damaged facilities by Division for descriptions of the damage and facility codes). Note that the Ameren-CIPS figures include the Alton and East St. Louis area.

[345] Responses to Data Requests #137, #138, and #266.

November 2006 Storm		Damaged Poles			
Cause	**Category**	**CILCO**	**CIPS**	**IP**	**Grand Total**
DROPPED FOR SAFETY	POLEBR		4	5	9
	POLEDN	1		1	2
DROPPED FOR SAFETY Total		1	4	6	11
LOSS OTHR UTLY SUPLY	POLEFA			1	1
LOSS OTHR UTLY SUPLY Total				1	1
NO CAUSE FOUND	POLEBR		5	3	8
	POLELN			1	1
NO CAUSE FOUND Total			5	4	9
OTHER - EXPLAIN	POLEBR	3	6	9	18
	POLEDN		1	4	5
	POLELN		2	2	4
OTHER - EXPLAIN Total		3	9	15	27
OVERHD EQUIP MALFUNC	POLEBR	38	19	38	95
	POLEDN	11	4	21	36
	POLEFA			1	1
	POLELN			4	4
OVERHD EQUIP MALFUNC Total		49	23	64	136
PUBLIC VEHICLE ACCID	POLEBR	2	2	1	5
	POLEDN	1			1
PUBLIC VEHICLE ACCID Total		3	2	1	6
TREE CONTACT	POLEBR	1	7	7	15
	POLEDN			4	4
	POLELN		1	4	5
TREE CONTACT Total		1	8	15	24
TREE LIMB BROKEN	POLEBR	8	30	24	62
	POLEDN	4	5	12	21
	POLELN		4	2	6
TREE LIMB BROKEN Total		12	39	38	89
Grand Total		69	90	144	303

November 2006 Storm		Damaged Primary Wires			
Cause	**Category**	**CILCO**	**CIPS**	**IP**	**Grand Total**
ANIMAL ON CIRCUIT	PRI FA			1	1
ANIMAL ON CIRCUIT Total				1	1
LOSS OTHR UTLY SUPLY	PRI FA			6	6
LOSS OTHR UTLY SUPLY Total				6	6
NO CAUSE FOUND	PRI DN		5	3	8
	PRI LO		1		1
NO CAUSE FOUND Total			6	3	9
OTHER - EXPLAIN	PRI BR		3	2	5
	PRI CP		0	1	1
	PRI DN	2	5	7	14
	PRI FA		1		1
	PRI LO		2		2
OTHER - EXPLAIN Total		2	11	10	23
OVERHD EQUIP MALFUNC	PRI BR	9	9	26	44
	PRI BU		0	1	1
	PRI CP		0	1	1
	PRI DN	22	10	82	114
	PRI FA		1	1	2
	PRI LO	1	0	1	2
OVERHD EQUIP MALFUNC Total		32	20	112	164
OVERLOADED EQUIPMENT	PRI BU	1	0		1
OVERLOADED EQUIPMENT Total		1	0		1
TREE CONTACT	PRI BR		14	8	22
	PRI CP	1	1		2
	PRI DN	1	39	49	89
	PRI LS		0	1	1
	PRI SH		1	2	3
TREE CONTACT Total		2	55	60	117
TREE LIMB BROKEN	PRI BR		5	20	25
	PRI CP	3	0	2	5
	PRI DN	15	43	112	170
	PRI FA		0	1	1
	PRI LO	1	1	1	3
	PRI SH		1	2	3
TREE LIMB BROKEN Total		19	50	138	207
Grand Total		56	142	330	528

November 2006 Storm		Damaged Secondary Wires			
Cause	**Category**	**CILCO**	**CIPS**	**IP**	**Grand Total**
LOSS OTHR UTLY SUPLY	SEC FA			2	2
LOSS OTHR UTLY SUPLY Total				2	2
NO CAUSE FOUND	SEC BR	1	1	1	3
	SEC DN		4	2	6
	SEC LO			1	1
NO CAUSE FOUND Total		1	5	4	10
OTHER - EXPLAIN	SEC BR			3	3
	SEC CP			1	1
	SEC DN		2	10	12
	SEC LO		1		1
	SEC LS		1		1
OTHER - EXPLAIN Total			4	14	18
OVERHD EQUIP MALFUNC	SEC BR	10	1	4	15
	SEC BU	1		5	6
	SEC CP			1	1
	SEC DN	3	7	18	28
	SEC FA			3	3
	SEC LO		2	1	3
	SEC LS	1			1
OVERHD EQUIP MALFUNC Total		15	10	32	57
TREE CONTACT	SEC BR		4	3	7
	SEC CP		1	3	4
	SEC DN	3	23	25	51
	SEC FA		1		1
	SEC LO		1		1
	SEC LS		2		2
	SEC SH		3		3
TREE CONTACT Total		3	35	31	69
TREE LIMB BROKEN	SEC BR	3	3	28	34
	SEC BU		2	2	4
	SEC CP	4		1	5
	SEC DN	30	36	61	127
	SEC FA		3		3
	SEC LO			1	1
	SEC LS	2			2
	SEC SH		1	1	2
TREE LIMB BROKEN Total		39	45	94	178
Grand Total		58	99	177	334

November 2006 Storm		Damaged Service Wires			
Cause	**Category**	**CILCO**	**CIPS**	**IP**	**Grand Total**
CUSTOMER EQUIP PROBL	SVC BR		1		1
	SVC DN	1	2	1	4
CUSTOMER EQUIP PROBL Total		1	3	1	5
LOSS OF AMEREN TRANS	SVC DN			2	2
	SVC LO			1	1
LOSS OF AMEREN TRANS Total				3	3
LOSS OTHR UTLY SUPLY	SVC DN			3	3
	SVC FA			10	10
LOSS OTHR UTLY SUPLY Total				13	13
NO CAUSE FOUND	SVC BR	1	12	1	14
	SVC CP			1	1
	SVC DN	1	47	23	71
	SVC FA		2	1	3
	SVC LO		2	1	3
	SVC LS		2		2
NO CAUSE FOUND Total		2	65	27	94
OTHER - EXPLAIN	SVC BR		9	7	16
	SVC BU		1	1	2
	SVC DN	5	24	112	141
	SVC FA		20	7	27
	SVC LO		2	5	7
	SVC LS		3	4	7
	SVC SH		3		3
OTHER - EXPLAIN Total		5	62	136	203
OVERHD EQUIP MALFUNC	SVC BR	6	18	55	79
	SVC BU		3	1	4
	SVC CP		1	5	6
	SVC DN	36	73	256	365
	SVC FA		3	7	10
	SVC LO		3	7	10
	SVC LS		3	8	11
	SVC SH			1	1
OVERHD EQUIP MALFUNC Total		42	104	340	486
PUBLIC VEHICLE ACCID	SVC DN	1			1
	SVC LO			1	1
PUBLIC VEHICLE ACCID Total		1		1	2
TREE CONTACT	SVC BR		60	81	141
	SVC BU	1			1
	SVC CP	2		6	8
	SVC DN	13	305	305	623
	SVC FA		1	1	2
	SVC LO	2	9	8	19
	SVC LS		1	5	6
	SVC SH		3	1	4
TREE CONTACT Total		18	379	407	804
TREE LIMB BROKEN	SVC BR	17	175	250	442
	SVC BU		5	5	10
	SVC CP	3		3	6
	SVC DN	43	502	709	1254
	SVC FA		1	1	2
	SVC LO	1	8	14	23
	SVC LS		6	8	14
	SVC SH		1		1
TREE LIMB BROKEN Total		64	698	990	1752
TREE TRIMMERS	SVC DN		1		1
TREE TRIMMERS Total			1		1
UNDRGRD EQUIP MALFUN	SVC BU	1			1
	SVC FA		1		1
UNDRGRD EQUIP MALFUN Total		1	1		2
Grand Total		134	1313	1918	3365

Ameren-IL provided a summary of materials used to complete the restoration in a report to the ICC. The table below provides that information.[346] The summary of material used in the restoration is consistent with the Outage Analysis System data for damaged facilities. For example, the total number of poles should be of the same order of magnitude as the total damaged pole orders. Single damaged pole orders in Outage Analysis System are often associated with multiple poles damaged, thus the number of poles used is greater than the damaged pole orders but within the same order of magnitude. The number of replacement poles per damaged pole order was over four, suggesting that many damaged pole orders were instances of multiple pole failures per location. This is higher than the July 2006 storm, and confirmed that icing caused more structural damage than the summer windstorm.

Primary/secondary wire stock used corresponds to about 1,600 feet primary of wire per damaged primary wire order. Service-wire orders, *i.e.*, #2 tri-plex stock material, correspond to about 90 feet service wire per damaged service order, which is consistent with lot line distances in the areas affected. Service-wire orders correspond with house knobs used. Fuse links correspond with fused tap outages, i.e., the total number of DO & GO orders.

Item	
Poles	1,359
Transformers	554
Wire & Cable	1,380,000 feet
#2 Triplex	302,000 feet
House Knobs	3,444
65 T Fuse Links	1,099
100 T Fuse Links	775

The table below shows the November 2006 storm summary of customer interruptions by cause for each of the Illinois companies.[347] Note that the table provides the ICC cause category and the Outage Analysis System cause code.

[346] Responses to Data Requests #8-B and #123-C.
[347] Response to Data Request #266.

November 2006 Storm: Sum of Customer Interruptions		IL-Company			
ICC Category	**Cause**	**CILCO**	**CIPS**	**IP**	**Grand Total**
ANIMAL RELATED	ANIMAL ON CIRCUIT	17	60	149	226
ANIMAL RELATED Total		17	60	149	226
CUSTOMER	CUSTOMER EQUIP PROBL	37	53	60	150
CUSTOMER Total		37	53	60	150
INTENTIONAL	DROPPED FOR SAFETY	365	2,743	15,776	18,884
	NULL		0	4	4
INTENTIONAL Total		365	2,743	15,780	18,888
JURISDICTIONAL	NULL	3	0	1	4
	TREE TRIMMERS		10	13	23
JURISDICTIONAL Total		3	10	14	27
LOSS OF SUPPLY	LOSS OTHR UTLY SUPLY	11	1	1,828	1,840
LOSS OF SUPPLY Total		11	1	1,828	1,840
NO OUTAGE	NO OUTAGE OCCURRED	101	37	728	866
NO OUTAGE Total		101	37	728	866
OTHER	OTHER - EXPLAIN	127	6,336	29,643	36,106
OTHER Total		127	6,336	29,643	36,106
OVERHEAD EQUIPMENT	OVERHD EQUIP MALFUNC	3,544	1,577	6,352	11,473
OVERHEAD EQUIPMENT Total		3,544	1,577	6,352	11,473
OVERLOAD	OVERLOADED EQUIPMENT		28		28
OVERLOAD Total			28		28
PUBLIC	DAMAGE BY PUBLIC		0	3,783	3,783
	DIG-IN BY PUBLIC		0	1	1
	PUBLIC VEHICLE ACCID	50	740	576	1,366
	STRUCTURE FIRE		0	1	1
PUBLIC Total		50	740	4,361	5,151
SUBSTATION EQUIPMENT	SUBSTA EQUIP MALFUNC	61	592		653
SUBSTATION EQUIPMENT Total		61	592		653
TRANSMISSION OUTAGE	LOSS OF AMEREN TRANS	2,021	14,373	13,261	29,655
TRANSMISSION OUTAGE Total		2,021	14,373	13,261	29,655
TREE BROKEN	TREE LIMB BROKEN	551	260	1,133	1,944
TREE BROKEN Total		551	260	1,133	1,944
TREE CONTACT	TREE CONTACT	130	4,163	140	4,433
TREE CONTACT Total		130	4,163	140	4,433
UNDERGROUND EQUIPMENT	UNDRGRD EQUIP MALFUN	139	33	246	418
UNDERGROUND EQUIPMENT Total		139	33	246	418
UNKNOWN	NO CAUSE FOUND	109	724	332	1,165
UNKNOWN Total		109	724	332	1,165
WEATHER	NO CAUSE FOUND	161	10,684	11,295	22,140
	OVERHD EQUIP MALFUNC	17,432	31,296	270,277	319,005
	OVERLOADED EQUIPMENT	1	0	1,053	1,054
	SUBSTA EQUIP MALFUNC		929	1	930
	TREE CONTACT	1,638	12,164	61,430	75,232
	TREE LIMB BROKEN	3,332	41,276	79,819	124,427
	UNDRGRD EQUIP MALFUN	112	3,151	547	3,810
WEATHER Total		22,676	99,500	424,422	546,598
Grand Total		29,942	131,230	498,449	659,621

2. The November 2006 Storm Comparison

a. National Weather Service (NWS) Comparative Data

Severe weather data from the past 20 years in Ameren-IL's service territory indicate that winter storms account for about 5 percent of the annual severe weather days. Severe winter weather is generally of less duration and of lesser wind gust velocity than thunderstorms, although the NWS

has recorded individual maximum wind gust observations at 100 mph.[348] Characteristically different from thunderstorms, winter storms can nevertheless cause significant electric utility facility damages and customer interruptions. Icing conditions alone can cause significant damage and resultant customer interruptions to electric utilities due to static structural loading and collateral damage from, for example, ice-damaged trees. Wind conditions need not be severe in order to compound icing damages directly or indirectly from falling trees or branches. The National Weather Service did not record severe wind gust data (≥50 mph) in Illinois for the November 2006 storm,[349] although weather stations reported gusts in the 20 mph range and average wind speed peaks near 35mph.[350]

b. Ameren Major Event Comparative Data

The November 2006 storm was the largest single storm-related major event in recent Ameren-IL history.[351] Ameren-CILCO, however, experienced worse storm-related major events in July 2006, November 2004, and April 2000 based on peak number of interrupted customers.[352] In addition, Ameren-CIPS experienced worse storm-related major events in July 2006 and November 2004.[353] Of 12 major events reported by Ameren-IL companies from July 2004 through November 2006, pursuant to the Illinois Administrative Code Section 411.120, 11 were storm related (the other was a substation equipment failure).[354] Based on the initial peak customers interrupted for the combined Ameren-IL companies, the November storm was by far the worst. The table below provides a comparison of recent Ameren-IL reportable major events during winter season.[355]

Ameren-IL Major Events			Event Parameters						
Description			Total Customers Interrupted					Advance Notice	
ID	Storm Start Date/Time	Event	CILCO	CIPS	IP	Total Days To Restore	Ameren-IL Cust Total	Forecast Lead Time[1] (Hours)	Weather Statement Lead Time[2] (Hours)
1	11/24/2004	Snowstorm	48,142	37,815	10,000	4	95,957		
2	12/19/2004	Substation Failure			18,638	0	18,638		
3	12/22/2004	Windstorm			4400	1	4,400		
4	11/30/2006	Ice/Snowstorm	16,950	42,740	179,390	10	239,080	>24	>24
Notes:		1. Interval between the NWS severe weather forecast and the first NWS severe weather statement 2. Interval between the first NWS severe weather statement and ground truth severe weather observation							

During interviews, several Ameren-IL personnel identified the November 2006 storm as one of the largest storms in their experience.[356]

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[348] http://www.spc.noaa.gov/archive/. Metered weather data. 853 severe weather days in the past 20 years.
[349] http://www.spc.noaa.gov/archive/.
[350] http://cdo.ncdc.noaa.gov/qclcd/qclcdhrlyobs.htm; NWS hourly actual data in Peoria, St Louis (MO), Decatur, Champaign.
[351] Response to Data Request #122.
[352] Responses to Data Requests #122, #266, and #432.
[353] Responses to Data Requests #122, #438, #471, #491.
[354] Response to Data Request #122.
[355] Response to Data Request #122 and NWS archives: http://www.spc.noaa.gov/archive
[356] Interview #9, October 8, 2007, Interview #13, October 3, 2007, and Interview #40, November 8, 2007.

c. Restoration Duration Data

An Edison Electric Institute report suggests that, "One of the best indicators of the severity of a storm is the peak number of customers who lose power during the storm and who are without power at the same time."[357] The ICC reporting requirements do not explicitly require the peak number of customers affected.[358] However, for the purpose of comparing this storm with historical events, Liberty used the numbers provided by each company in Illinois to report the notice requirement, *i.e.*, "An estimate of the number of customers the interruptions affect" to provide a common comparison basis.

The four tables below show the November 2006 storm summary of customer restorations for each Ameren-IL company.[359] Note that the data for these tables includes the duplication of customers associated with SR (Service Request) orders. These are non-outage orders. Ameren-IL creates a "lights out" order for these instances to track formally the customer outage and the aggregation of customer interruptions for the outage. Ameren-IL retains SR orders separately to ensure public safety for damaged facility instances, and must close these orders separately. The November 2006 storm included over 14,000 SR orders.[360]

These tables below provide comparison of the individual company restorations for the November storm.[361] Overall, the tables provide another comparison of the severity of the storm. The components of these tables, total customers restored and total numbers of days to restore, reflect the severity of the storm for each of the individual Ameren-IL companies. In addition, the difference between the peak number of customers out of power and the total customers restored is apparent by inspection of the tables below compared to the Ameren-IL Major Events Summary table above.

All Ameren-IL Companies

Date/Time	Days	Customers Restored per day	Total Customers Restored	%Restored per day	Cummulative % Restored
12/01/06 17h	1	203,586	203,586	27%	27%
12/02/06 17h	2	85,812	289,398	11%	39%
12/03/06 17h	3	82,270	371,668	11%	50%
12/04/06 17h	4	88,463	460,131	12%	61%
12/05/06 17h	5	87,136	547,267	12%	73%
12/06/06 17h	6	90,577	637,844	12%	85%
12/07/06 17h	7	61,662	699,506	8%	93%
12/08/06 17h	8	41,194	740,700	6%	99%
12/09/06 17h	9	7,623	748,323	1%	100%
12/10/06 17h	10	103	748,426	0%	100%

[357] EEI's *Utility Storm Restoration Response*, January 2004, page 4.
[358] Illinois Administrative Code Section 411.120, Notice & Reporting Requirements.
[359] Response to Data Request #432.
[360] Response to Data Request #266.
[361] Response to Data Request #473

Ameren-CILCO

Date/Time	Days	Customers Restored per day	Total Customers Restored	%Restored per day	Cummulative % Restored
12/01/06 17h	1	6,708	6,708	22%	22%
12/02/06 17h	2	6,548	13,256	22%	44%
12/03/06 17h	3	6,219	19,475	21%	65%
12/04/06 17h	4	3,232	22,707	11%	76%
12/05/06 17h	5	1,813	24,520	6%	82%
12/06/06 17h	6	4,631	29,151	16%	98%
12/07/06 17h	7	643	29,794	2%	100%
12/08/06 17h	8	73	29,867	0%	100%
12/09/06 17h	9	3	29,870	0%	100%
12/10/06 17h	10	0	29,870	0%	100%

Ameren-CIPS

Date/Time	Days	Customers Restored per day	Total Customers Restored	%Restored per day	Cummulative % Restored
12/01/06 17h	1	50,344	50,344	37%	37%
12/02/06 17h	2	22,349	72,693	16%	53%
12/03/06 17h	3	15,259	87,952	11%	64%
12/04/06 17h	4	16,982	104,934	12%	77%
12/05/06 17h	5	9,455	114,389	7%	83%
12/06/06 17h	6	9,741	124,130	7%	91%
12/07/06 17h	7	5,844	129,974	4%	95%
12/08/06 17h	8	6,913	136,887	5%	100%
12/09/06 17h	9	233	137,120	0%	100%
12/10/06 17h	10	1	137,121	0%	100%

Ameren-IP

Date/Time	Days	Customers Restored per day	Total Customers Restored	%Restored per day	Cummulative % Restored
12/01/06 17h	1	146,534	146,534	25%	25%
12/02/06 17h	2	56,915	203,449	10%	35%
12/03/06 17h	3	60,792	264,241	10%	45%
12/04/06 17h	4	68,249	332,490	12%	57%
12/05/06 17h	5	75,868	408,358	13%	70%
12/06/06 17h	6	76,205	484,563	13%	83%
12/07/06 17h	7	55,175	539,738	9%	93%
12/08/06 17h	8	34,208	573,946	6%	99%
12/09/06 17h	9	7,387	581,333	1%	100%
12/10/06 17h	10	102	581,435	0%	100%

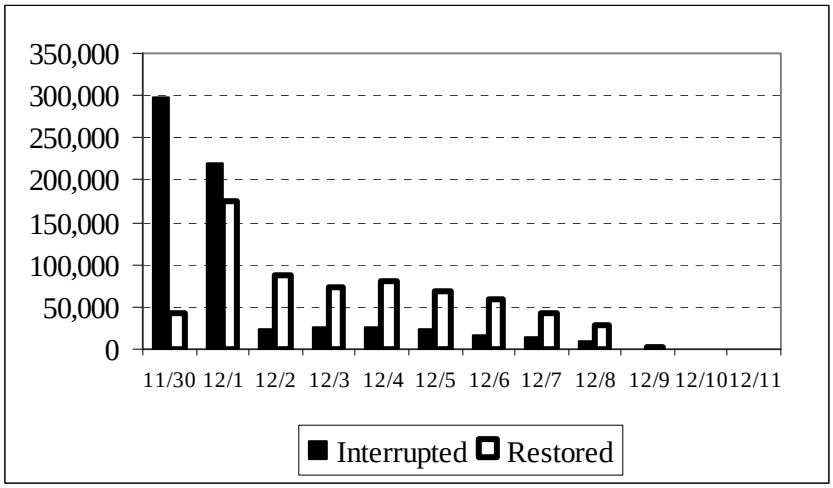
3. Accuracy of Interruption Data

a. Outage Analysis System and the November Storm

The above corresponding section of this report on the July storms describes the Outage Analysis System (OAS) and the re-ordering process that can affect the number of customer interruptions.

In the November storm, the re-ordering phenomenon is evident by the large number of interruption orders that occurred daily even after the storm was over at approximately 10:30 a.m., December 1.[362] Overall, as the restoration progressed the Outage Analysis System numbers had a characteristic daily ebb and flow pattern, or large numbers of order closures and newly created orders as the chart below shows.[363]

Ameren-IL OAS Daily Interruptions and Restorations, November 2006



Ameren reported that the total number of customer interruptions in Illinois was 370,322 for the November 2006 storm.[364] However, the total number of daily interruptions (and restorations) shown in the chart above is 659,621. The Outage Analysis System re-ordering duplication is the primary reason for the difference. Maintenance outages and "normal" outages (from unaffected areas) are also included in with these totals shown above. The multiplier effect due to re-ordering of approximately 1.75-2.0 shows from the difference between the total customer interruptions reported and the total customers restored [depending on whether all order types are included in the comparison, e.g., (659,621)/370,322 vs. (748,426)/370,322].[365]

The Outage Analysis System data for the November 2006 storms was consistent and stable. Ameren-IL provided multiple Outage Analysis System data extracts over a two-month period during the investigation. Liberty combined these extracts in a storm database to derive storm data summaries. In other instances, Ameren-IL provided storm data summaries directly in response to specific data requests. The Ameren-IL results were consistent with Liberty's derived results.[366] The summary totals were generally consistent with independent analyses and those provided by Ameren-IL, but slightly less consistent than those for the July 2006 storm.[367] In addition, Liberty found the referential integrity of the data provided in several data requests to be excellent.[368]

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[362] NWS short term forecasts 011534 & 01170.
[363] Response to Data Request #266.
[364] Response to Data Request #123.
[365] Responses to Data Requests #266 and #473.
[366] Responses to Data Requests nos. 135-138, 266, 473, 496, 621-626, 735-737.
[367] Responses to Data Requests #266 and #473, comparative accuracy of total customers affected within 4 percent.
[368] Responses to Data Requests #135, #136, #137, #138, #266, #472, and #473.

Ameren-IL's method for assigning Outage Analysis System cause codes to ICC annual reporting requirements was consistent and repeatable.[369] Liberty's initial review of the data indicated that Ameren-IL made a reasonable effort to determine the proper cause.[370] Outage Analysis System training manuals contain instructional guides for the assessment of root cause and component relationships.[371] Ameren-IL did not enter the "Unknown" causes excessively.[372] Liberty reports on its evaluation of the methods for determining cause codes by field personnel during storm activity in another chapter of this report.

b. Interruption Causes – November 2006 Storm

Before Ameren-IL can close an Outage Analysis System service interruption order, personnel must enter a cause code.[373] The principal Outage Analysis System cause codes used during the November 2006 storm were the following:[374]

- Overhead Equipment Malfunction – 50 percent
- Tree Contact and Tree Limb Broken – 31 percent
- Other - Explain – 5 percent
- No Cause Found – 4 percent
- Dropped for Safety – 3 percent
- All other causes – 7.0 percent

For reporting to the ICC, Ameren-IL must use a different set of interruption cause codes.[375] Ameren-IL uses Outage Analysis System cause codes and weather codes to map interruptions to the ICC-required causes.[376] The principal causes for the November 2006 storm using ICC causes were the following:[377]

- Weather – 83 percent
- Other – 5 percent
- Transmission Outage – 4 percent
- Intentional – 3 percent
- Overhead Equipment – 2 percent
- Public – 1 percent
- Tree Broken and Tree Contact – 1 percent
- All other causes – 1 percent

The differences between these two sets of interruption causes is the result of translating the cause and weather codes used by the Outage Analysis System into the cause code definitions adopted

[369] Response to Data Request #363.
[370] Response to Data Request #266.
[371] Response to Data Request #257.
[372] Response to Data Request #266.
[373] "Edit-check feature" of Outage Analysis System, Interview #37; November 2, 2007.
[374] Response to Data Request #266.
[375] Illinois Administrative Code, Section 411.20.
[376] Response to Data Request #363.
[377] Response to Data Request #364.

by the ICC. It is apparent from the two sets of cause information immediately above that reports to the ICC indicate weather as the main cause, while the Outage Analysis System uses cause codes that do not include weather but captures other information that describes weather conditions. In addition to required reporting, accurate determinations of outage causes can be useful for post-storm analyses of things Ameren-IL could do to prevent or mitigate the effect of future storms. While the November 2006 outage data show that Ameren-IL personnel made reasonable efforts to identify the proper cause, having 4 percent of the total number of customers interrupted pinned to "no cause found" demonstrates a need for increased emphasis on determining an accurate cause. In addition, the "other-explain" cause, which accounted for 5 percent of the customer interruptions, requires researching individual outage orders for any meaningful analysis.

4. Accuracy of the Data Provided to the Media and ICC

a. Press Releases

Ameren issued eight Illinois press releases regarding the November 2006 storm.[378] The timing of the releases was:

- November 30 mid-day (pre-emptive storm notice)
- December 1, 10:00 a.m.
- December 1, 1:00 p.m.
- December 1, 5:00 p.m.
- December 3, morning (joint applicability to Illinois & Missouri)
- December 4, morning
- December 4, mid-day
- December 5, 10:00 a.m. (joint applicability to Illinois & Missouri)

Overall, the information provided to the media was timely. The press release at 10:00 a.m., December 1 stated that 220,000 Ameren-Illinois customers had their service interrupted.[379] Retrospective Outage Analysis System data indicates that the total was significantly (*i.e.*, by 75 percent or more) greater.[380] An overloading of Ameren-IL's telecommunication systems blocked a large percentage of customer calls within the first 24 hours of the storm. Liberty addresses this problem in another chapter of this report. However, it is clear that blocked customer calls prevent the Outage Analysis System from capturing service interruptions. Therefore, while Ameren likely used available Outage Analysis System information to provide data to the media, it ultimately proved to be inaccurate.

Estimated restoration times (ERTs) are an important aspect of the information provided to the public and customers. The initial press releases were prudently noncommittal on specific ERTs. Within the initial 24 hours of the storm, press releases indicated that Ameren was unable to

[378] Responses to Data Requests #366 and #474.
[379] Responses to Data Requests #366 and #474.
[380] Response to Data Request #266 OAS indicates 379,053 at 8a.m.; Response to Data Request #123, part C indicates approximately 437,000 customers at 10 a.m.

provide ERTs due to the nature of the damage.[381] A morning press release on Monday, December 4, 2006, stated that Ameren would restore most customers by Wednesday, December 6, 2006. A final press release issued on Tuesday, December 5 at 10 a.m. indicated that customers might need to make repairs on the customer's side of the service entrance, however, Ameren expected to restore the bulk of the customers by the end of day December 6.[382] Ameren issued no further press releases for Illinois customers.[383] Ameren-IL completed CILCO's restoration on December 7, CIPS' restoration on December 8, and IP's restoration on December 10.[384]

The press releases provided the number of the initial total customers interrupted, and Ameren updated this number to reflect the total known after completion of field assessment. The press releases were more consistent in format than those Ameren issued during the July 2006 storm. For example, they cited totals for Ameren-IL customers affected consistently.[385]

The content of the press releases was an improvement over the press releases for the July 2006 storm. The press releases also provided specific coverage of Illinois customer restorations in identified communities.[386]

b. ICC Notifications

There were 81 notices provided to the ICC during the November/December storm for the Illinois companies as required by Illinois Administrative Code Section 411.120. The notices generally complied with the requirements for content and consistency. Ameren-IL typically reports the current number of customers remaining without service at the time of the first ICC notice.[387] This total decreases as restoration progresses with subsequent notices.

The accuracy of the information provided is difficult to assess for this storm because of two timing issues related to source input data. First, blocked customer calls prevented the Outage Analysis System from capturing all service interruptions. Second, the re-ordering process within the Outage Analysis System will affect the number of customer interruptions at any particular time. The total remaining customers without service in "live" data would understate the actual total from about 10 p.m. until the next day throughout the restoration.[388] The call grouping analyzer then re-establishes a higher estimate of the remaining customers without service as customers call back to report their outages.[389] Since the time of a reordered outage starts at the time of the first call,[390] the retrospective data total would exceed the actual "live" estimate of this total provided in real-time to the ICC. This cycle of inaccuracy repeats with diminishing severity

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[381] Response to Data Request #366.
[382] Responses to Data Requests #366 and #474.
[383] Response to Data Request #366.
[384] Response to Data Request #122.
[385] Response to Data Request #366.
[386] Response to Data Request #366.
[387] Notices are required only during normal business hours Monday-Friday.
[388] Response to data Request #434; Interview #120, January15, 2008; the system suspends restoration verification callbacks via the Voice Response Unit nightly. Customers would be required to re-report the outage the following day.
[389] Interview #37, November 2, 2007.
[390] Interview #120, January 15, 2008.

until the reordering stops or restoration had progressed to the point that the system no longer grouped the remaining outages to a higher device.

Ameren reported an estimate of the number of customers remaining without service in each of the ICC notices provided. The ICC notice at 8:30 a.m. December 1 stated that 210,450 Ameren-Illinois customers had service interrupted in the combined total for the three Illinois companies.[391] Retrospective Outage Analysis System data indicates that the actual total was significantly (*i.e.*, by 68 percent or more) greater.[392] Therefore, although Ameren-IL may have used the only available information, it ultimately proved to be inaccurate.

The table below shows the number of customer interruptions reported to the ICC compared to the retrospective total in the Outage Analysis System.[393] The data are consistent with the expected general influence of the issues identified above.

November 2006 Storm - Customers Remaining Without Service				
ICC_Notice Day	**Notice Total (1st AM rpt)**	**OAS Total[1] 00:00 hr**	**Difference**	**Percent Error**
Fri 12/1/06	210,450	379,053	168,603	80%
Sat 12/2/06	N/A[2]	300,430	N/A[2]	N/A[2]
Sun 12/3/06	N/A[2]	236,882	N/A[2]	N/A[2]
Mon 12/4/06	146,400	189,626	43,226	30%
Tue12/5/06	109,875	137,133	27,258	25%
Wed 12/6/06	70,440	90,653	20,213	29%
Thu 12/7/06	44,550	50,097	5,547	12%
Fri 12/8/06	20,301	21,742	1,441	7%
Sat 12/9/06	423	21,742	21,319	Note 3
Sun 12/10/06	N/A[2]	75	N/A[2]	N/A[2]
Mon 12/11/06	0	9	9	Note 3
Note: [1] Order type basis includes all order types.				
Note: [2] No reporting during non-business hours.				
Note: [3] Single orders and customer service repair orders.				

Estimated Restoration Time (ERT) information provided was more conservative than that Ameren provided in the July 2006 storm. There were only single revisions (extensions) to the Ameren-CIPS and Ameren-IP ERTs of approximately 24 hours each during storm.[394] However, Ameren-IL did not update ERT estimates at the end of the restoration. Sixteen ICC notices provided on or after December 7 contained ERT estimates that were already in the past (December 6).[395]

[391] Response to Data Request #122.
[392] Response to Data Request #266 OAS indicates 379,053 at 8 a.m.; Response to Data Request #123, part C indicates approximately 437,000 customers at 10 a.m.
[393] Responses to Data Requests #122 and #266.
[394] Response to Data Request #122.
[395] Response to Data Request #122.

Within first 24 hours of this storm, on December 1, the notifications indicated that Ameren-IL could not estimate the restoration times for all Illinois customers due to the extent of the damage.[396] Overall, Ameren-IL extended the restoration times provided to the ICC one time for Ameren-IP customers and one time for Ameren-CIPS customers.[397] Ameren did not retain Emergency Operations Center conference call minutes for the November storm, unlike the July 2006 storm practice.[398] Therefore, it is unclear whether the source of the ERT inaccuracy was due to the inaccuracy of operational personnel estimates. The combined influence of call blocking and OAS reordering would expectedly decrease the ability of operational personnel to provide accurate ERT estimates.

The content of the ICC notices was generally consistent and addressed the required information for the reporting requirement.[399] The notifications reported the total customers affected consistently. Ameren-IL's reporting practice is to provide the current level of interrupted customers at the time of the report. Ameren provided additional information to the ICC to update the initial peak total customers interrupted in subsequent notices; however, the accuracy of these updates is subject to the same issues noted above with the initial number provided.[400]

F. Reliability Reporting

This section addresses the effects of OAS storm mode inaccuracy on mandatory ICC reliability management reporting requirements.

1. Annual Reported Reliability Indices

The ICC requires Illinois electric utilities to report annually the overall reliability indices for customer service continuity and outage duration performance. The July and November 2006 storms contributed 40 percent of the annual customer interruptions for Ameren-IL and 85 percent of the customer interruption minutes for Ameren-IL.[401] The storm mode duplication due to re-ordering in these storms was in the range of 1.5-2.0 times the actual estimated customers interrupted.[402] Because of this major contribution and storm mode data inaccuracies, the annual reliability indices are inaccurate. Liberty estimates that the frequency indices are the most inaccurately overstated. Duration indices are inaccurate to a lesser degree due to the loss of customer interruption minutes that occurs in re-ordering scenarios when customers must re-initiate their outage reporting. Such inaccuracies are long standing because of the contribution of major storm days and severe weather occurrences in Illinois weather history.

[396] Responses to Data Requests # 424 and #122.
[397] Response to Data Request #122.
[398] Response to Data Request #424.
[399] Response to Data Request #122.
[400] Response to Data Request #122.
[401] Response to Data Request #'s 1, 2, 3, 621, and 737.
[402] Response to Data Requests #'s 265 and #266.

2. Worst 1 Percent Performing Circuits (WPC) Program

The ICC requires Illinois electric utilities to report annually the 1 percent worst performing circuits (WPC). Circuits whose primary reason for inclusion was the contribution of the July and November 2006 storms heavily populated Ameren's WPC program for 2006. Ameren-IL estimated that 96 percent of its 2006 WPC circuits were attributable to major storms.[403] Ameren-IL did not estimate the inaccuracy in its identification of these circuits caused by OAS storm mode inaccuracies[404] The OAS re-ordering duplication presents a displacement risk. In other words, there could have been circuits that experienced worse service than those identified on the 1 percent list.

3. Customer Target Program

Under the Customer Target Program, Illinois electric utilities report annually the customers who have experienced interruptions or durations that exceeded minimum target levels of unreliability for three consecutive years. Ameren-IL recently reached a settlement agreement with the ICC that omits the inclusion of "controllable interruptions" for this minimum target level. As a result, each Ameren-IL utility reported the facilities for which it exceeded the minimum target levels for either frequency or duration regardless of cause. This program often identifies "pockets" of customers, *i.e.*, customers protected by a common circuit lateral fuse or sub-section device, but generally does not replicate the 1 percent worst performing circuits. Utilities must report the root cause and remediation actions to mitigate the underlying causes of unreliability under this regulatory requirement.[405]

Liberty found that the major storm contribution to approximately 90 percent of the Ameren-IL 2006 Customer Target Program facilities was more than 50 percent. This program suffers inaccuracy for frequency-based target identification. However, because a fixed percentage does not cap the program, there is no displacement risk associated with this inaccuracy. Ameren-IL may be taking mitigation actions due solely to the re-ordering duplication.

4. Significance of "Weather" Interruptions in Overall Data

Ameren-IL estimated that in 2006, weather-related causes account for 43 percent of its annual outages, 57 percent of customer interruptions, 92 percent of customer interruption minutes, 96 percent of the worst performing circuits for frequency of interruptions, 90 percent of the worst performing circuits for duration of interruptions, 55 percent of facilities in excess of customer frequency targets, and 45 percent of facilities in excess of customer duration targets.[406] Despite the overwhelming evidence of weather as the fundamental driver behind Ameren-IL's reliability challenge, Ameren-IL's approach to improving its weather intelligence lacks a programmatic approach and has been largely reactive. Ameren-IL's processes lack an ability to learn from weather impacts and to assess the effectiveness of system weather hardening efforts.

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[403] Response to Data Request #'s 1, 2, 3, 627, 628, & 742.
[404] Interview #172, May 7, 2008.
[405] Interview #38, November 2, 2007; Interview #171, April 4, 2008; Response to Data Request #'s 1, 2, & 3.
[406] Response to Data Request #'s 1, 2, 3, 621-623, and 737.

Ameren-IL categorizes weather-related interruptions as uncontrollable without adequate correlation of weather severity and root cause determination of whether the interruption "could have prevented through the use of generally accepted engineering, construction, or maintenance practices."[407] Liberty agrees that the weather is beyond Ameren-IL's control, however Liberty disagrees with Ameren-IL's practice of retrospectively and formulaically applying "uncontrollability" to weather-related interruptions without adequate root cause analysis.[408] Ameren-IL's practice circumvents the intent of the Administrative Code and could contribute toward corporate complacency with weather-related outages. While there is value in tracking "storm-adjusted" reliability measures, it should not come at the expense of apathy towards proactive weather hardening initiatives.[409]

G. Conclusions

1. The July 2006 storms in the Ameren-IL service territory came without advanced warnings, were severe in magnitude, and caused considerable damage to Ameren-IL's electric delivery system.

Prior to July 19, the National Weather Service (NWS) had not predicted storms to occur in the Ameren-IL service territory until July 20. It reported unstable air in the morning of July 19 and the first interruptions did not occur until after 2 p.m. The storm brought three tornados, high winds, and significant lightning activity, with the most intense hour of the storm occurring between 7 p.m. and 8 p.m. on July 19. During restoration, a second severe storm came into the service territory on July 21. Over 300,000 customers of the Ameren-IL companies had service interrupted. The effect on Ameren-IL's distribution system was significant, with over 500 damaged poles.

2. There was advanced warning of the November 2006 storm in the Ameren-IL service territory, but it was even more severe than the July storm in terms of customer interruptions and damage to Ameren-IL's electric delivery system.

The National Weather Service (NWS) provided 48 hours advance notice of a major winter storm for the Ameren-IL service territory on November 30 and December 1. The predicted severity worsened within 24 hours of its start. The NWS predicted that the storm could produce significant snow and ice accumulations on exposed surfaces and power lines. The storm brought icing accumulations in excess of ½″ and peak snow accumulations of 13″. Over 370,000 customers of the Ameren-IL companies had service interrupted. The effect on Ameren-IL's distribution system was significant, with over 1,300 damaged poles and 3,000 downed wires.

3. The July and November 2006 storms were more significant than any others that the Ameren-IL companies experienced in recent history.

The 2006 storms interrupted more customers, caused more damage, and took longer to restore than recent, documented storms. Ameren personnel repeatedly said that the storms were the

[407] Interview #38, November 2, 2007; Interview #171 April 4, 2008.
[408] Response to Data Request #363.
[409] Interview #38, November 2, 2007; Interview #171 April 4, 2008; Data Request #'s 625, 738, & 739.

worst in their experience. Thus, the storms presented new challenges to the utilities that came without the benefit of actual experiences. In November 2004, Ameren-CILCO experienced a snowstorm that caused more interruptions than the number experienced in July 2006. However, the restoration time was much shorter in the 2004 event.

4. OAS 2006 storm mode performance was stable but inaccurate both in real time and in retrospective performance. (Recommendations IV-14, IV-15, IV-16, and IV-20 in Chapter IV of this report)

The 2006 storms demonstrated that high call volume periods cause problems for OAS input communication systems and real-time lags for OAS. In addition, the storm process relies on inexperienced OAS users, who lack direct system access and timely real-time customer status and facility connectivity information. As a result, 2006 OAS historical storm information, which is used in system storm assessment, restoration planning, and for external reporting, was inaccurate. The number of customers affected reported by OAS in real-time may have been under-reported by ~153,000 customers on December 1. In addition, the number of total customer interruptions reported by OAS retrospectively in both 2006 storms was over-reported by a factor of two. This duplication [referred to as "reordering" in this chapter text] of interruptions ultimately delays the assessment and communication of accurate estimated restoration times.

The stability of OAS was demonstrated by the repeatability and consistency of retrospective summaries provided within the audit. The July and November storm summaries provided by Ameren were within reasonable accuracy of Liberty's summary analyses of raw retrospective OAS data extracts. The referential integrity of OAS's unique order numbering schema and its event time stamping provided additional evidence throughout the investigation of OAS data stability. Nevertheless the complexity of storm mode operations which includes multiple and nested facility failure conditions, and the additional complexities of storm mode OAS operation due to aforementioned high volume input, personnel inexperience, and OAS system access limitations, resulted in the lag (understated totals) in real-time mode and duplication (overstated totals) of OAS customer interruptions retrospectively.

Ameren's service-interruption database system contained complete and consistent data. Liberty recognizes that the stability of the OAS data permitted Liberty to identify its inaccuracy. The Outage Analysis System is an operational system, and therefore interpretation of the data is required for non-operational uses such as providing required notifications. Liberty's analysis of Outage Analysis System data showed that the system produced consistent and useful results despite its inaccuracy due to several contributing factors.

5. Customer interruptions and damages sustained by Ameren-IL's electric delivery system were consistent with the track and severity of both the July 2006 storms and the November 2006 storm.

The location and timing of severe weather conditions during the storms matches closely with Ameren-IL customer interruptions and electrical facility damages. The storm effects aggregated by Ameren-IL company and by Ameren-IL service division were consistent with the storm track and severity. In the November storm, the location of damaged facilities was consistent with the track of significant icing.

6. It is not clear that Ameren-IL used weather-services information effectively. (Recommendation II-1, IV-1, and IV-2)

The November 30 storm came with ample warning and NWS forecasts progressively escalated their prediction of the storm's severity. Ameren personnel used the advanced information to notify the public of the impending threat to service continuity and to reinforce public confidence in Ameren-IL's preparedness for the severe weather. Internally, Ameren-IL placed its personnel on alert for the deployment of the Electric Emergency Restoration Plan. Emergency Operations Center managers were in a state of readiness for the developing storm.

However, the onset of the July 19 storm came with little warning and early storm reports contained conflicting predictions of the coming severity. Nevertheless, expectations for and services provided by Ameren's subscription weather service were not well understood. Ameren employees could disable weather service alerts and early notifications provided through individual preference settings of personal pagers or other electronic personal assistant devices. The weather service provider kept no records of the content of the weather services it provided to Ameren-IL, the transmittal of notifications to Ameren-IL, and the timeliness of forward intelligence it provided to Ameren-IL. Ameren-IL also kept no records. Ameren did not use models or subscribe to services that related forecasted severe weather to Ameren-IL specific interruption and damage estimates.

Ameren's use of weather service information on the July 19 storm was inconsistent. During interviews, Ameren personnel acknowledged the inaccuracy of weather forecasts as they pertain to the July 19, 2006 storm. However, on July 19, Ameren personnel were content to accept a weather prediction, in the middle of an active storm within the service territory, which purportedly suggested that the storm would end, despite available and generally more accurate and precise NWS severe weather statements that suggested otherwise.

7. Ameren lacks a programmatic approach to weather intelligence and system weather hardening. (Recommendation II-3)

Liberty finds that Ameren has an opportunity for improvement in several weather intelligence areas. Ameren uses no advance weather modeling and pre-storm impact assessment. Ameren provides no analysis of weather modeling effectiveness to support claims of par value with past weather services. Ameren demonstrated little leveraging of ground-truth observations in the July 2006 pre-storm monitoring of storm development.

Ameren assigns a majority of storm mode outages to weather without adequate correlation of weather parameters, e.g., metered or ground-truth observation. Ameren's weather cause assignment is formulaic and is not supported by field reported cause information. OAS "enhancements" (to better map outages on Ameren's website) will likely exacerbate this practice in order to compensate for lagging field restoration assessments during storm mode operation.

Ameren conducts no post-storm weather-severity root cause analysis of damaged facilities. Photographic evidence is not archived neither are metered weather parameters correlated to establish weather severity nor design basis withstand capability of facility designs and/or material condition.

Ameren-IL conducts no weather hardening programs because of wind speed and ice loading conditions due to weather borne damages. Ameren-IL conducts no studies on the effectiveness of design basis to withstand weather impacts and weather hardening efforts.

8. Ameren-IL did not adequately capture photographic evidence of the storms' damage and did not adequately archive the photographic media that it did capture. (Recommendation II-2)

There was no effort to capture photographic evidence of facility damages for forensic analysis and evaluation of the effectiveness of equipment condition, design, construction, and maintenance effectiveness. Major events and storms provide a unique opportunity to improve overall future reliability by the archival of the types of facility damages and failures that could relate to materials or practices. The primary objective of Ameren's photographic team working in Illinois after the storm was to capture personnel engaged in restoration activities. While employee morale and public relations are important, the reliability of the system is of long-term strategic importance.

Ameren-IL needs to establish a formal indexing method to archive photographic media in general, and specifically for major storm photographic archival. Ameren took photographs of the storm restoration. However, Ameren had not organized the photographic materials in a useful way that would enable retrieval for specific content.

9. Ameren provided inaccurate information about the effects of the storms to the media and the ICC. (Recommendations IV-16, IV-17, and IV-18, all in Chapter IV, Storm Restoration Performance)

During the November/December 2006 storm, Ameren-IL provided the total number of Ameren-IL customers interrupted to the media and the ICC in 89 separate press releases and ICC notifications. The Outage Analysis System (OAS) was the source of these "live" reports. Based on a "point in time" reference, these reports were reasonably accurate. However, the OAS did not accurately capture the initial peak effect of the storm primarily due to customers not being able to report service interruptions. The accuracy of subsequent reports was also inaccurate due to continued call blocking and OAS reordering. The net effect of these issues was to under estimate significantly the initial and ongoing storm status of the remaining customers without service in externally provided reports. This same phenomenon occurred during the July storms but Ameren-IL's reporting inaccuracy was not as great.

10. Ameren's annual ICC reporting programs are inaccurate due to the contribution of OAS inaccuracy during storm mode operation. (Recommendation II-4)

Major storm days contributed 31 percent of the customer interruptions and 81 percent of the customer interruption minutes to Ameren-IL's retrospective 2006 annual reliability indices as reported in the Illinois Annual Reliability Reports. In addition, Ameren-IL attributed weather-related causes for the entire year of 2006 to 93 percent, 93 percent, and 70 percent of the total interruptions and interruption minutes for Ameren-IP, Ameren-CIPS, and Ameren-CILCO, respectively. Thus, Ameren-IL uses OAS storm mode data for much of its reliability reporting and these data are inaccurate due to the OAS re-ordering process.

The July and November 2006 storms heavily populated Ameren-IL's mandatory reliability programs. For example, the major storm contribution to approximately 90 percent of the Ameren-IL 2006 Customer Target Program facilities was more than 50 percent. Ameren-IL may select the wrong facilities for mitigation efforts because the extent of the inaccuracy is unknown. Ameren-IL personnel acknowledge that duplication does occur in storm mode and that in general the process is only accurate in non-storm mode.

Some frequency-based worst performing circuits (WPC) may actually have worse performance than those identified but were displaced from the WPC program due to the duplication of outages from storm mode contributions. Chronic worst annual performance particularly in non-storm operations may be displaced by inaccurate duplication from OAS storm mode. Duration-based programs may also be inaccurate but to a lesser degree by omission of storm based minutes due to re-ordering gaps.

H. Recommendations

The following recommendations are applicable to all three Ameren-IL companies.

II-1 Improve service level agreements with weather service providers. Engage weather service providers more aggressively.

a. Ameren-IL should establish written service level agreements with weather services providers with explicit criteria for notification and qualifying severity conditions prior to and during severe weather including significant changes in forecasted and actual weather phenomenon.

Ameren-IL should establish written service level agreements with weather services providers with explicit criteria for notification timeliness and qualifying severity conditions prior to and during severe weather including significant changes in forecasted and actual weather phenomenon. The criterion should address as a minimum the content, notification thresholds of qualifying severity conditions, and timeliness of significant weather conditions notifications. The service level agreement should also address the content, timing, and confidence levels communicated in forecast services. The service level agreement should define the transmittal protocols and distribution call-out policies for after hour notifications. Ameren-IL should complete this review and establish written service level agreements within six months of the date of this report.

b. Ameren-IL should engage more interactively with its weather service provider to affect an improvement in Ameren-IL's preparedness for severe weather.

Beginning as soon as possible, and regardless of service level agreements established, Ameren-IL should engage more interactively with its weather service provider to affect an improvement in Ameren-IL's preparedness for severe weather. Ameren-IL should engage in direct contact with weather service providers in the event of severe weather prediction or detection to improve its understanding of weather prediction assumptions, modeling weaknesses, and confidence levels of weather service intelligence. Ameren-IL may need to develop scripts, teleconference formats, or other appropriate methods to extract better forward business intelligence from weather service providers during these interactions.

II-2 Develop an integrated forensics process to examine equipment and infrastructure failures.

Ameren-IL should gather and index forensic data of future storm damages and major events involving equipment failures or damages. The evidence to be included in such an analysis should include photographic evidence, meteorological data, design standards, field condition reports, and other such pertinent data. The forensic team should include applicable technical expert personnel. Ameren-IL should review the integration of the forensic evidence with weather parameters and equipment damages in an effort to better estimate storm damage in future events. Ameren-IL should begin to implement this recommendation as soon as possible but not more than three months from the date of this report.

II-3 Develop a comprehensive weather intelligence process.

a. Continue to improve and refine baseline general knowledge of service territory weather, historical severity, trending, historical weather "hot-spots" or geographic sub-pockets, severe weather risk periods, etc. though retrospective analysis and quantification.

b. Establish usage of pre-storm predictive modeling and damage assessment models. (Refer to Recommendation IV-2.)

c. Improve pre-storm preparation and communications based upon interactive weather service interrogation and sensitivity analysis. (Refer to Recommendation II-1 above.)

d. Explore opportunities to obtain more detailed real-time weather data. Improve in-storm weather intelligence from ground truth observation, expedite data transfer, and incorporate developing weather-tool capability enhancements.

e. Improve post-outage cause assignment and conduct damaged facility weather severity correlation from weather monitoring/metering facilities.

f. Establish post-outage root cause archival and photographic evidence integration/archival at least on a sampling basis. (Refer to Recommendation II-2 above.)

g. Establish programmatic weather hardening initiatives based on system trending of storm damages, and weather severity, and weather hardening initiatives.

h. Conduct analysis and mapping of nearest weather station metering for Ameren facilities. Conduct cost effectiveness studies and analysis of pilot programs that include additional weather monitoring devices, distribution and sub-transmission facility mounted weather camera surveillance as a component of weather monitoring.

Ameren-IL should implement this recommendation within one year of the date of this report and be consistent with the referenced recommendations. Liberty recognizes that item "g." above will require more time for actual field implementation. Ameren-IL should propose a schedule for this item.

II-4 Conduct an assessment of the effect of OAS storm mode inaccuracy on annual ICC reporting programs.

Ameren-IL should conduct an investigation into the effect of OAS storm mode contributions to quantify the inaccuracy of storm mode operations on annual ICC reporting programs. Ameren-IL should address in this study the effects on annual reliability indices, worst performing circuits, and the Customer Target Programs that rely on retrospective OAS data for summary aggregation or facility identification. Ameren-IL should include this assessment with its next annual report.

III. Emergency Plans

A. Objectives

This chapter provides a description and evaluation of the emergency plans that the Ameren-IL utilities had in effect prior to the 2006 storms. Liberty's objective for the work included in this chapter was to assess the companies' emergency plans, including the companies' training and drill procedures for emergency response. The chapter addresses the following items and questions included in the ICC's Request for Proposals for this investigation:

- **4.3.2.5.22** Ameren utility emergency plans.

Liberty evaluated the following characteristics of Ameren-IL's emergency plans:

1. The adaptability of the plans to address different sizes of events, including a method to categorize events by severity level and to detail activities required for each level
2. The accessibility of the plans to all response personnel
3. The extent to which the plans are user-friendly and provide necessary information in a clear, concise format
4. The extent to which response personnel have a good working knowledge of the plans
5. The comprehensiveness of the plans, covering all phases of emergency response – pre-event, restoration, and post-event
6. The extent to which the plans contain recognized utility best practices
7. The frequency, comprehensiveness, and effectiveness of drills and training exercises on the plans and emergency response activities
8. The extent to which the plans capture and use feedback from drills, training exercises, and post-event critiques of actual storm responses to affect improvements in the plans
9. The proven effectiveness of procedures, methods, organizational structures, and processes as set forth in the plans
10. The frequency, comprehensiveness, and effectiveness of updates to the plans.

B. Background

The familiar saying, "Plan your work and work your plan," is never more applicable than with the response of a utility to a major outage event. While all utilities are experienced, and to varying degrees efficient, in responding to common outages, a major outage event brings more and greater challenges in both degree and complexity. For any utility to respond appropriately, it must begin with comprehensive, user-friendly emergency plans. Comprehensive plans address all aspects of the response process beginning with pre-event activities, covering all aspects of the restoration, and concluding with the post-event period. They also address major outage events other than those related to storms, such as floods, catastrophic facility or equipment failures, overload emergencies, and terrorist activities.

In addition to being user-friendly, the plans must be readily accessible to all response employees in both print and electronic format. To be useful, utilities must use their emergency plans. Response employees must have a good general knowledge of all aspects of the plans and a

verified working knowledge of those sections of the plans dealing specifically with their functional area. To ensure that the employees have this degree of knowledge and are comfortable using the plans, utilities must conduct regularly scheduled drills and training activities. All key responders should be drilled or receive supplemental training at least once per year.

Failing to keep the plans updated can have a significant negative effect on their usefulness. Not only does the out-of-date or lacking information cause confusion and lost efficiency, but also the signal sent to the responders is that company leaders do not put a high priority on the plans. A good test of a utility's commitment to having an outstanding response organization is the quality of its emergency plans, and the resources expended in drilling and training their responders and in updating their plans.

C. Findings and Analysis

This section presents Liberty's findings and analysis of:

- Emergency plans in effect at the Ameren-IL utilities at the time of the July 2006 storm
- Content of these plans analyzed for comprehensiveness, adaptability, clarity, and usefulness
- Accessibility of the plans to response employees
- Response employees' familiarity with and knowledge of the plans' content
- Drills and training exercises on plan content for response employees
- Recognized utility best practices incorporated in the plans
- Proven effectiveness of the procedures, methods, organizational structures, and processes included in the plans
- Ameren-IL's practices of gathering feedback from drills, training exercises, and post-event critiques of actual outages and using this feedback to improve the plans
- Frequency, comprehensiveness, and effectiveness of updates to the plans.

1. Emergency Plans

Liberty found that Ameren recognized the importance of emergency plans and committed considerable effort and resources to developing and maintaining them.[1] At the time of the July 2006 storms, there were two different emergency plans that provided guidance in the response at the Ameren corporate level. The primary document was Ameren's Electric Emergency Restoration Plan (EERP). All Ameren utilities used the EERP. Prior to the July 2006 storms, Ameren revised and re-issued the EERP in May 2006.[2] The other plan, "Communication Plans for Severe Storms," covered corporate communications exclusively. This plan had been in place since the "mid-1990s," and the last update was sometime "after the IP acquisition in late 2004."

[1] Responses to Data Requests #64, #421, #478, and #497, Interviews #11 and #84.
[2] Response to Data Request #64.

Ameren created it as a subset of a larger emergency communications plan and designed it specifically to address storms.[3]

The EERP and the corporate communications document constituted the entirety of the emergency plans at the corporate level in effect for the three Ameren-IL utilities during both the July and November storms that are the subject of this report. The corporate EERP provides for each operating division to develop its own division EERP, and each of the seven Ameren-IL operating divisions had a division plan at the time of the 2006 storms. In addition, each Distribution Dispatch Operations (DDO) center had a plan setting forth the process for responding to major electric outages. This report includes a review of the division and DDO plans.

The Ameren-IL Call Centers did not have formal storm emergency plan documents for the 2006 storms. As part of a corporate-wide process, each of the Call Centers developed Business Continuity Plans[4] addressing disaster scenarios such as tornados, fires, earthquakes, work stoppages, and pandemic events such as the Asian Flu. However, these plans do not address emergency storm response.

2. Content of the Plans

a. Corporate Electric Emergency Restoration Plan (EERP)

The EERP consists of a Table of Contents, 14 sections, and an Appendix. The section titles are:

- Overview
- Emergency Operations Center (EOC)
- Individual Job Duties/Responsibilities
- Damage Assessment
- Restoration Update Conference Calls
- Extensive Damage Recovery
- Division Electric Emergency Restoration Plans
- Division Supply List
- Logistics
- Sending/Receiving Crews within the Ameren System
- Handling Outside Crews
- Mutual Assistance to Other Utilities
- Technology
- Contingency Planning for Loss of Critical Systems and Facilities.

Liberty's evaluation of each section of the EERP follows.

[3] Response to Data Request #421.
[4] Response to Data Request #207.

- Section 1 – Overview

1. Description: This two-paragraph section begins with the following statement, "The purpose of this document is to provide a consistent detailed execution plan for use by Ameren Corporation during major electric service interruptions or major electric emergencies." It stresses, "Safety and Customer Service are the key drivers in this plan."[5]

2. Deficiencies: The section does not provide a key element that should be at the beginning of any plan – a mission statement. While the section mentions several key issues such as customer service, efficiency, safety, and timely and accurate information, the wording is more in the form of recommendations than in directives. It is very important that the emergency plan overview set a strong tone for the rest of the document with a clear, concise, and strongly worded mission statement.

The EERP overview section does not contain any reference to Ameren's target or goal as to the length of restoration. For example, a target statement could say, "It is Ameren's goal to limit the most extreme major outages to less than seven (7) days. Although severe conditions might extend the time in some cases, this should be the exception." Target statements such as this, while not a part of the mission statement, give guidance to the response organization in putting together the necessary workforce to address the emergency. Target statements also serve to shape the expectations and understanding of Ameren's constituents including customers, regulators, and the media.

A comprehensive overview section should also provide an explanation of the logic behind the organization of the plan and a brief overview of the content of each section. Ameren's EERP section does not do this.

The overview section in the EERP makes no specific reference to the different types of outage events covered by the plan. Although the opening sentence refers to "major electric service interruptions or major electric emergencies," there are no details in the overview section to set forth the types of emergencies addressed in the EERP, and subsequent wording seems to speak exclusively of "storms." A comprehensive overview should specifically set forth the types of events covered by the plan, and indicate where users can find information unique to certain types of events. The overview section is also where one should expect to find brief, general information regarding the different levels, or classifications of emergency by size. The Ameren EERP overview does not cover this.

Finally, a good overview section will clearly communicate the company leadership's complete and enthusiastic support of the plan and those leading the restoration effort. It will also communicate their expectation that all company employees will actively support the plan and adhere to the directives provided by the plan and the restoration leaders. Other than the statement that, "all procedures contained in this document must be followed," the Ameren EERP overview provides no indication of the support and expectations of company leadership.

[5] Response to Data Request #64, Section 1, page 4.

3. Corrective Action: Ameren should revise their EERP to include a mission statement, a restoration goal, the logic behind the organization of the plan itself, the types and severity levels of emergencies covered by the plan, and a clear statement of company leadership support and expectations regarding the plan.

- Section 2 – Emergency Operations Center (EOC)

1. Description: This section has an opening paragraph and the following seven (7) subsections:
   2.1 Activation
   2.2 Storm Levels
   2.3 EOC/Division Responsibilities
   2.4 EOC Operations
   2.5 Resource Procurement/Release
   2.6 Restoration Update Conference Call
   2.7 Storm Critique

The opening paragraph in this section describes the location of the EOC as being in the Ameren General Office Building (GOB) in St. Louis. It also sets forth the mission of the EOC, "to monitor, facilitate and coordinate all major emergency restoration activities in the Ameren service territory," and states that Ameren will activate the EOC during "all major events affecting Ameren customers." It defines a "major event" as "any situation that results in an outage to a large number of customers or a situation that results in the potential loss of public confidence in Ameren's ability to provide service to its customers."[6]

2. Deficiencies: Although entitled "Emergency Operations Center (EOC)," this section actually covers a number of topics that apply more generally to the entire response organization. A separate section in the EERP should be devoted to some of the topics—for example, Activation, Storm Levels, EOC/Division Responsibilities—and it should group some under other sections. For example, it could place Resource Procurement/Release under the newly created section, EOC/Division Responsibilities. Having key plan sections clearly identified and set out where personnel can quickly reference them is essential to making a plan useful to the emergency responders.

This wording establishes the EOC role (or mission) as one of monitoring, facilitating, and coordinating, as opposed to having direct authority over, and responsibility for, the overall emergency restoration activities. The role of the EOC is crucial to a successful emergency restoration effort. The Ameren approach does not give clear authority to the EOC to direct the restoration activities. A best practice among utilities is to establish clearly the authority of the EOC, and specifically the EOC Director, to direct the restoration activities. Limiting the role or mission of the EOC to monitoring, facilitating, and coordinating does not provide the strong leadership so essential in major outage restoration efforts.

The second part of the definition of a major event, *i.e.*, "a situation that results in the potential loss of public confidence in Ameren's ability to provide service to its customers," is problematic. The plan states that the EOC will operate during major events. Taken literally, this could call for

[6] Response to Data Request #64, EERP, published 5/01/2006, Section 2, page 4.

the activation/operation of the EOC during periods of time in which the issue is not an emergency or potential emergency, but rather an issue concerned with public confidence in Ameren. While this is certainly a serious issue, and Ameren is correct for identifying it as one that it must address aggressively, the plan should not call for it to require the activation/operation of the EOC. As an example, customer perception of Ameren's response to a major outage event such as the two 2006 events that are the subject of this report could certainly result in the "potential loss of public confidence" in Ameren's service response. Ameren should address this issue aggressively of course, but activating the EOC to address customer perception would not be a part of the strategy.

3. Corrective Action: Ameren should restructure Section 2 – Emergency Operations Center (EOC) – so that the subject matter more accurately fits the section title and so that it either covers other subjects in a new separate section or combines them with other existing sections. Ameren should revise the EERP wording in order to establish clearly the authority of the EOC to direct the restoration activities. Ameren should revise the second part of the EERP definition of a "major event" so as not to require activation of the EOC when not necessary.

The comments below address the findings and analysis of the different subsections of Section 2, notwithstanding the notion that Ameren should place some of these subsections elsewhere in the EERP.

- Subsection 2.1 – Activation

1. Description: The Activation subsection states that, "The Activation of the EOC will be initiated by the EOC Director, or their designee." It also states, "Any Ameren Officer, Vice President, Director, Division Manager or Superintendent may request the activation of the EOC. This should be done by contacting the EOC Director."[7]

The plan states that activation will occur "when electric service outages reach certain limits,"[8] and then goes on to quantify the activation trigger as a situation involving several divisions with help being brought in from outside, or one division with damage to the extent that help is needed from several different locations. It defines a major event as typically being one requiring resources from more than one division and an adjacent division, and states "it is expected that the EOC will be operating" in those cases where resources "from a number of Divisions" respond to an outage situation in Ameren-IL's service area.[9]

2. Deficiencies: This wording clearly sets forth authority and responsibility for activation. However, the subsection provides very little guidance as to the type circumstances that would normally call for EOC activation. The plan should clearly set forth the criteria that will trigger activation. While the wording gives general guidelines, it lacks the specificity and clarity needed to make it most effective as an emergency response plan.

Most notable is the absence of any clear wording on the activation notification process. The activation of the EOC is a significant step in initiating an emergency response. Not only does

[7] Response to Data Request #64, Subsection 2.1, page 4.
[8] Response to Data Request #64, Subsection 2.1, page 4.
[9] Response to Data Request #64, Subsection 2.1, page 4.

Ameren need to notify the EOC employees of the decision to activate, but also should alert the entire Ameren response organization to this development. The EERP Activation Subsection does not address notification. The next chapter of this report addresses Ameren's actual performance of the activation process, but the EERP provides no guidance or direction for this important aspect of the response. For example, a best practice among many utilities is a paging process to alert simultaneously all designated responders.

3. Corrective Action: Ameren should revise the EERP to include specific criteria requiring activation of the EOC and to establish an activation notification process such as a company-wide paging system.

- Subsection 2.2 – Storm Levels

1. Description: This subsection defines three different storm levels – Level 1, Level 2, and Level 3. Ameren activates the EOC for Level 2 and 3 storms, both of which the plan calls "major storms." Resources of the affected division and perhaps partial resources from an adjacent division typically can handle Level 1 storms. Ameren employees and contract employees "currently on the Ameren property" can restore customers in Level 2 storms. Level 3 storms require outside assistance—contractors and Mutual Assistance[10] utility crews if needed. A Level 3 storm might also involve the Extensive Damage Repair process as detailed in Section 6 of the EERP. This subsection also establishes Ameren's ambitious goal of restoring all customers in a major storm event in "less than 72 hours."[11]

2. Deficiencies: Providing clear and meaningful storm level definitions is a best practice used in emergency response plans. To be most effective, a plan should classify storm levels in a way that will communicate to the response organization (as well as to key constituents such as customers, regulators, and media) the severity of the storm in terms of numbers of customers affected and anticipated total restoration time. The Ameren plan's definition of storm levels does not furnish a clear message in these two important areas.

The established goal of restoring all customers "in less than 72 hours" following a major storm is appropriate for certain levels of major events. Ameren's history of restoration includes a number of outage events restored within that period. The experience in the 2006 storms, however, teaches that a 72-hour target is not realistic in those cases involving major, widespread damage and outages. The plan would be more meaningful and useful to the responders if Ameren redefined the storm levels to include numbers of customers affected and anticipated restoration times. In this way, some levels of major storms could have a 72-hour target, while larger events would have a target reflective of the amount and scope of damage.

3. Corrective Action: Ameren should reclassify the storm levels as defined in this subsection to communicate the severity of the event and the anticipated restoration time. In this way, Ameren could maintain its current 72-hour target for certain levels of storms while providing more realistic targets for those events that involve extensive, widespread damage.

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[10] "Mutual Assistance" is a term used to describe the agreement between electric utilities to assist each other during major outage events on a "not for profit" basis.
[11] Response to Data Request #64, Subsection 2.2, page 5.

- Subsection 2.3 – EOC/Division Responsibilities

1. Description: This subsection identifies certain responsibilities of the EOC and others reserved for the operating divisions. For example, the EOC is responsible for "all restoration resource procurement and restoration resource assignment outside of an affected Division's normal staff." Furthermore, the EOC has the responsibility to "direct the placement of storm materials trailers and/or the mobile command center(s)." The plan also charges the EOC with "supplying all data used in Media information releases and information to the ICC, MOPSC and other government agencies." The plan states that that the "EOC will not direct crew locations or assign work to crews within the Division."

With regard to the divisions, the plan states, "Division offices and local management maintain control and responsibility for all restoration efforts within their boundaries." "Job assignment, materials, direct restoration efforts, and logistic support of restoration resources" are part of the responsibility of division personnel. The plan provides that the EOC can assist in these tasks if requested by the divisions. The Distribution Dispatch Offices maintain control of the sub-transmission and distribution systems.[12] This includes the Worker Protection Assurance (WPA) process and all switching activities on these systems.[13]

2. Deficiencies: The issues dealt with in this subsection are set forth clearly and concisely, but Ameren could improve the format to make it easier to access the information quickly. Subject matter such as this lends itself well to a chart-type presentation, listing the activity in one column, with separate columns to indicate whether it is EOC or division responsibility. In addition, there are other activities that it should address, *e.g.*, specific support functions such as safety, transportation, logistics, and security. As mentioned above, the plan states that "logistic support of restoration resources" is a division responsibility, but the plan needs more detail here, such as the responsibility to set up staging sites.

3. Corrective Action: Ameren should improve the format of this subsection to facilitate quick access, such as a chart-type presentation. Ameren should address additional support activities in this subsection such as safety, transportation, logistics, and security and should furnish additional information setting out areas of responsibility for logistics' functions.

- Subsection 2.4 – EOC Operations

1. Description: This subsection describes the three stages of EOC operations—Initiation, Continuous Operations, and Deactivation. The plan refers to a checklist kept at the EOC, and includes a condensed list taken from that checklist, with 9 activities listed under the Initiation Stage, 12 activities listed under the Continuous Operations Stage, and 4 activities listed under the Deactivation Stage.

2. Deficiencies: In their condensed format, the lists in the EERP give general information about the needed steps, but responders need more information in order to respond adequately. For example, the first step listed under the Initiation Stage is "Notification of appropriate parties that

[12] Sub-transmission is 69,000 and 34,000 volts, distribution is 4,000 to 15,000 volts.
[13] Response to Data Request #64, Subsection 2.3, page 5.

an event has occurred."[14] The plan does not state who the "appropriate parties" are and who specifically should contact whom. A comprehensive plan would include the complete checklist with enough detail to aid responders in actually performing the necessary activities.

3. Corrective Action: Ameren should revise Subsection 2.4 to provide a complete checklist with appropriate detail.

- Subsection 2.5 – Resource Procurement/Release

1. Description: The first paragraph of this two-paragraph subsection describes the role of the EOC (and in some cases specifically "the EOC Director or designee") in the procurement of resources from Ameren Operating Companies, contractors, Mutual Assistance utilities, and other Ameren departments. According to the plan, the EOC and/or the EOC Director/designee will work in cooperation with the Ameren Operations Managers, Asset Management group, and other department representatives in accomplishing this.

The second paragraph details the division of responsibility between the EOC and the Ameren divisions in the allocation, work assignment, reassignment, and release of resources from outside the division. Specifically, the EOC has the responsibility for the allocation, reassignment to other divisions, and release of these resources, while the division has the responsibility for work assignments once the outside resources are committed to that division.[15]

2. Deficiencies: The description of the roles and responsibilities of the EOC and divisions contained in this subsection is a very important part of the emergency plan. The plan should cover this subject under a separate section devoted just to that issue. Furthermore, the formatting of the information in chart form would facilitate quicker and more user-friendly access.

The information in this subsection, while touching on a number of key issues, is not comprehensive enough to provide the responders with sufficient guidelines. For example, the plan states that the EOC Director/designee "will work with the Operations Managers to procure resources from the Ameren Operating Companies to assist in the restoration effort." A comprehensive plan would spell out the process (perhaps in a separate section in the appendix), detailing the specific steps taken by Operations Managers and the EOC Director/designee. As another example, the plan states, "If more resources are still required, Mutual Assistance partners will be contacted." The plan gives no information as to who specifically is responsible for making those contacts or any details of the contact process. Although the plan may contain some of this information in other parts, it would be better located in this part of the plan dealing specifically with procurement of resources.

3. Corrective Action: Ameren should create a separate section to deal with resource procurement/release. Ameren should provide a chart to communicate some of the key responsibility areas. Ameren should revise the EERP to spell out clearly the process for the EOC Director/designee to work with Operations Managers in procurement of resources and to provide specifics for the responsibility of contacting Mutual Assistance utilities.

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[14] Response to Data Request #64, Subsection 2.4, page 6.
[15] Response to Data Request #64, Subsection 2.5, page 7.

- Subsection 2.6 – Restoration Update Conference Call

1. Description: This subsection briefly describes the Restoration Update Conference Calls and establishes the responsibility with the EOC to schedule the initial call and to coordinate all subsequent calls. The text then refers the reader to Section 5 of the plan for more specific details about these calls.

- Subsection 2.7 – Storm Critique

1. Description: This subsection deals with a very important step in any major outage restoration – the post-event review or "storm critique." The subsection includes the following points:

- "A storm critique should be performed for every major restoration effort."
- Those items that "helped improve safety or shorten the restoration" should be continued and "shared with and implemented in other areas."
- Those items "that did not provide the expected benefit" should be modified or eliminated.
- "As soon as practical after the completion of an event, each Division/Department should perform a critique." It lists examples of issues, including "crew movements, crew support, field checking, staging sites or other logistics… (and) interaction with other departments, the EOC, or other Divisions."
- The responsibility for scheduling the organization-wide critique lies with the EOC. Participants in this critique should include "one or two individuals from each Division, Dispatch, Asset Management, Stores, and other support groups involved in the Operation."
- The EOC is also responsible for the management of the organization-wide critique meeting "and ensuring that all the ideas from the meeting are captured, documented and distributed to affected departments."
- Ameren enters information from this critique into an information web site, and EOC has the responsibility to see that personnel complete this task.
- "When storm activity is very high and frequent, one critique may serve to address issues on several restoration efforts."[16]

2. Deficiencies: Although the wording of this subsection stresses the importance of these critiques as well as the goal of ensuring that Ameren captures and implements the positive items throughout the organization and the negative items are either improved or eliminated, the plan does not provide any detail of the necessary actions to get that done. The wording says that these items should be "discussed" and that the EOC should make sure that the "ideas…are captured, documented, and distributed." (See sixth bullet above.) Missing are the process to assign specific responsibility and a tracking process to verify that those responsible take the necessary steps in a timely manner.

3. Corrective Action: Ameren should revise the EERP to establish the process that will ensure that it performs post-event critiques and captures and tracks action items to completion.

[16] Response to Data Request #64, Subsection 2.7, page 7.

- Section 3 – Individual Job Duties/Responsibilities

1. Description: The introduction states the purpose of this section as listing, defining, and explaining the importance of "the critical roles and elements needed for a successful major electric outage restoration effort." It stresses that these roles and elements "must be consistently executed throughout the Ameren Corporation," and "variations between Divisions must be minimized." It contains a disclaimer that the titles used to describe storm roles may not be the same as the employee's normal job title and are not related to any Human Resources job titles, but rather are intended to describe the job duties of the storm role. It also states that Ameren will not fill all the listed storm job titles in every major event, but that the intention is to have someone designated in advance for each position. It refers to the organization charts contained in the Appendix of the Plan.[17]

Section 3 includes the following subsections with storm positions listed under each as shown:

3.1 EOC Personnel
- EOC Director
- Operations Manager
- EOC Field Engineering Coordinator
- EOC Logistics Coordinator
- EOC Resource Coordinator
- EOC Field Support Coordinator
- EOC PSA Dispatcher
- EOC Cut & Clear Dispatcher[18]

3.2 Distribution Dispatch Offices
- Supervisor/Superintendent Distribution Control
- Distribution Dispatcher
- Electric First Responders[19]

3.3 Division Storm Center
- Division Manager
- Division Coordinator
- Division Logistics Coordinator
- Office Construction Supervisor[20]

3.4 Construction Field Jobs
- Field Superintendent
- Checkpoint Director
- Ameren Liaisons
- Staging Site Director
- Field Construction Supervisor
- Crew Squad Leader
- Crew Guide
- Construction Crew[21]

3.5 Service Crew Work

[17] Response to Data Request #64, Section 3, page 8.
[18] Response to Data Request #64, Subsection 3.1, pages 9 – 11.
[19] Response to Data Request #64, Subsection 3.2, pages 11 and 12.
[20] Response to Data Request #64, Subsection 3.3, pages 12 and 13.
[21] Response to Data Request #64, Subsection 3.4, pages 14 and 15.

Service Crew Supervisor
Service Crews[22]
3.6 Damage Assessment Roles
Field Checker Leader
Field Checker Dispatcher
Field Checker
Public Safety Advisor (PSA)
Cut and Clear Crews[23]
3.7 Division Support
Asset Management
Safety Coordinator
Vegetation Management Supervisor
Construction Management
Telecommunications Contact
Division Gas Operations Contact
Division Stores/Materials Contact
Environmental Contact
Corporate Communications Contact
Division Fleet Services Contact[24]

2. Deficiencies: The plan lists the job duties under each of these positions. The descriptions are of a general nature, which is appropriate to provide a quick overview of the responsibilities of each position. The plan should include details of each duty/activity listed in following sections of the plan. It is essential that this section is comprehensive in listing all of the positions that should be included during a major restoration effort.

3. Corrective Action: Ameren should revise the EERP to include all positions that comprise the response organization in a major restoration effort and should provide details of job duties in sections of the EERP dealing with those response functions

- Section 4 – Damage Assessment

This section lists and discusses four stages of the damage assessment process. They are:

- Subsection 4.1 – Information Review

1. Description: The plan states that available data from four sources—Outage Analysis System (OAS), Supervisory Control And Data Acquisition (SCADA), Ameren DDO (Distribution Dispatch Organization) Home Page, and weather data and forecasts—"should be reviewed prior to, during, and immediately after the severe weather activity occurs to determine the extent of the damage and if additional assistance is needed." The plan also places responsibility on "on duty Operating and Division staffs" for monitoring these data and alerting the EOC Director "when warranted."[25]

[22] Response to Data Request #64, Subsection 3.5, page 16.
[23] Response to Data Request #64, Subsection 3.6, pages 16 and 17.
[24] Response to Data Request #64, Subsection 3.7, pages 18 and 19.
[25] Response to Data Request #64, Subsection 4.1, pages 19 and 20.

This is the appropriate initial stage of an effective damage assessment process. The four data sources mentioned and the specific types of data listed provide the type of input needed in the early stages to inform effectively the response organization of the scope and severity of the event. Obviously, it is critical to the effectiveness of the assessment process that the data sources be accurate and up-to-date.

- Subsection 4.2 – Initial Field Damage Assessment (High Level)

1. Description: The plan describes the Initial Field Damage Assessment stage as one that "determines the magnitude of the storm damage for evaluating crew and material needs." Personnel perform it "generally within the first few hours immediately after the storm hits, with minimal detail." The plan calls for the use of "the first available field checkers, engineers, or supervisors," and specifically states that on duty employees who are first responders should not be used for this assessment. In order to expedite the completion of this stage, there should be no effort to trouble shoot or make repairs by those responsible for the assessment. The information specifically sought is:

- Number of poles down/broken
- Number of spans of wire down
- Number of locations with trees on wires

The plan references a form—Initial Damage Assessment Checklist—that personnel can access electronically through the shared storm web site.

The plan gives the Division Coordinators the responsibility of determining the location and timing of these assessments, as well as the responsibility to direct these activities. The plan lists two types of patrols – aerial patrol and circuit (riding) patrol. The Divisions are to initiate the patrols and in the case of aerial patrols are to coordinate with the EOC and other departments that may want to participate.[26]

- Subsection 4.3 – Detailed Damage Assessment

1. Description: This stage consists of the field assessment of individual Outage Analysis System orders, performed by Division Field Checkers and outside assistance as required (coordinated through the Emergency Operations Center). The Division Coordinators make the assignments. The goal is to prioritize and check the orders first that will have the greatest effect in restoring power. To the extent possible, the Coordinators are to prioritize the orders and dispatch the Field Checkers before assigning them to a crew. The plan calls for Ameren to give priority to "Critical Customers (hospitals, fire houses, police stations, schools, nursing homes)." Giving priority to such customers is essential for a coordinated, effective major outage restoration. This is a helpful element in Ameren's EERP.

The plan provides guidelines for the prioritization of orders, as well as for the handling of substation and transmission outage orders. Field Checker Dispatchers have geographic areas to avoid confusion and overlap in assigning orders. The Field Checker Dispatchers assign the orders directly to the Field Checkers.

[26] Response to Data Request #64, Subsection 4.2, pages 20 and 21.

Field Checkers will check all orders in an Outage Analysis System area. The plan establishes the following completion criteria, "Field Checking in an OAS area will be considered complete when:

- All outage orders have been checked
- All emergency orders have been checked
- All wire, pole, service, and tree problems have been checked
- There are no storm related orders on the X screen."[27]

This is a very concise, helpful way to define the process and set a completion target for an important functional area.

2. Deficiencies: This subsection provides good information, but missing is that portion of the process for the Field Checker to input the assessment into the system – *i.e.*, what the Field Checker is to do with assessment data, forms to be used, and responsibility to enter data into system for restoration to be initiated.

3. Corrective Action: Ameren should revise the EERP to include the process for the Field Checker to input the damage assessment into the system.

- Subsection 4.4 – Heavy Localized Damage Assessment

1. Description: This subsection deals with a special application where major damage has occurred in a concentrated, "localized," area. In such cases, as pointed out by the plan, the standard Detailed Damage Assessment may not be the best approach. After personnel make the Initial Field Damage Assessment, Ameren would implement the Heavy Localized Damage Assessment in this manner: "If entire isolated areas are severely damaged, the Division, working with Dispatch and the EOC, will determine that a substation should be turned over to an area for a substation feeder recovery approach."[28] Section 6 of the plan – Extensive Damage Recovery – provides specific details of this approach, often referred to as "sweeping" a circuit or area.

2. Deficiencies: This subsection should refer to Section 6. Utilities commonly use the "substation feeder recovery approach" in major outage events, and consider it a best practice. The Ameren plan calls for its use in very limited situations. Ameren should modify the plan to allow for more frequent, widespread use of this approach.

This section on Damage Assessment provides helpful information to plan users. Ameren could provide a quick reference to the different stages of damage assessment by the use of a chart such as the example below:

[27] Response to Data Request #64, Subsection 4.3, page 21.
[28] Response to Data Request #64, Subsection 4.4, page 22.

Assessment Stage	Timetable	Level of Detail Sought
Information Review	Prior to, during, and immediately after the severe weather activity occurs	Outage Analysis System (OAS), Supervisory Control And Data Acquisition (SCADA), Ameren DDO Home Page, and weather data and forecasts
Initial Field Damage Assessment (High Level)	Within the first few hours immediately after the storm hits	Minimal Detail – # of poles down/broken # of spans of wire down # locations – trees on wire
Detailed Damage Assessment	OAS orders prioritized and dispatched to Field Checkers prior to crew assignments if possible	Detailed Assessment of OAS Orders prioritized as follows Greatest # of customers out Wire problems (down, burning, etc.) Critical Customers (hospitals, fire houses, police stations, schools, nursing homes)
Heavy Localized Damage Assessment	Used in special applications of localized, heavy damage after Initial Field Damage Assessment is completed	"Substation feeder recovery" approach

3. Corrective Action: Ameren should revise the EERP to reference Section 6 in Subsection 4.4 and to expand the use of the Heavy Localized Damage Assessment process. Ameren should include a chart in the EERP to illustrate more effectively the applications of the different damage assessment stages.

- Section 5 – Restoration Update Conference Calls

The stated purpose of the Restoration Update Conference Calls is "to link the EOC, Dispatch, and the Division Operating Centers together to discuss the progress to date, upcoming challenges, and next steps for the following day." The plan goes on to say, "The intent of the calls is to allow all affected areas to hear and share the same information pertaining to the crisis at hand, to resolve critical issues, and allow non Operating Center support groups to monitor the call for areas of interest, or to offer assistance in some cases."[29] This section covers the following topics in four subsections:

- Subsection 5.1 Call Time and Participants

1. Description: The plan indicates that Ameren will hold these calls twice daily – in the morning and evening. The EOC Director will set the times, and the EOC will manage the call. It lists nine groups as those who "may participate" in the calls.[30]

[29] Response to Data Request #64, Section 5, page 22.
[30] Response to Data Request #64, Subsection 5.1, page 22.

2. Deficiencies: The plan would be more helpful if it provided times for the calls with a provision to vary from those times if the situation required. In addition, for the sake of better communication throughout the Ameren organization, the plan should encourage others to sit in on the calls, but not to participate.

3. Corrective Action: Ameren should revise the EERP to provide scheduled times for the Restoration Update Calls with a provision to change as required and to identify call participants while encouraging others to sit in on the calls.

- Subsection 5.2 Call Set Up

1. Description: This subsection requires that each Operating Center provide a point-of-contact instructed on the call dial-in procedure. It also refers to the Storm Information SharePoint site for call-in instructions.[31]

- Subsection 5.3 Call Content

1. Description: The plan breaks call content into four segments:

- Status report update of the overall effort by the Emergency Operations Center (EOC)
- Reports from Divisions with active ongoing restoration efforts
- Current weather forecast from weather vendor Surface Systems Inc. (presented by EOC)
- Scheduling of time of next call by EOC

The plan describes 12 topics that division reports should cover and provides for an open discussion by participants at the end of each division report. Each division report is to begin with safety, first a "safety update to include any personal injuries, or motor vehicle incidents that may have occurred," and second with "(a)n update of safety briefing and activities."

There is also a reminder for all participants to put their phones on "mute" when not speaking on the call.[32]

2. Deficiencies: This subsection provides good guidelines for an effective conference call process. The plan could improve efficiency by furnishing in advance as much as possible of the information covered by the Emergency Operations Center and divisions in the status update reports. In that way the person reporting can refer participants to the furnished data and just touch on the most significant points. In addition, it would be better if the plan relocated the instruction to place the phones on "mute" to the "Call Time and Participants" subsection. Ameren could add that instruction in the same paragraph with the aforementioned suggestion to allow others to call in but not participate.

3. Corrective Action: Ameren should revise the EERP to establish the procedure of furnishing restoration status information in advance of Restoration Update Conference Calls and to relocate the instructions for "muting" the telephone to Subsection 5.1.

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[31] Response to Data Request #64, Subsection 5.2, page 22.
[32] Response to Data Request #64, Subsection 5.3, page 23.

- Subsection 5.4 Call Documentation

1. Description: This one sentence subsection provides for the documentation by the EOC of the call. It states that notes of the call are to be distributed "to each Division and other identified groups via e-mail."[33] This is a very important provision. The documentation from these conference calls is invaluable in post-event critiques and in other applications that need a historical record of the restoration effort.

- Section 6 – Extensive Damage Recovery

1. Description: This section details the process for restoration in areas of heavy or extensive damage. Subsection 4.4 – Heavy Localized Damage Assessment – addresses the damage assessment process for this recovery approach. The "substation recovery approach," also known as "sweeping,"[34] described in this plan consists of five steps:

- "Assign a responsible person to the substation (Field Superintendent, or Supervisor)
- Provide for all isolation points to be open and held off
- Assign crews to specific areas
- Assign Field Checkers to specific areas
- Isolate damaged taps and focus on restoring the backbone portion of the circuit and then the taps to eventually restore all customers"

In order to use this approach, the Division, the Emergency Operations Center, and the Local Dispatch Office must all agree. The stated goal is first the restoration of "backbone portions" of substation feeders. The process will then continue until Ameren restores all customers in that area. The plan stresses the need for circuit maps, close coordination of all resources, and the communication of "the restoration progress to the appropriate DDO." It closes with this directive limiting its use, "This approach will only be used in extreme circumstances where an abnormal number of feeders are out of service due to extensive damage in concentrated areas."[35]

2. Deficiencies: The approach laid out in this section is a very effective way to restore service following a major event such as a windstorm or winter storm. As pointed out under Subsection 4.4 above, most utilities use it in major events and consider it a best practice. It is a helpful element of Ameren's plan, and Ameren could improve the plan by allowing more flexibility in the use of this approach.

3. Corrective Action: Ameren should revise the EERP to allow for more flexibility in the use of the Extensive Damage Recovery process.

- Section 7 – Division Electric Emergency Restoration Plans (EERP)

1. Description: This short section of the plan provides for a Division EERP patterned after the Ameren plan. As stated, "The intent of the Division EERP is to provide a consistent and detailed set of information to augment the storm restoration process." The plan assigns the Division

[33] Response to Data Request #64, Subsection 5.4, page 24.
[34] Interviews #17 (October 25, 2007) and #72 (October 30, 2007).
[35] Response to Data Request #64, Section 6, page 24.

Manager responsibility for the drafting and updating of the Division EERP. There is a reference to a template for the Division plan on the Storm Information SharePoint site. As outlined in this section, the primary focus of the Division plan is to be logistics. It is to be stored at both the Division and the Emergency Operations Center.

The only detail provided in this section regarding the Division plan is in the closing paragraph. "The Division EERP is heavily focused on logistics and pre planning activities for logistical arrangements. Efforts should be made before any restoration effort commences to have contracts in place with hotels, vendors for meals and box lunches, fuel, staging sites and other issues needed to support the resources provided in a restoration effort."[36]

2. Deficiencies: While the plan refers to a template on the SharePoint site, Ameren could make it more effective by providing some detail such as a table of contents for the division plan.

3. Corrective Action: Ameren should revise the EERP to provide more detail concerning the content of the Division EERP, *e.g.*, a table of contents.

- Section 8 – Division Supply List

1. Description: This section lists 21 separate "essential items that need to be available and assembled before storms strike." The plan does not intend this as a complete list but furnishes it as a guideline.[37]

2. Deficiencies: This is a helpful list, and appears to serve the intended purpose of a guideline, rather than a complete list. Ameren could improve the plan if it formatted this information into a checklist with specific assigned responsibility for ensuring availability/operability of all items prior to onset of a major event.
3. Corrective Action: Ameren should revise the EERP to provide a checklist of essential division supply items with specific assigned responsibility for ensuring the availability or operability of all items prior to onset of a major event.

- Section 9 – Logistics

1. Description: This section provides "a set of general logistical needs" as guidelines for individual operating centers to follow "as Division Storm Plans are developed." The plan states, "it is critical that these logistical necessities be in place prior to a storm." It lists five logistical categories as subsections under this section:

  - Subsection 9.1 – Equipment/Vehicles

The plan urges responders to know the type of equipment needed and available, and to maintain contact lists where they can obtain these resources. It lists several types of equipment as examples.

[36] Response to Data Request #64, Section 7, page 25.
[37] Response to Data Request #64, Section 8, page 25.

- Subsection 9.2 – Staging Areas

This subsection provides more specificity with guidelines for a minimum of 3 acres of gravel or paved area for "materials, meals, fuel, ice, water, laundry, portable lighting, portable toilets, security, and trash containers (30 yard dumpsters)." It assigns responsibility for laying out the staging areas to "(s)tores personnel and Staging Site Directors." Prior to the onset of the outage event, the plan requires arrangements for contacting the responsible people at each site – including 24-hour coverage "if necessary." The plan references the Storm Information SharePoint site for "sample layouts for staging sites."

- Subsection 9.3 – Lodging and Meals

This subsection gives directives in the categories of hotel reservations, box lunches, and other meals. The "Division Logistics Coordinator" has responsibility for coordinating much of the details in this area, and the plan again refers to the Storm Information SharePoint site for the forms that people should use. While the language strongly suggests that mid-day meals will be box lunches, the plan states, "The EOC Logistics Coordinator should inform the Division Logistics Coordinator if box lunches will be obtained." Prior arrangements for lodging and meals are "strongly recommended."

The wording for "Hotel Reservations" provides good specificity, setting forth steps such as determining room availability, and assignment of room numbers.

- Subsection 9.4 - Security

This short subsection simply references "the Security Request tab of the Logistics worksheet," with directions as to how to enter data. It also refers to the SharePoint site for access to this worksheet.

- Subsection 9.5 - Miscellaneous

This subsection lists nine "other logistical needs that must be addressed" with no further guidelines.[38]

2. Deficiencies: Logistics is an essential part of any major restoration effort and is certainly deserving of a separate section in the plan. The Ameren plan is short on details in this important area. The plan covers the duties of the Emergency Operations Center Logistics Coordinator in section 3.1, but does not refer to that information in this section on logistics. The Logistics section should cover the duties and specific logistics activities at the EOC, Division, and Operating Center level.

3. Corrective Action: Ameren should revise the EERP to furnish specific details on logistic duties and activities at the EOC, Division, and Operating Center level.

- Section 10 – Sending/Receiving Crews within the Ameren System

1. Description: As stated in the EERP, "The purpose of this section is to establish procedures and guidelines when Divisions are either sending crews to assist another Division or receiving crews

[38] Response to Data Request #64, Section 9, pages 26-28.

from another Division or outside resource."[39] The section contains two subsections – Sending Crews to Assist (10.1) and Receiving Crews to Assist (10.2).

Subsection 10.1 provides guidelines for staffing crews to assist, including the ratio of workers to type of equipment, ratio of supervisors to workers, type of equipment needed, and a general reminder concerning truck stock and personal needs of crewmembers. It makes reference to two forms (found on Storm Information SharePoint site) that personnel are to complete prior to the crews' departure from their home location.

Subsection 10.2 sets forth the duties of the EOC Logistics Coordinator, the Division Logistic Coordinator, and the Division Coordinator in communicating with each other and with the various supervisors concerning the number of crews coming to assist, contact information, and logistics and work issues.[40]

2. Deficiencies: Section 11 of the EERP deals with certain aspects of receiving crews coming in from the outside to assist the affected area. Ameren should combine these two sections, and provide more specific details as guidelines for both sending and receiving crews to assist during major outage events. For example, it should provide specific instructions for pre-travel and travel activities when sending crews. Guidelines for how and where to meet with assisting crew team leaders would be beneficial.

3. Corrective Action: Ameren should revise the EERP to combine sections 10 and 11 and to provide more details for sending and receiving crews, *e.g.*, pre-travel and travel activity instructions and the process for meeting with the leaders of crews who have come in to assist.

- Section 11 – Handling Outside Crews

1. Description: For the purpose of this section, the plan defines outside crews as "crews coming from other utilities or contractors that have not previously worked on Ameren property."[41] The subsections are:

  - 11.1 Checkpoints
  - 11.2 Checkpoint Coordinator
  - 11.3 Ameren Liaison
  - 11.4 Safety Coordinator
  - 11.5 Squad Leaders
  - 11.6 Crew Guides

The entire content of this section deals with the positions and job duties used in providing coordination, orientation, and direction of the outside crews.

2. Deficiencies: As noted in the comments on Section 10 above, Ameren could improve its plan by combining Sections 10 and 11 and providing guidelines that are more specific.

[39] Response to Data Request #64, Section 10, page 28.
[40] Response to Data Request #64, Subsections 10.1 and 10.2, pages 28 and 29.
[41] Response to Data Request #64, Section 11, page 29.

3. Corrective Action: Ameren should revise the EERP to combine sections 10 and 11 and provide more specifics concerning both sending and receiving crews.

- Section 12 – Mutual Assistance to Other Utilities

1. Description: This very short section simply outlines the process whereby Ameren routes requests for assistance from other utilities through the Operations Managers in each state (Missouri and Illinois) and coordinates with designated management in the divisions and at the corporate level. Ameren presently is a member of two mutual assistance organizations – the EEI (Edison Electric Institute) Mutual Assistance Group and the Midwest Mutual Assistance Group.[42]

2. Deficiencies: As written, this section adds little or no value in providing direction for emergency response. Ameren could logically include the subject matter, mutual assistance to other utilities, in the recommended combination of Sections 10 and 11. Ameren should include specific information to place clearly the responsibility for contacts with Mutual Assistance Utilities on a designated position in the Ameren emergency response organization. It should also include guidelines in the plan as to the maximum number of resources that Ameren would be willing to send to assist other utilities.

3. Corrective Action: Ameren should revise the EERP to include section 12 in the new combined sections 10 and 11 dealing with sending and receiving crews. The EERP should include specific information placing clear responsibility for making the contacts with Mutual Assistance utilities and establishing guidelines as to the maximum number of resources that Ameren would be willing to send to assist other utilities.

- Section 13 – Technology

1. Description: The stated purpose of this section is to "provide an overview of the various technologies which can provide benefit during a Major Outage along with other pertinent information."[43] There are twelve subsections:

- 13.1 Dispatch/EOC Phones
- 13.2 Cellular Phones
- 13.3 Satellite Phones
- 13.4 Voice Radios
- 13.5 Consoles/Truck/Portables
- 13.6 Computers/PCs
- 13.7 Mapping
- 13.8 Plotters/Printers
- 13.9 FAX Machines
- 13.10 SCADA
- 13.11 Weather Tools
- 13.12 Web Pages

[42] Response to Data Request #64, Section 12, page 31.
[43] Response to Data Request #64, Section 13, page 31.

2. Deficiencies: The content of most of these subsections is very brief and general, providing little value other than just the naming of the different types of technology available for emergency response. The exceptions to this are those instances in which the plan gives specific contact information such as subsection 13.1, the information on the different radio systems in subsection 13.4, the extent of communications between these systems in subsection 13.5, the information on storm kits and the guidance concerning UPS systems in subsection 13.6, and the description of available web page information in subsection 13.12.

3. Corrective Action: To provide comprehensive emergency restoration guidance, Ameren should include more information in EERP Section 13 concerning available technology, such as the content of work packets and how it will use this technology in developing work packets.

- Section 14 – Contingency Planning for Loss of Critical Systems and Facilities

1. Description: "The purpose of this section is to define contingency plans to mitigate loss of technology resources, such as communications or OAS, and critical facilities during restoration efforts. It also defines plans for any other extraordinary events requiring special handling."[44] There are four subsections:

  - 14.1 Loss of OAS
  - 14.2 Loss of Communications
  - 14.3 Loss of Offices
  - 14.4 Environmental Problems

The information in this section is helpful. It refers on more than one occasion to "applicable Illinois or Missouri Energy Delivery Work Area Recovery (WAR) Plans or Business Continuity Plans." Liberty reviewed these plans as they related to Section 14 of the emergency plan.[45] The "WAR" plans are impressive and contain comprehensive details on business continuity action-plans Ameren would take in the event of different contingencies. The WAR plans address the different areas of Ameren's operation as shown above and are set out in a helpful, user-friendly manner that should prove quite valuable to responders. Ameren could improve other areas of its emergency plans by patterning them more like these WAR plans.

2. Deficiencies: One problem noted was the reference to Sections 7 and 9 of the EERP – Division Electric Emergency Restoration Plans, and Logistics, respectively. Neither of these sections contains the information referenced in Section 14.

3. Corrective Action: Ameren should correct the EERP to either add information to Sections 7 and 9 as referenced in Section 14 or remove this reference.

- Appendix

1. Description: The Appendix to the EERP consists of three pages – the first two are organization charts, entitled "EOC Operating Structure" and "Storm Duty Roles," respectively and the third page is entitled "Instructions for downloading and uploading documents to the SharePoint web sites."[46]

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[44] Response to Data Request #64, Section 14, page 35.
[45] Response to Data Request #521.
[46] Response to Data Request #64, Appendix.

The two organization charts in the EERP Appendix submitted with Ameren's response to Liberty blacked out job titles or duties, but Liberty assumes that the actual charts furnish helpful data. The instructions concerning the SharePoint web sites appeared adequate for their intended purpose.

2. Deficiencies: Given the amount of information covered by the EERP, the Appendix should contain much more information to supplement the main body of the plan. In addition, a subject index would be a helpful addition.

There is no mention in the EERP of emergency drills or training. Ameren stated, "The Ameren EERP does not specifically require drills or training exercises."[47] This is a significant omission. No emergency plan, no matter how comprehensive, will prove effective if the company does not regularly drill and train all response employees in the different facets of the plan. Drills and training of employees, along with the other items noted above, represent significant improvement opportunities for the Ameren corporate EERP.

The EERP does not reference the Distribution Dispatch Operations (DDO) Electric Storm Process or the Communication Plans for Severe Storms. The definitions of storm levels are not consistent between these plans.

3. Corrective Action: Ameren should revise the EERP to provide supplemental information in the Appendix, such as a subject index and to provide specific instructions requiring annual drills and training in the EERP. The Ameren corporate EERP should reference all other emergency plans such as the Distribution Dispatch Operations (DDO) Electric Storm Process and the Communication Plans for Severe Storms, and the definitions of storm levels should be consistent between these plans.

b. Division Electric Emergency Restoration Plans (EERP)

1. Description: Section 7 of the Ameren corporate EERP assigns responsibility to each Division Manager "for drafting and updating a plan that is in alignment with the Ameren Electric Emergency Restoration Plan." The stated purpose of the Division EERP, according to this Section, is "to provide a consistent and detailed set of information to augment the storm restoration process."[48]

In addition, Ameren provides a template for the Division EERP on the SharePoint web site. The introduction to this template states, "The following template is to serve as a guide for the types of items that need to be included in each Division plan. Ameren-IL expects that each division will develop their own version of a plan that includes the following information at a minimum. More specific details and phone lists will be necessary for your plan to be effective."

The template contains the following recommended Table of Contents:

- Purpose and Intent of Guide

[47] Response to Data Request #66, page 1.
[48] Response to Data Request #64, Section 7, page 25.

- Storm Declaration and Response
- Storm/Outage Response Coordination
- District Information
- Construction Role/Skill Sets
- Staging Areas
- Outside Services
- Miscellaneous Forms

In responding to a data request from Liberty, all seven Ameren-IL divisions confirmed that they had a division storm plan in place prior to the 2006 storms that are the subject of this report.[49]

Liberty reviewed the EERP of Division III and Division IV. Both contain most of the items listed in the EERP template, and much more helpful information that is useful to responders during a major emergency. The plans included information specific to the division as well as general storm response guidelines, such as the procedure for obtaining switching clearances and the Ameren hotel and meal policy. They both include instructions on the use of the Outage Analysis System (OAS) with work flow charts. The Division IV plan in particular was very comprehensive—57 pages in length—with such information as time entry and accounting considerations, instructions on accounting for material movement, Outage Analysis System "quick tips," examples of Outage Analysis System procedures for partial restoration, and the procedure for monitoring restoration efforts using the Outage Analysis System and the Distribution Dispatch Operations (DDO) website.

2. Deficiencies: Ameren acknowledges that, "Division storm response plans are not consistent and contain varying levels of detail. In some instances, information is not up-to-date."[50] Based on the wording of the Ameren corporate EERP regarding division storm plans, and on information gained in interviews[51], it is apparent that Ameren-IL gives each division the responsibility to develop its own EERP. There is no effort made to have division plans that are consistent in content and organization.

3. Corrective Action: In light of the comments regarding the lack of consistency and varying levels of detail mentioned above, Ameren-IL could improve the quality of these plans by using the Division IV plan as a template.

c. Distribution Dispatch Operations (DDO) Electric Storm Process

1. Description: Liberty reviewed the Decatur DDO Electric Storm Process document. The 25-page plan begins with the activation process and includes six sections with nine appendices as follows:

Section I. Small to Medium Storms

[49] Response to Data Request #66.
[50] Response to Data Request #65, attachment 65A, page 1.
[51] Interviews #11 (October 3, 2007), #73 (October 29, 2007), and #83 (November 15, 2007).

Section II. Large Storms
Section III. WPA
Section IV. EOC Process
Section V. Accounting
Section VI. Technology
Appendix 1 Roles and Responsibilities
Appendix 2 Dispatch Radio Numbers
Appendix 3 Government Notifications
Appendix 4 Dispatch Areas
Appendix 5 Ameren-IL Map
Appendix 6 Example Split Decatur OC
Appendix 7 DDO Phone Number Template
Appendix 8 OAS Batch Callback Process
Appendix 9 Technology Tools and Reports[52]

Appendix 1 sets out the roles and responsibilities for both Distribution Dispatch Operations personnel and field personnel. For field personnel, the plan deals exclusively with the use of the Outage Analysis System and interaction with the dispatch office. Specifically, the plan includes roles and responsibilities for the following field positions: Construction Supervisor, Field Checkers, Troublemen/Servicemen, and Forestry.

2. Deficiencies: Sections I and II do not define "small," "medium," or "large" storms. The EERP defines storm levels based on the amount of help required to restore service. The plan defines three levels, with levels 2 and 3 designated "major storms." The definition of storm level or severity, and designations such as "small," "medium," "large," or "major" should be consistent with all emergency response plans. Section IV of this plan references the Ameren corporate EERP, but the Ameren corporate EERP makes no mention of the Distribution Dispatch Operations plan. It is essential that all emergency plans be coordinated, especially in this instance where the Distribution Dispatch Operations plan sets out specific roles and responsibilities for field personnel for whom the corporate and division EERPs also cover.

3. Corrective Action: Ameren should revise the Distribution Dispatch Operations (DDO) Process to establish definitions of storm level or severity that are consistent with those of the corporate EERP and other emergency response plans.

d. Communication Plans for Severe Storms (Corporate)

1. Description: The objective of this 5-page plan is, "To protect the corporation's reputation as a safe, reliable provider of power, a good corporate citizen and a strong leader in the business community by proactively communicating accurate and complete information during severe storms." This plan defines a "severe storm" as "any storm that results in outages that number greater than 50,000 (out of 2.4 million electric customers in Illinois and Missouri) and that last longer than 24 hours."[53] The plan contains helpful guidelines for developing messages and directing communications efforts.

[52] Response to Data Request #452, attachment 452A.
[53] Response to Data Request #421, attachment 421A, page 1.

This communications emergency response plan contains sections as follows:

- Key strategies
- Preparation: (in advance)
- Possible Core Messages
- Core Tactics
- After the Storm
- Outages Communications (flow chart)

2. Deficiencies: There is no reference in this plan to the corporate EERP or the Ameren emergency response organization. Again, there is no correlation between the definitions of storm level in this plan with the corporate EERP and the Distribution Dispatch Operations plan. To be effective, emergency plans need to be coordinated and consistent with each other. In addition, the plan does not contain any information concerning the communications emergency response organization or job duties within that organization. To be a complete and effective corporate communications emergency response plan, it should furnish this information and should be coordinated with and refer to the corporate EERP.

3. Corrective Action: Ameren should revise the Communication Plans for Severe Storms to reference the corporate EERP and other emergency plans and to establish consistent definitions of storm levels between the different plans.

3. Response Employees' Use of the Plans

Liberty interviewed all Ameren-IL division managers, electric operating superintendents, and representatives from all key emergency response functions. In addition, Liberty made a field visits to six Ameren-IL storm rooms used during the July 2006 or November 2006 storm responses. In all of these interviews, Liberty asked specific questions about the emergency plans, both the corporate and division EERP.

The level of familiarity with the corporate EERP, and the extent to which personnel used the EERP varied between interviewees. For the most part, there was little evidence that they studied the EERP in advance or used it during the emergency response. In more than one interview, it was obvious that the interviewee was not familiar with the EERP at all. On several occasions, the interviewee made a statement to the effect that the interviewee had access to and was familiar with the plan, but it was not something that they would refer to during the response effort.[54]

The extent to which Ameren-IL actually followed its EERP was brought into question when, in their response to a Liberty data request for an EOC organization chart, a number of the EOC roles and job titles reported differed from those shown in the EERP. Specifically, a number of the job titles did not match those in the EERP, and three positions listed in the Ameren response were "not specifically defined" in the EERP.[55]

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[54] Interviews #11 (October 3, 2007), #22 (October 24, 2007), #24 (October 24, 2007), #84 (November 28, 2007), and #93 (January 8, 2008).
[55] Responses to Data Requests #70, #332, and #388.

Liberty found an exception to this when interviewing some of the division managers and electric operating supervisors. Notable in this group were representatives from Divisions III and IV. In tours of storm rooms in these divisions, personnel made unprompted reference on a number of occasions to the Division EERP, and how they used it during the restoration effort.[56] In addition, interviewees in Division VI stated that they made continual use of their emergency plans.[57]

A key factor in the accessibility to and knowledge of the EERP was the issue of whether Ameren-IL allows bargaining unit employees access to the plans. In most divisions, they are not, but Division IV was an exception. In that division, all employees have access to the plans.[58]

With regard to the Communication Plans for Severe Storms, Liberty found that, generally speaking, the communication responders were familiar with and followed the plan to the extent it furnished specific guidelines.[59] Similarly, it appeared that the distribution dispatch responders were familiar with and followed the Distribution Dispatch Operations Electric Storm Process plan.[60]

No matter how comprehensive and helpful an emergency plan is, its effectiveness is limited when responders do not have accessibility to it, are not familiar with its content, or do not use it during emergencies.

4. Drills and Training Exercises

The Ameren corporate EERP does not require, and in fact does not mention, drills and training for response employees. Liberty's interviews with key response personnel at the corporate and division level revealed that Ameren-IL spent very little time in training and even less in conducting drills.[61]

In a response to a data request from Liberty, Ameren reported that at the corporate level it provided training in the Outage Analysis System (OAS) and in roles and responsibilities for Public Safety Advisor (PSA), Field Checker, and Field Checker Dispatcher – all emergency response positions identified in the corporate EERP. Of the seven Ameren-IL operating divisions, three did not respond with any details about training of employees. The other four divisions all mentioned some training of employees in Outage Analysis System and various aspects of the division and corporate EERPs. Especially notable were the training efforts of Divisions III and IV. In particular, the Electric Operating Superintendent in Division III has developed a very comprehensive and impressive training presentation.[62]

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[56] Interviews #124 (January 15, 2008), #125 (January 15, 2008), and #126 (January 14, 2008).
[57] Interviews #73 (October 29, 2007) and #74 (October 29, 2007).
[58] Interview #126 (January 14, 2008).
[59] Interviews #91 (November 27, 2007) and #97 (November 13, 2007).
[60] Interview #102 (November 15, 2007).
[61] Interviews #24 (October 24, 2007), and #84 (November 28, 2007).
[62] Interviews #124 (January 15, 2008) and #126 (January 14, 2008).

With regard to drills, Ameren reported none at the corporate level and only Division VII among the operating divisions reported conducting drills. Ameren-IL also reported that representatives of Division VI participated in these drills.[63]

The lack of emphasis on training and drills on a regular basis for all of the Ameren response organization helps explain the lack of familiarity and use of the emergency plans.

5. Best Practices and Proven Effectiveness of Plan Elements

The next chapter of this report discusses Ameren-IL's actual emergency response performance in the July 2006 and November 2006 storms. This section addresses elements of the emergency plans that Liberty recognized as a utility "best practice" or elements that proved to be especially effective.

Based on its review of the emergency plans, Liberty identified as an industry best practice:

- The Restoration Update Conference Call
- The Extensive Damage Recovery, Public Safety Advisor, and Cut and Clear processes.

As noted in the next chapter of this report, Liberty concluded that the Ameren response organization made a sincere and arduous effort in responding to the two 2006 significant outage events. Elements of the plan such as those mentioned above, when applied with such effort, will help make Ameren's response to emergencies more effective.

6. Critiques, Feedback, and Updates of Plans

As noted in the discussion of EERP Subsection 2.7 above, Ameren's emergency plan states that it should hold post-event critiques for all major outage events.[64] However, the EERP does not set forth a process whereby it captures critique items that dictate change and makes updates to the plan. Likewise, the EERP does not set out any process to gather ongoing feedback on needed changes or updates not related to any particular major outage event.

In response to a Liberty data request, Ameren reported that it held critiques for the overall Ameren-IL response for both the July 2006 and the November/December 2006 storms. In addition, Ameren reported that post-storm critiques were held by three divisions – Division IV, V, and VI – and Ameren-IL Field Checkers, Supply Chain, and Logistics functions.[65]

Based on this information, as well as responses gained through other Liberty interviews with key Ameren-IL division and functional area representatives, Liberty found that Ameren-IL did not consistently follow the process for post-event critiques for the 2006 storms. Only three of the seven Ameren-IL divisions submitted critiques, even though at least one more division had significant outages during the November/December 2006 storm, and all divisions participated in

[63] Response to Data Request #66.
[64] Response to Data Request #64, Subsection 2.7, page 7.
[65] Response to Data Request #8, attachment DR8 Summary.

the restoration effort. In addition, several key functional areas did not perform critiques, most notably the EOC.[66]

In response to Liberty's data request concerning updates to emergency plans as a result of "lessons learned" in the subject restoration efforts, Ameren reported that significant changes have been put in place since 2006 including "the split of the Distribution Operations function into a Missouri organization and an Illinois organization." In addition, Ameren-IL reported that it had created an Ameren Illinois Emergency Operations Center in Decatur, Illinois, and that this change "will be leading to changes in the emergency response plan for Illinois as well as the divisional storm response plans."[67] However, in a subsequent interview with the Ameren-IL CEO, it became clear that Ameren-IL did not make these particular changes because of Ameren's experience in the 2006 storms. Rather, Ameren-IL began planning these changes in the spring of 2006, before the July 2006 storm.[68]

In summary, even though the EERP sets out a post-event critique process, Ameren-IL did not consistently perform critiques. In addition, there is no structured process for capturing items from these critiques as well as from ongoing review of the plans and for effecting changes and updates to the emergency plans.

D. Conclusions

1. Ameren recognized the importance of emergency plans and committed considerable effort and resources to developing and maintaining them.

All Ameren-IL utilities used the corporate Electric Emergency Restoration Plan (EERP), which Ameren revised and re-issued prior to the July 2006 storm. This plan is available on Ameren's SharePoint storm information database. Ameren also has a corporate communications emergency plan, a distribution dispatch emergency plan, and each Ameren-IL operating division has its own EERP.

2. Ameren did not have emergency response plans for key response areas at the time of the 2006 storms. (Recommendation III-1)

As an example, two specific functional areas that the Ameren corporate EERP (or other emergency plans) did not address are the Call Centers and the Safety function. A thorough review of the corporate EERP reveals that there is a need for additional plans for functional areas such as these two or Ameren should add sections to the existing plan to address them.

[66] Interviews #84 (November 28, 2007), #88 (January 9, 2008), #92 (November 15, 2007), and #95 (January 1, 2008).
[67] Response to Data Request #65, attachment DR65 Summary.
[68] Interview #15, November 14, 2007.

3. The Ameren emergency plans in use at the time of the 2006 storms were not coordinated and consistent with each other. (Recommendation III-2)

Just one example of this inconsistency is the differing definitions of storm levels between the corporate EERP, the corporate Communication Plan for Severe Storms, and the Distribution Dispatch Operations Electric Storm Process plan. They use terms such as Levels 1, 2, and 3, "major," "severe," and "small, medium, and large" and there is no correlation of storm levels between the different plans.

4. The Ameren corporate Electric Emergency Restoration Plan (EERP) contains a number of helpful elements, including some "best practices."

Elements such as priority for "Critical Customers (hospitals, fire houses, police stations, schools, and nursing homes)",[69] Field Checking completion criteria,[70] Restoration Update Conference Calls,[71] and the Extensive Damage Recovery,[72] Public Safety Advisor,[73] and Cut and Clear[74] processes are important, and have proven effective in major outage restoration response.

5. The Ameren corporate Electric Emergency Restoration Plan (EERP) needs improvement in a number of different areas. (Recommendation III-3.)

Liberty's review of the corporate EERP noted several improvement opportunities. The list includes:

- Section 1 - Ameren should revise the EERP to include a mission statement, restoration target/goal, logic behind the organization of the plan itself, types and severity levels of emergencies covered by the plan, and a clear statement of company leadership support and expectations regarding the plan.
- Section 2 - Ameren should restructure Section 2 – Emergency Operations Center (EOC) – so that the subject matter more accurately fits the section title and so that it either covers other subjects in a new separate section or combines them with existing sections. Ameren should revise the EERP wording to establish clearly the priority of the EOC to direct the restoration activities. Ameren should revise the second part of the EERP definition of a "major event" so as not to require activation of the EOC when not necessary.
- Subsection 2.1 - Ameren should revise the EERP to include specific criteria requiring activation of the EOC and to establish an activation notification process such as a company-wide paging system.
- Subsection 2.2 - Ameren should reclassify the storm levels as defined in this subsection to communicate the severity of the event and the anticipated restoration time. Ameren should establish restoration goals for major events which would reflect the storm level, maintaining their present 72-hour target for certain level storms,

[69] Response to Data Request #64, Subsection 4.3, page 21.
[70] Response to Data Request #64, Subsection 4.4, page 22.
[71] Response to Data Request #64, Section 5, page 22.
[72] Response to Data Request #64, Section 6, page 24.
[73] Response to Data Request #64, Subsection 3.1, page 10.
[74] Response to Data Request #64, Subsection 3.1, page 11.

while establishing targets for larger storms that recognize the scope and amount of damage.

- Subsection 2.3 - Ameren should improve the format of this subsection to facilitate quick access, such as a chart-type presentation. Ameren should address additional support activities in this subsection such as safety, transportation, logistics, and security and should furnish additional information that sets out areas of responsibility for logistics functions.
- Subsection 2.4 - Ameren should revise Subsection 2.4 to provide a complete checklist with appropriate detail.
- Subsection 2.5 - Ameren should create a separate section to deal with resource procurement/release. Ameren should provide a chart to communicate some of the key responsibility areas. Ameren should revise the EERP to spell out clearly the process for the EOC Director/designee to work with Operations Managers in procurement of resources and to provide specifics for the responsibility of contacting Mutual Assistance utilities.
- Subsection 2.7 - Ameren should revise the EERP to establish the process to ensure that it performs post-event critiques, captures action items, and tracks the action items to completion.
- Section 3 - Ameren should revise the EERP to include all positions that comprise the response organization in a major restoration effort and should provide details of job duties in sections of the EERP dealing with those response functions.
- Subsection 4.3 - Ameren should revise the EERP to include the process for the Field Checker to input the damage assessment into the system.
- Subsection 4.4 - Ameren should revise the EERP to reference Section 6 in Subsection 4.4 and to expand the use of the Heavy Localized Damage Assessment process. Ameren should include a chart in the EERP to illustrate more effectively the applications of the different damage assessment stages.
- Subsection 5.1 - Ameren should revise the EERP to provide scheduled times for the Restoration Update Calls with a provision to change as required and to identify call participants while encouraging others to sit in on the calls.
- Subsection 5.3 - Ameren should revise the EERP to establish the procedure of furnishing restoration status information in advance of Restoration Update Conference Calls and to relocate the instructions for “muting” the telephone to Subsection 5.1.
- Section 6 - Ameren should revise the EERP to allow for more flexibility in the use of the Extensive Damage Recovery process.
- Section 7 - Ameren should revise the EERP to provide more detail concerning the content of the Division EERP, *e.g.*, a table of contents.
- Section 8 - Ameren should revise the EERP to provide a checklist of essential division supply items with specific assigned responsibility for ensuring availability/operability of all items prior to onset of a major event.
- Section 9 - Ameren should revise the EERP to furnish specific details on logistic duties and activities at the EOC, Division, and Operating Center level.

- Section 10 - Ameren should revise the EERP to combine sections 10 and 11, and provide more details on sending and receiving crews, *e.g.*, pre-travel and travel activity instructions and the process for meeting with the leaders of crews who have come in to assist.
- Section 11 - Ameren should revise the EERP to combine sections 10 and 11 and provide more specifics concerning both sending and receiving crews.
- Section 12 - Ameren should revise the EERP to include section 12 in the new combined sections 10 and 11 dealing with sending and receiving crews. The EERP should include specific information placing clear responsibility for making the contacts with Mutual Assistance utilities and establishing guidelines as to the maximum number of resources that Ameren would be willing to send to assist other utilities.
- Section 13 - To provide comprehensive emergency restoration guidance, Ameren should include more information in EERP Section 13 concerning available technology, such as the content of work packets and how it will use this technology in developing work packets.
- Section 14 - Ameren should correct the EERP to either add information to Sections 7 and 9 as referenced in Section 14 or else remove this reference.
- Appendix - Ameren should revise the EERP to provide supplemental information in the Appendix, such as a subject index.
- Overall Plan – Ameren should revise the EERP to provide specific instructions requiring annual drills and training in the EERP. The Ameren corporate EERP should reference all other emergency plans such as the Distribution Operations (DDO) Electric Storm Process and the Communication Plans for Severe Storms, and the definitions of storm levels should be consistent between these plans.

6. The Ameren Energy Delivery Work Area Recovery (WAR) Plans or Business Continuity Plans (as referenced in Section 14 of the corporate Electric Emergency Restoration Plan (EERP)) are very comprehensive, user-friendly, and should prove helpful to responders.

The plans set forth important business continuity action steps for the contingencies that could be expected by Ameren Energy Delivery. Ameren could improve other of its emergency plans by patterning them like the WAR plans.

7. During the 2006 storms, there was a general lack of familiarity with and limited use of the corporate EERP by many of the Ameren responders. (Recommendation III-4.)

Liberty's interviews with a large cross-section of the Ameren response organization revealed that a number of interviewees were not familiar with the plan or did not refer to the plan during the response effort. In Ameren's response to Liberty detailing the EOC positions employed during the 2006 storm restoration, there was a disparity with the EOC positions listed in the EERP. As an exception, several division interviewees – notably from Divisions III and IV – clearly had a great deal of familiarity with the corporate and division EERPs and relied on them during their response.

8. The corporate and division EERPs were not accessible to bargaining unit employees involved in the emergency response to the 2006 storms. (Recommendation III-5.)

Other than Ameren-IL Division IV, the operating divisions told Liberty during interviews[75] that union employees did not have access to the EERP. While it is understandable that some information needs to be restricted in a collective bargaining environment, it is important that key response personnel have access to and are familiar with the emergency restoration plan.

9. Ameren was inconsistent in training on emergency plans and made very little use of storm drills prior to the 2006 storms. (Recommendation III-6.)

Three of the seven Ameren-IL operating divisions did not do any training of employees in the EERP. Only one of the seven divisions reported that it held a storm drill, and one other division sent representatives to sit in on those drills. In addition, interviewees from other key functional areas in the Ameren response organization indicated that they did not conduct training or drills.[76]

10. Ameren was inconsistent in the use of post-event critiques before and after the 2006 storms. (Recommendation III-7.)

Only three of the seven Ameren-IL divisions submitted critiques, even though at least one more division had significant outages during the November/December 2006 storm, and all divisions participated in the restoration effort. In addition, several key functional areas did not perform critiques, most notably the EOC.[77] The failure to use the post-event critique process results in Ameren-IL missing improvement opportunities.

11. Ameren had no structured process for soliciting, collecting, and incorporating feedback on needed changes or updates to their emergency plans prior to the 2006 storms. (Recommendation III-8.)

There were no provisions for plan feedback, updates, or modifications in any of the emergency plans. Just as important as post-event critiques is a structured process to ensure that Ameren-IL solicits, collects, and incorporates feedback on the plans. To do this requires a clearly defined process with accountability and follow-up to ensure that it makes updates and changes in a timely, accurate, and comprehensive manner.

12. Ameren-IL Division EERPs (emergency plans) need improvement. (Recommendation III-9.)

Ameren-IL admitted that, "Division storm response plans are not consistent and contain varying levels of detail. In some instances, information is not up-to-date."[78] In reviewing division plans from Ameren-IL Divisions III and IV, both of which are well done, Liberty noted that the plans had varying levels of detail.

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[75] Interviews #121 (January 14, 2008), #122 (January 1, 2008), and #124 (January 15, 2008).
[76] Interviews #84 (November 11, 2007) and #93 (January 8, 2008).
[77] Response to Data Request #8, attachment DR8 Summary.
[78] Response to Data Request #65, attachment 65A, page 1.

13. The Ameren corporate Communication Plan for Severe Storms needs improvement. (Recommendation III-10.)

For example, there is no reference in this plan to the corporate EERP or the Ameren emergency response organization. In addition, the plan does not contain any information concerning the communications emergency response organization or job duties within that organization.

14. The noted plan deficiencies and the lack of familiarity and use of the plans had a negative effect on the Ameren restoration effort in the 2006 storms. (Recommendation III-11.)

For example, the corporate EERP details a process for Checkpoints to facilitate the coordination of outside crews coming in to help Ameren. However, Ameren-IL either did not use or made minimal use of this process.

E. Recommendations

III-1 Review and modify as necessary all existing emergency plans to ensure that all key response areas are included as a section in a plan or are covered by a separate plan.

Some important emergency response areas within Ameren-IL did not have emergency plans. Examples are Call Centers and Safety. Ameren-IL should complete the implementation of this recommendation within six months of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-2 Revise emergency plans so that they are coordinated and consistent.

This report notes several instances of inconsistency and lack of coordination. The definition of various storm levels is one example. Ameren-IL should complete the implementation of this recommendation within six months of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-3 Review and improve the Electric Emergency Restoration Plan.

The Electric Emergency Restoration Plan has several improvement opportunities. As examples, there should be clear wording in the overview concerning top management's expectations and support. The plan should specifically address drills, training, and plan updates. Ameren-IL should complete the implementation of this recommendation within one year of the date of this report.

In response to Liberty's request for information regarding changes made to the Electric Emergency Restoration Plan since the 2006 storms, Ameren responded:[79]

[79] Response to Data Request #65.

> *The Ameren Electric Emergency Restoration Plan (EERP) was issued in May 2006… Since 2006 the Ameren Illinois organization has continued to evolve, particularly with the split of the Distribution Operations function into a Missouri organization and an Illinois organization. This has also created an Ameren Illinois Emergency Operations Center, in Decatur, Illinois, along with additional structure and will be leading to changes in the emergency response plan for Illinois as well as the divisional storm response plans. These changes have been approved by Senior Illinois Leadership and are in the implementation phase."*

Ameren also provided general details of the proposed changes to the emergency response organization and both the corporate and the division emergency plans. As noted by Ameren, these changes were in the implementation phase. The information provided by Ameren did not provide specifics with regard to proposed changes to the plan; therefore, Liberty does not have any comment on whether Ameren's intended changes will address the issues raised in this report.

In its comments on the draft report, Ameren-IL accepted this recommendation but proposed an 18-month implementation schedule. Liberty believes this is too long, but changed the recommended completion date from nine months to one year.

III-4 Ensure that all emergency response personnel are familiar with and use emergency plans.

Ameren-IL personnel were not all familiar with and did not refer to emergency plans during the 2006 storms. Ameren-IL should take the steps necessary to make sure emergency response personnel are familiar with emergency plans within six months of the date of this report and on an on-going basis as it revises the plans. Ameren-IL should also reinforce the use of the plans and determine whether personnel used them after actual emergencies.

In its comments on the draft report, Ameren-IL accepted this recommendation but proposed familiarization as it develops and implements revised plans. Liberty maintains that Ameren-IL should take steps to ensure that personnel are familiar with and use existing plans within six months.

III-5 Make the Electric Emergency Restoration Plans (both corporate and division) accessible to all key response personnel, including bargaining unit employees.

It is important that key response personnel have access to and are familiar with the emergency restoration plans. Ameren-IL should complete the implementation of this recommendation within six months of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-6 Conduct annual training and storm drills that involve response employees from all operating divisions and key response functional areas.

Ameren-IL should begin training before the end of 2008 and begin conducting storm drills no later than the second quarter of 2009.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-7 Hold post-event critiques following every significant outage event.

Ameren-IL needs to capture systematically and completely lessons learned from significant outage events. Critiques should include all affected operating divisions and response functional areas. Ameren-IL should implement this practice now.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-8 Implement a structured process for soliciting, collecting, and incorporating feedback on needed changes and updates to emergency plans.

There were no provisions for plan feedback, updates, or modifications in any of the emergency plans. A structured process to ensure that it acquires feedback on the plans requires a defined process with accountability and follow-up. Ameren-IL should complete the development and implementation of this recommendation as part of its emergency plans within nine months of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-9 Improve Division emergency response plans.

Ameren-IL should develop a comprehensive template that all operating divisions will use in developing or improving their Electric Emergency Restoration Plans. It could use the plans of Divisions III and IV as guidelines. Ameren-IL should complete the template within six months of the date of this report, and the divisions should produce improved, consistent emergency plans within 15 months of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation but proposed an extended completion timeline. Liberty extended the original recommended completion date but not as much as Ameren-IL suggested.

III-10 Improve the Ameren corporate Communication Plan for Severe Storms.

Ameren-IL should revise the Communication Plan to cover the issues noted in this report and make the plan more comprehensive. Ameren-IL should complete this improvement within one year of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation.

III-11 Improve emergency plans by evaluating actual performance.

Ameren-IL should review all chapters of this report and its own critiques of their 2006 storm performance to identify specifically those areas in which it did not follow emergency plans and which resulted in a negative effect on the restoration effort. Ameren-Il should continue these critiques on all future events, and identify and follow specific plans of action to address identified improvement areas. Ameren-IL should develop these action plans within six months of

the applicable storm response critique and complete action plans where possible within one year following the critique.

In its comments on the draft report, Ameren-IL accepted this recommendation.

IV. Storm Restoration Performance

On July 19 and 21, 2006, wind and thunderstorms struck the service areas of all three Ameren companies in Illinois. On November 30, 2006, an ice storm struck central Illinois. In both instances, customers numbering in the hundreds of thousands lost electric service and total restoration took over one week. A very important part of the investigation requested by the Illinois Commerce Commission is an evaluation of how well the Ameren companies planned for the storms and executed storm restoration. The previous chapter of this report covered emergency planning. This chapter presents Liberty's evaluation of the restoration from the July and November 2006 storms. The major sections in the chapter are:

A. Chapter Summary
B. Pre-Storm Preparations
C. Organizational Performance
D. Outage Information
E. Communications
F. Support Organizations
G. Field Restoration
H. Post-Storm Activities

After the chapter summary, each major section lists the objectives of Liberty's evaluation for the topics contained in that section. The chapter addresses item numbers 23 through 36 in part 4.3.2.5 of the Illinois Commerce Commission's Request for Proposals for this investigation. In summary, these are:

23. Pre-Event and Alert Processes
24. Mobilization of the Emergency Response Organization
25. Restoration Personnel
26. Outage Management Systems
27. Communications
28. Public Education
29. Support Organizations
30. Material Shortages
31. Replacement Materials
32. Restoration Delays
33. Restoration Times
34. Restoration Work Quality
35. Filed Restoration Activities
36. Post-Event Processes

In general, Ameren's organization for and response to the storms was not company specific. That is, Ameren-IP, Ameren-CIPS, and Ameren-CILCO did not take actions independently related to the storms and the restoration. In this chapter, Liberty uses the term Ameren-IL to mean all of the Ameren companies in Illinois, and the term Ameren to mean those same companies plus Ameren in Missouri. In cases where there were circumstances unique to one of the Ameren companies, Liberty distinguishes that company's name. Liberty's recommendations in this chapter apply to all three Ameren-IL companies.

A. Chapter Summary

Ameren-IL monitored weather predictions and the status of its electric delivery system prior to the storms. It activated division command centers in an effective manner, but the activation of the Emergency Operations Center (EOC) was not timely or efficient. Because the July 19, 2006, storm caught Ameren-IL by surprise, there was little pre-storm mobilization of any first responders or repair crews. Liberty also found that Ameren-IL should have been more proactive in procuring and mobilizing outside resources to assist in restoration efforts.

In its review of Ameren-IL's organizational performance during the 2006 storms, Liberty found that the members of the Emergency Operations Center (EOC) team were dedicated utility veterans. The team made a good effort to recruit outside resources to assist in the restoration efforts. However, the size of the workforce Ameren-IL assembled for the July storms was smaller than desired given the significance of the storms. This lengthened the duration of the outages by as much as two days. Prevailing weather conditions across the Midwest precluded Mutual Assistance utilities and some contractors from responding immediately to Ameren-IL's requests for assistance. Liberty recommends some organizational improvements, such as making clear the reporting relationship between corporate management and the emergency response organization, and adding a call center coordinator to the emergency response team.

Ameren-IL's process to develop and offer estimated restoration times was non-existent during the 2006 storms. This was a key reason why customers were highly dissatisfied with Ameren's storm response. In addition, Ameren-IL failed to identify "critical care customers" or "critical infrastructures" in its Outage Analysis System prior to the July or November/December 2006 storms, making it difficult for field personnel to prioritize restoration efforts appropriately.

Ameren's website is an excellent source of storm information, even after the growing pains experienced during the July 2006 storm. The website is rich in outage information and provides an interactive tool to view maps of affected areas and the ability to query the number of customers affected by zip code and geographical area.

Liberty reviewed call center operations and found that Ameren-IL did not have a formal call center emergency storm-response plan document prior to the 2006 storms. Moreover, the staffing at the centers during the storms was insufficient to handle the volume of calls received. Liberty found that Ameren's high-volume, outage-overflow service could not cope with the high volume of calls received during the 2006 storms. As a result, there were many blocked customer calls, including many emergency calls reporting downed wires.

Most of the Ameren employees who performed in lead support function roles all had good experience in their assigned storm role. Support functions such as security, transportation, logistics, and safety all performed well during the storms, but Liberty identified several improvement opportunities for the support functions.

The Ameren-IL field operating center organization was functional, appropriate for the task of field restoration, and staffed by experienced utility operating personnel. Overall, the field restoration performance was safe, timely, and effective, but there are improvement opportunities. The decision by Ameren-IL to replace the existing radio systems with one system allowing

communications between all legacy companies will correct one constraint that existed during the 2006 restoration efforts.

Liberty found that Ameren's post-event ramp-down from the storms went reasonably well. Ameren needs to formalize some of the procedures and guidance available for this phase of the restoration. Ameren also needs to do a better job at acquiring and tracking improvement opportunities from post-event critiques.

B. Pre-Storm Preparations

1. Objectives

This section of the report provides a description and evaluation of the pre-storm preparations and activities undertaken by the Ameren-IL utilities prior to the 2006 storms. Liberty's objective for the work included in this report was to assess the companies' pre-storm preparations and activities and to determine whether they were adequate and timely, including:

- An assessment of the effectiveness and accuracy of the utilities' weather and load monitoring to allow the utilities to take appropriate pre-event actions such as mobilizing work forces and emergency centers and preparing for load reductions.
- A review of the utilities' alert processes and use of pre-event damage predictions.
- A review of the information available to the utilities before the storms.
- Assessments regarding whether the utilities' predictions were reasonable and pre-event responses were appropriate.

The report addresses the following items and questions included in the ICC's Request for Proposals for this investigation:

- **4.3.2.5.23** Weather and load monitoring, alert processes, and pre-event prediction of damage and effects.

Liberty evaluated the following characteristics of Ameren-IL's pre-storm preparations and activities:

1. The services, processes, and procedures used by Ameren to monitor weather and electric load conditions at the time of the 2006 storms, including specifics on how Ameren used these services, processes, and procedures to aid pre-storm preparations.
2. The processes used by Ameren at the time of the 2006 storms to detect the threat of a potential major weather/outage event, including the prediction of the severity of the potential event in terms of damage to Ameren facilities and customer outages.
3. The pre-event alert processes used by Ameren in the 2006 storms to alert the response organization of the pending threat of a major outage event, including the timeliness and effectiveness of this alert process.
4. The processes and procedures used by Ameren in the 2006 storms to mobilize and activate the response organization and the timeliness and effectiveness of these activities, including opening and staffing of storm centers, calling out and staging field checkers and repair crews, and requesting assistance from resources outside of the Ameren organization.

2. Background

The amount of advanced notice that utilities receive concerning major weather events can vary significantly. In the case of hurricanes, it is common for utilities to have as much as a week's advanced notice of the threat of a major outage event. Weather services often track for days other weather systems, such as major winter storms moving across a large area. Even in the event of the rather sudden windstorm or tornado, a weather system typically develops over a period of hours. For a utility to respond appropriately, it is important that it makes the best use of this advanced notice in order to be prepared if the outage event occurs. Utilities should have access to weather services and software that will give them timely, accurate information on developing weather events, and they should make effective use of these services. Utilities should use this information to determine in advance the likely affected area and the severity of the event.

Utilities should use this information to develop a prediction of the timing of the onset of the event, the area impacted, the amount of damage, the number of customer interruptions, and the total restoration time. This prediction should then become the basis for the pre-storm planning and preparations, as well as the pre-storm communications to internal and external constituents. With these planning criteria in mind, the utility should immediately begin its process of alerting its response organization, activating its command centers, mobilizing its restoration workforce (*e.g.*, first responders, line and tree crews, field checkers, support functions) and recruiting outside resources in order to achieve the predicted restoration time.

No utility ever wants to have to play "catch up" in responding to a major outage event. The way a utility avoids that is to ensure that it completes pre-storm preparations in a timely, comprehensive, and effective manner.

3. Findings and Analysis

During the course of its investigation, Liberty issued many requests for information and conducted many interviews. Approximately 50 of the interviews specifically addressed issues related to Ameren-IL's pre-storm preparations and activities. Liberty based the findings in this section on the information gained in these interviews, the responses to the data requests, and Liberty's experience with and knowledge of utility practices. More specifically, this section presents Liberty's findings and analysis of the following:

1. Weather services, weather computer software, and internal processes available to and used by the Ameren-IL utilities prior to the 2006 storms
2. The effectiveness of these weather services, weather computer software, and internal processes in tracking the weather prior to the onset of the 2006 storms, including the extent and effectiveness of Ameren's use of them
3. Ameren's pre-storm activities in defining the severity and scope of the pending weather events in the 2006 storms
4. Ameren's pre-storm activities in predicting the amount of damage and number of customers affected by the pending weather events in the 2006 storms
5. Ameren's use of any pre-storm threat definition or damage prediction to determine in advance of the onset of the storms the amount of resources needed and to estimate the length of the outage event in each of the 2006 storms that are the subjects of this report

6. Ameren's pre-storm activities in alerting the response organization—and the entire Ameren organization—of the pending major outage events, including the timing and method of the alert process
7. Ameren's pre-storm activities in activating and mobilizing the response organization, including the activation of storm centers, mobilization of response units such as field checkers and repair crews, staging of repair material and equipment, and the acquisition and deployment of resources outside of the Ameren organization.

a. Weather Monitoring

Chapter II of this report describes the 2006 storms and includes information about Ameren-IL's use of weather services. This section supplements that information with analysis of the monitoring of weather conditions and system outages in the period leading up to the two 2006 storms, and how Ameren-IL used this monitoring in pre-storm preparations. More specifically, this section analyzes the monitoring performed by individual Ameren responders, the Distribution Dispatch Operations (DDO) centers, Emergency Operations Center (EOC) personnel, and the contracted weather service employed by Ameren at the time of the 2006 storms.

(1) Monitoring by Individual Employees

The Ameren employees who headed the key response functions and the seven Ameren-IL operating divisions during the 2006 storms were all seasoned, experienced utility operations veterans. Interviews with these individuals revealed that they monitor the weather on an ongoing basis—during regular business hours and after hours, weekends, and holidays—through the weather sources available to them. They not only monitor the weather, but also closely follow outages in their area using the Outage Analysis System (OAS).[1] In addition, key Ameren response personnel received automatic "pages" through a paging system from the contracted weather service, Surface Systems Inc. (SSI).[2] They also have a paging system that will alert them at a pre-determined level of outages in their area.[3] All of these processes and systems were in use at the time of the 2006 storms; many of the employees responsible for heading the divisions and the key response functions were aware of the weather forecasts and developments in the hours preceding the onset of the major outages.

In the case of the July 2006 storm, the information gathered by individual responders was inconclusive and did not lead them to take any specific pre-storm preparations prior to actual outages occurring in their area of responsibility.[4] The only exception to this was at the Peoria Operations Center where repair crews were "held over" at the end of the normal workday when it appeared that severe weather was imminent in that area.[5] In the November/December 2006

[1] For example, Interviews #17 (October 25, 2007), #24 (October 24, 2007), #68 (November 1, 2007), #69 (November 29, 2007), and #70 (November 1, 2007).
[2] Interviews #13 (October 3, 2007), and #106 (November 29, 2007), and the response to Data Request #357.
[3] Interviews #22 (October 24, 2007), #24 (October 24, 2007) and #70 (November 1, 2007).
[4] For example, Interviews #17 (October 25, 2007), #24 (October 24, 2007), #68 (November 1, 2007), #69 (November 29, 2007), and #70 (November 1, 2007).
[5] Response to Data Request #72, attachment #72A, page 2.

winter storm, monitoring by individual responders, Distribution Dispatch Operations (DDO) centers, Emergency Operations Center (EOC) personnel, and the contracted weather service provided a much clearer indication of a potential major event.[6]

(2) Monitoring by Distribution Dispatch Operations (DDO)

Four Ameren Distribution Dispatch Operations centers were responsible for the Ameren-IL service area during the 2006 storms – St. Louis, Decatur, Peoria, and Mattoon. Since the 2006 storms, Ameren-IL distribution dispatching has been consolidated in three offices, all located in Illinois. As a normal part of their duties, the distribution dispatchers monitor the weather using the contract service and other weather services available to them such as the Weather Channel, AccuWeather®, Intellicast®, the National Weather Service (NWS), local television weather reports. The contracted weather service at the time of the 2006 storms, Surface Systems Inc. (SSI) now DTN Meteorologic, initiated contacts with the Distribution Dispatch Operations concerning weather threats. This process was in place and was functioning in the pre-storm period of the 2006 storms, and the distribution dispatchers were aware of the weather forecasts and developments in the hours preceding the onset of the major outage.[7]

In addition, the Distribution Dispatch Operations centers monitor two supervisory control and outage analysis systems, Supervisory Control and Data Acquisition (SCADA) and the Outage Analysis System (OAS), on an ongoing basis, and are the "first line of defense" when system interruptions and outages occur. As part of their normal duties, the Distribution Dispatch Operations dispatchers at the four centers were monitoring these systems, were aware of system developments during the time period leading up to both of the 2006 major outages, and communicated this information to appropriate Ameren management personnel.[8]

(3) Monitoring by Emergency Operations Center (EOC) Personnel

The Ameren corporate Electric Emergency Restoration Plan (EERP) specifies that the Emergency Operations Center (EOC) "may also be activated by the prediction of a major event in preparation for restoration activities." The Electric Emergency Restoration Plan places the responsibility for activating the EOC on the EOC Director.[9] Although not specifically spelled out in the Electric Emergency Restoration Plan, this wording implies the obligation on the EOC Director/designee to monitor and maintain an awareness of weather and outage conditions that might indicate the potential for a major event. Within the EOC organization, operations managers have the responsibility for alerting and coordinating the response of specific operating divisions assigned to them. Ameren-IL split the responsibility for the seven Ameren-IL divisions between two operations managers.

[6] Interviews #17 (October 25, 2007), #24 (October 24, 2007), #68 (November 1, 2007), #69 (November 29, 2007), and #70 (November 1, 2007), and #83 (November 15, 2007).
[7] Interviews #11 (October 3, 2007), #13 (October 3, 2007), #93 (January 8, 2008), and #130 (January 10, 2008).
[8] Interviews #93 (January 8, 2008), and #130 (January 10, 2008).
[9] Response to Data Request #64, Subsection 2.1, page 4.

The EOC Director in charge of the entire Ameren response—both Missouri and Illinois—for the July 2006 storm reported that at approximately 3:00 p.m. on July 19 there was a thunderstorm in northern Illinois that was "not real big" and had caused "some outages." Ameren made a call to the contracted weather service, Surface Systems Inc. (SSI), who reported that the storm was moving south but would weaken after doing a little more damage. The EOC Director talked to the division having outages and learned that it did not need outside resources to assist them. The EOC Director said that there had been some activity in Iowa, northern Illinois, and southern Minnesota, but the activity was not atypical. As a result, everyone went about their normal activities and left work at the normal hour.

After the major event occurred on July 19, and while restoration efforts to restore that damage continued, a second storm hit the Ameren area on July 21. In the case of this second storm, the EOC Director reported that they became aware of that storm by 8:00 a.m. on July 21. He reported that Colombia, MO had 80 mph winds and 100-degree temperatures. Based on that, in his words, Ameren "could have expected it."[10] In the case of the second storm, since the restoration workforce was already in place and functioning, Ameren had already made the normal pre-storm preparations, and it was then only necessary to adjust and react to the new damage and outages caused by the second storm.

In the November 2006 storm, Ameren named a second EOC Director in addition to, not in place of, the existing Director. Both EOC Directors served as Co-Directors, with one responsible for Ameren-MO and the other responsible for Ameren-IL. The Co-Directors reported that on November 30, 2006, the potential for a winter storm was "pretty well known" by the Ameren responders. The weather service had told them to expect one-half inch of ice or more. The weather situation explained to them was wet with a cold front moving through, and the amount of icing would depend on how quickly the front moved through the area.

Ameren-IL held two conference calls with its operating divisions on November 30, one early in the day, and another at 2:30 p.m. For the first call, the weather forecast was for some icing but was very "unspecific." On the second call, the forecast was more encouraging with no significant icing. As it turned out, the "icing line" was much wider than the weather service predicted. Instructions for the divisions on these calls were to get out the storm plans and check them and contact employees, vendors, and lodging establishments to put them on alert.[11]

In summary, Ameren EOC personnel were monitoring weather and outage conditions in advance of both the 2006 storms, and had communications with the operating divisions in Ameren-IL prior to the onset of the major outage events.

(4) Monitoring by Contracted Weather Service

At the time of the 2006 storms, Ameren had a contracted weather service, Surface Systems Inc. (SSI), predecessor of present supplier, DTN Meteorologic. As part of their contracted services, SSI provided Ameren with a weather forecast each morning plus notification of National Weather Service (NWS) warnings and watch "alerts" by means of automatic "pages" to

[10] Interview #11 (October 3, 2007).
[11] Interviews #11 (October 3, 2007) and #83 (November 15, 2007).

designated Ameren personnel using a paging system.[12] Ameren provided the list of designated personnel to SSI.[13] These individuals had the ability to disable this alert at their own discretion.[14]

In the case of the July 19, 2006, storm, after initial outages had begun in the northern portion of the Ameren-IL service area, SSI reported that the storm was moving south but would weaken after doing a little more damage. The EOC Director responsible for Ameren-IL in the July 2006 storm rated the performance of SSI in predicting the July 19 storm as "very poor" but stated that all weather services missed on this storm. For the second July storm, he rated SSI's performance as "good" and said that that they were aware of that storm by 8:00 a.m. that day.[15]

The EOC Director for Ameren-MO assessed the SSI performance in the November 2006 storm as "pretty good." The Ameren-IL EOC Co-Director during the November 2006 storm said that although the potential for a winter storm on November 30 was "pretty well known" in the Ameren organization, the SSI forecast was "unspecific" with earlier forecasts of ½″ or more of ice, and then later more encouraging forecasts that there would be no significant icing. As it turned out, the system reformed, bringing more icing across a wider area than originally predicted.[16] One interviewee stated that due to the erroneous information from the weather service that the threat had passed, Ameren released crews that it had held over after the normal workday, and then had to call them back out again later.[17]

According to one interviewee, SSI initiates contact concerning weather threats and Ameren follows up. Ameren can call SSI at any time. They do not set up specific conference calls with SSI. Rather, one Ameren representative usually calls and gets the information. This person typically asks the question "Is there anything else you can tell us?" The calls are "short and to the point." Ameren followed this process for both the July and November 2006 storms.[18] Another interviewee stated the opinion that Ameren was not aggressive in pushing SSI for better information in the 2006 storms.[19] Liberty concluded that Ameren was not proactive with SSI at the time of the two 2006 storms. It did not use conference calls and follow-up questioning in any attempt to gain more information about the probability of a major weather event.

b. Threat Prediction

Effective monitoring of the weather and utility system disturbances and outages is an important part of pre-storm preparations. While Ameren engaged in pre-storm monitoring, there is room for improvement. Equally important is the next step, which is to use the information gained by monitoring the weather and system outages to develop a prediction of the severity and scope of the threat. The utility should express the prediction in terms of the timing of onset of the event, the area affected, the number of customer outages, the amount of damage (*e.g.*, number of poles, conductor spans, switches, and transformers damaged), and the anticipated total restoration time.

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[12] Interviews #13 (October 3, 2007), #106 (November 29, 2007), and the response to Data Request #357.
[13] Response to Data Request #127 and Interview #40 (November 6, 2007).
[14] Interview #106 (November 29, 2007).
[15] Interview #13 (October 3, 2007).
[16] Interviews #11 (October 3, 2007) and #83 (November 15, 2007).
[17] Interview #77 (November 2, 2007).
[18] Interview #93 (January 8, 2008).
[19] Interview #88 (January 9, 2008).

Although Ameren monitored the weather and customer outages in advance of the onset of the two major 2006 storms, it had no process in place to use this information in predicting the scope and severity of the events.

The Ameren corporate Electric Emergency Restoration Plan (EERP) defines storm levels in terms of the number of operating divisions affected and the source of the needed assistance to restore power (see Chapter III – Emergency Plans). Liberty recommends in Chapter III that Ameren revise the corporate Electric Emergency Restoration Plan to define storms in terms of the number of customer outages and anticipated restoration time. Doing this will help Ameren in its pre-storm preparations by defining in more specific terms the anticipated outages and length of restoration, which can then be used to determine the amount of resources needed to meet this restoration target.

In response to a specific data request concerning the use of predictive modeling to determine in advance the potential impact of an approaching weather event, Ameren responded: [20]

> *Ameren is aware of the presence of predicative (sic) weather/system models and their potential use in the utility business. At the present time the models do not provide sufficient additional benefit over and above existing services to warrant any actions other than ongoing monitoring of their status and implementation at other utilities."*

In this response, Ameren refers to "existing services," but Liberty's investigation did not reveal any processes or services used by Ameren to predict the scope or severity of either the July 2006 storm or the November/December 2006 storm.

In addition to helping set restoration targets and expectations of constituents, a benefit of using such a modeling process is in predicting the amount of resources the utility will need. Responses to a number of interviews indicated that Ameren did not have a specific number of needed resources in mind when seeking to recruit outside help. The statement used by one interviewee, "get everyone you can coming this way"[21] is indicative of the approach Ameren used in its recruitment of outside resources. In another interview, one of the Ameren responders responsible for recruitment of outside help stated that it was a hard decision as to "how far out to go," speaking of which outside resources it should contact and ask to respond.[22]

Notwithstanding Ameren's response to the contrary, predictive modeling has proven to be quite beneficial to utilities in planning for and responding to a major outage event. Predictive modeling is a best practice among utilities. Utilities can purchase commercial models or develop their own. Ameren could have enhanced its pre-storm preparations by using a predictive model.

c. Pre-Event Alert Process

Another key element in pre-storm preparations is the notification, or alert, process. This section analyzes the pre-event alert processes used by Ameren in the 2006 storms to notify the response

[20] Response to Data Request #149.
[21] Interview #77 (November 2, 2007).
[22] Interview #82 (November 29, 2007).

organization of the pending threat of a major outage event, including the timeliness and effectiveness of this alert process.

(1) Alert Process Used by Ameren in 2006 Storms

In the period leading up to the two major 2006 outage events, key Ameren responders became aware of the potential threat by individual monitoring of weather systems and outages. Dispatchers at the Distribution Dispatch Operations (DDO) centers monitored the weather and system disturbances and outages. Emergency Operations Center (EOC) personnel monitored the weather systems and outages, and made contact with Surface Systems Inc. (SSI). SSI sent out a morning forecast and alerted designated Ameren responders via pager of any National Weather Service (NWS) weather alerts. As the weather systems intensified and widespread outages began to occur, Ameren initiated its process to alert the response organization of the onset of a major outage event.

Ameren's alert process for the 2006 storms was the following. People who were responsible for a particular function called the others involved in that function. Ameren used computerized duty screens listing those for contacting. Ameren made these calls in a timely manner. Ameren does not use a paging system to notify personnel.[23]

The use of a paging system to alert responders in a large utility such as Ameren is a utility best practice. In addition to saving the time of key response personnel, paging has proven to be more effective in alerting a large number of responders in the shortest time.

(2) Effectiveness of Ameren's Alert Process in 2006 Storms

Liberty found that Ameren's alert process as described above was effective. In the July 2006 storm and the November 2006 storm, the key responders "became aware" (a term used by several interviewees) of the threat or onset of a major outage event. Ameren relayed this information by e-mail, personal telephone call, or conference call. For some, the message came from their supervisor, for others from operations managers. Some employees received a call from the Emergency Operations Center (EOC) and still others heard from the Distribution Dispatch Operations (DDO) dispatchers. Although this alert process was effective, some interview responses indicated that there was a delay in alerting some response functional areas. Specifically, nobody alerted one of the key responders in the stores function of the major event in July until the next day. Nobody contacted Fleet Administration (fueling function) in the July storm until the second day, after crews had been working for 1½ days. Some of the Corporate Communications interviewees stated that they may receive an alert from an internal source, but in some cases, their first alert is from an external media contact. In addition, several of the interviewees could not recall who or how they were first alerted to the threat or onset of the 2006 major outage events.[24] There clearly is an opportunity for improvement in the effectiveness of the Ameren alert process by using a paging system.

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[23] Interview #84 (November 28, 2007).
[24] For example, Interviews # 16 (October 25, 2007), #20 (October 24, 2007), #22 (October 24, 2007), #24 (October 24, 2007), #71 (November 2, 2007), #74 (October 29, 2007), #76 (October 29, 2007), #87 (November 27, 2007), #89 (January 9, 2008), #90 (November 27, 2007), and #97 (November 13, 2007).

d. Pre-Event Mobilization and Activation

The pre-storm preparations of a utility in anticipation of a major outage event follow the sequence of activities described in this report. The utility monitors weather systems and forecasts along with system disturbances and outages. It uses this information to predict the severity and scope of the approaching storm. It alerts the response organization. Finally, it activates command centers and mobilizes resources and support functions. This section analyzes the pre-storm preparations of Ameren-IL in responding to the 2006 storms in the following areas: activation of command centers, mobilization of Ameren first responders, repair and tree crews and field checkers, mobilization of key support functions, and recruitment and mobilization of outside resources.

(1) Activation of the Corporate Emergency Operations Center (EOC), Division Command Centers, and Operations Center Storm Rooms

Activation of Ameren Corporate Emergency Operations Center (EOC)

The best way to describe Ameren's approach to managing a major restoration effort is "collaborative." Although most interviewees stated that the EOC Director ultimately had the authority to direct action (*e.g.*, tell divisions to activate their response organization), in practice each division and its operations centers made their own decisions as to the activation and mobilization of their command centers, storm rooms, and response organization. With regard to the corporate EOC, someone sometimes told individual EOC team members and functional units when to report and in other instances the individuals made those decisions independently.[25]

In July 2006, Ameren activated the corporate EOC at 7:15 p.m. on July 19.[26] The weather system that generated the July 19 storm did not follow a usual pattern, and the weather forecasts called for the system to weaken. The intense storm caught Ameren responders by surprise, so there was little advance preparation anywhere. Ameren did not activate the corporate EOC in advance of the storm. When the severe weather hit the metropolitan St. Louis area, the EOC Director initiated a conference call with key EOC team members and proceeded to the Emergency Operations Center at the Ameren General Office Building (GOB) in St. Louis.[27] According to the Ameren alert process, Ameren contacted EOC functional leaders and they in turn contacted the others involved in their functions.[28]

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[25] Interviews #11 (October 3, 2007), #16 (October 25, 2007), #20 (October 24, 2007), #23(October 24, 2007), #79 (November 13, 2007), #80(November 28, 2007), #82 (November 29, 2007), #86 (November 27, 2007), #94(January 14, 2008).
[26] Response to Data Request #72, attachment 72A, page 3.
[27] Interview #11 (October 3, 2007).
[28] Interviews #79 (November 13, 2007), #88 (January 9, 2008), #91 (November 27, 2007), #92 (November 15, 2007), #95 (January 10, 2008).

In the November 2006 storm, Ameren followed the following pre-storm response timeline:[29]

"Thursday, November 30, 2006

2:30 PM	A conference call was held with all Illinois managers to discuss the potential for significant icing
8:00 PM	The staff of the Ameren Emergency Operations Center, managers of contractor support and others decided to call in electric employees for work at 6 AM on December 1 in anticipation of power outages.
10:00 PM	The Emergency Operations Center was opened"

Ameren released general office employees from work early on November 30 due to bad weather and told them to report to work the next day. This included a number of EOC team members. Even though Ameren opened the Emergency Operations Center at 10:00 p.m. on November 30, it did not fully staff the center until the next day. Many of the EOC team members stated that they reported to the EOC for the first time on December 1.[30] One key EOC team member, an Operations Manager responsible for coordinating resources at the EOC level between the Ameren-IL operating divisions, did not report to the EOC for several days, opting to work out of a field office and a Distribution Dispatch Operations center at the outset.[31] One of the EOC team members who reported the next morning arrived to find that others had made some of the decisions in his assigned area of responsibility before his arrival.[32]

Even though a number of the EOC team members did not report until the next day, they were able to perform their response duties from home by using a computer and telephone. Notwithstanding this fact, a key element of an effective response to a major outage is to have the command team activated and assembled at the command center well in advance of the onset of the storm. Ameren-IL operating divisions report that significant outages began early in the evening of November 30, and at that time, it was obvious that this was going to be a major event.[33] Ameren's approach to staffing and activating the corporate EOC was in keeping with its "collaborative" approach to managing the restoration effort. Considering Ameren's experience just four months earlier with the July 2006 storm, and the fact that it had ample advance notice of the potential of a major storm, Ameren should have performed its activation of the corporate EOC in a more structured, timely, and efficient manner.

Activation of Division Command Centers and Operations Center Storm Rooms

Ameren-IL activated division command centers and operations center storm rooms at the time outages began in both July and November 2006. The only difference was that in the case of the July 2006 storm there was no advance notice. In November 2006, Ameren-IL held conference calls in advance and told divisions to get their storm plans out and check them and contact

[29] Response to Data Request #72, Attachment #72B, page 5.
[30] Interviews #79 (November 13, 2007), #82 (November 29, 2007), #86 (November 27, 2007), #87 (November 27, 2007).
[31] Interview #23 (October 24, 2007).
[32] Interview #80 (November 28, 2007).
[33] Interviews #69 (November 29, 2007), #126 (January 14, 2008).

employees, vendors, and lodging establishments, and alert them to the pending threat.[34] Liberty learned that these activations went well, and that the appropriate people were in place at the command centers and storm rooms in a timely manner.[35]

(2) Mobilization of Ameren first responders, repair crews, tree crews and field checkers

First responders and repair crews

Because the July 2006 storm caught Ameren-IL by surprise and unprepared, there was no pre-storm mobilization of any first responders or repair crews. The only exception to this was at the Peoria Operations Center, where management held crews and contractors over at the end of the normal workday on July 19 in anticipation of outages.[36] At all other Ameren-IL operations centers, Ameren-IL did not mobilize these responders until after outages began. After the storm hit, all Ameren-IL operating divisions mobilized in an "all hands on deck" manner, both the affected divisions and the divisions that were "exporting" help to others.[37]

On November 30, 2006, with advance notice of the approaching winter storm, there was some pre-storm mobilization in some of the Ameren-IL operating divisions. As the weather system moved across the Ameren-IL service area from west to east, the anticipated time of impact varied between those areas in the western part of the service area from those to the east. Accordingly, management made different decisions as to whether to hold over crews and first responders at the end of the normal workday, or to send them home for rest and reporting early the next day.

Ameren-IL Divisions IV and VI both reported that they held some responders over on November 30. There was one report that due to erroneous information from the weather service indicating that the threat had passed, management released some held crews and then had to call them back out again later.[38] Division II reported a contact from the Operations Manager on November 30 seeking to put some of the Division II crews "in queue" before the storm hit in anticipation that the storm would not hit Division II hard and management would ready the crews for sending to the aid of others. In this case, management decided to wait until the leading edge of the system had passed through Division II before taking that step.[39] All Ameren-IL divisions implemented an "all hands on deck" mobilization at the time outages began in their area or early in the morning of December 1, including the divisions "exporting" help to others as well as those heavily impacted by the storm.[40]

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[34] Interview #83 (November 15, 2007).
[35] Interviews #24 (October 24, 2007), #68 (November 1, 2007), #69 (November 29, 2007), #70 (November 1, 2007), #71 (November 2, 2007), #73 (October 29, 2007), #126 (January 14, 2008).
[36] Response to Data Request #72, Attachment 72A, page 2.
[37] Interviews #16 (October 25, 2007), #20 (October 24, 2007), #22 (October 24, 2007), #68 (November 1, 2007), #71 (November 2, 2007), #73 (October 29, 2007), #75 (October 31, 2007).
[38] Interview #77 (November 2, 2007).
[39] Interviews #22 (October 24, 2007), #69 (November 29, 2007), #73 (October 29, 2007).
[40] Interviews #16 (October 25, 2007), #20 (October 24, 2007), #22 (October 24, 2007), #68 (November 1, 2007), #71 (November 2, 2007), #73 (October 29, 2007), #75 (October 31, 2007).

Tree crews

Ameren uses four contract tree companies that maintain crews on the Ameren property at all times. As the July 2006 storm caught them by surprise, there was no pre-storm mobilization of tree crews. After the storm had hit, Ameren made calls to the four contractors on the night of July 19, and mobilized all available tree crews on Ameren's property early in the morning of July 20. Management relocated those working in areas not hit by the storm to affected areas that morning.

Ameren called some tree crews in on November 30 to work with repair crews as "first responders." Ameren sought to limit the number called in early so as not to "burn out" too many tree crew resources in the first hours of the restoration.[41]

Field Checkers[42]

After the storm hit on July 19, Ameren made a call to the Field Checker team leaders. The lead Field Check responder told them to report in early the next morning at a specified location. On November 30, Ameren conducted a conference call prior to the onset of the outage event. Ameren told Field Checkers when and where to report the next day.

The field checking (damage assessment) process is essential to a successful response to a major outage event. As soon as the severe weather has passed and there is enough daylight to be able to make an assessment, the field checkers should be in place making their initial assessments. Liberty found that the pre-storm preparations in mobilizing field checkers by Ameren-IL in the November 2006 storm (when they had advance notice) was appropriate and effective.

(3) Mobilization of key support functions

With no advance notice of the July 2006 major outage event, there were no pre-storm preparations by Ameren-IL in mobilizing the key support functions of safety, logistics, fueling, security, and stores/materials. With two exceptions, Ameren alerted and mobilized each of these support functions shortly after the storm had hit on July 19. In the case of fueling, there was no request to mobilize until the second day of the storm, after crews had been working 1½ days. In the stores/materials function, the lead responder for Ameren-IL did not receive a request to mobilize until early in the morning of July 20.[43]

In the case of the November 2006 storm, each of these support functions had advance notice of the approaching storm and made the appropriate pre-storm preparations. Liberty particularly noted that the stores/material function implemented continuous 12-hour shifts at the Ameren-IL Materials Distribution Facility (MDF) and moved a stores trailer from Decatur to Belleville, IL prior to the onset of the storm.[44]

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[41] Interview #94 (January 14, 2008).
[42] "Field Checkers" is the term used by Ameren to describe those responders whose assignment is to go out into the field, inspect the facilities, record all damages, and enter this information into the Outage Analysis System (OAS).
[43] Interviews #89 (January 9, 2008), #90 (November 27, 2007).
[44] Interviews #85 (November 27, 2007), #89 (January 9, 2008), #90 (November 27, 2007), #92 (November 15, 2007), and response to Data Request #72, Attachment #72B, page 5.

(4) Recruitment and Mobilization of Outside Resources

For the purpose of this report, Liberty refers to outside resources meaning contract line and tree crews that were not already on Ameren property prior to the onset of the major outage event and to Mutual Assistance[45] utility crews.

Contract line crews

With no advance notice before the storm hit on July 19, there was no pre-storm mobilization of outside contract line crews. Ameren made calls the night of July 19 after the storm had hit. In the case of the November 2006 storm, although Ameren lead team "had discussions" prior to the onset of the storm, they did not think it was going to hit them, and made no calls until early on December 1.[46]

Contract tree crews

With advance notice of a coming winter storm on November 30, Ameren called tree contractors prior to the event to determine the amount of resources available not presently working on Ameren's property. Ameren responders responsible for procuring tree crews stated that they could not perform a "full blown" assessment until the next morning and so did not target a specific amount of additional tree crew resources prior to the onset of the event.[47]

Mutual Assistance utility crews

Ameren is a member of two utility Mutual Assistance groups, Edison Electric Institute (EEI) and Midwest Mutual Assistance Group (MMAG). There are a number of such groups, most of which are regional in scope due to the fact that the most probable and reasonable approach to bringing in other utilities to assist is to draw from those nearby. As a matter of practice, Ameren uses the Midwest Mutual Assistance Group as its first resort.

After the storm had hit its service area on July 19, Ameren made the first calls to Mutual Assistance utilities that night. The initial calls were to individual utilities rather than to the Mutual Assistance Group. When a utility contacts the Midwest Mutual Assistance Group, the group sets up a teleconference with all participating utilities. The Ameren responder who had the lead in making Mutual Assistance calls said that he "sort of backed into" the Midwest Mutual Assistance Group calls in the July 2006 event.

In the November 2006 storm, Ameren did not initiate the Mutual Assistance calls until the Ameren responder came into the EOC early on the morning of December 1.[48]

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[45] "Mutual Assistance" is a term used to describe the agreement between electric utilities to assist each other during major outage events on a "not for profit" basis.
[46] Interviews #88 (January 9, 2008), #95 (January 10, 2008).
[47] Interview #94 (January 14, 2008).
[48] Interview #82 (November 29, 2007).

Given the Ameren experience in the July 2006 event and the advance notice available on November 30, Ameren should have been more aggressive in seeking to procure and mobilize outside resources during the day of November 30.

4. Conclusions

1. Ameren monitored weather and its transmission and distribution systems prior to the 2006 storms.

Many of the Ameren employees heading the key response functions and the seven Ameren-IL operating divisions monitored the approaching weather systems associated with the 2006 storms on an individual basis.

These seasoned utility operations veterans regularly monitored not only the weather using the weather service and Internet weather sources but also power outages using the Outage Analysis System (OAS). They did this during normal work hours and after hours. In addition, the contracted weather service sent pager notifications with information concerning National Weather Service (NWS) watch alerts, and they have a paging system that alerts them at a pre-determined level of outages in their area. Because of this, there was a certain level of awareness among most of the key Ameren response leaders about the potential for a major outage event in both 2006 storms.

The Distribution Dispatch Operations (DDO) centers responsible for the Ameren-IL service area at the time of the 2006 storms monitored the approaching weather systems as well as system disturbances and outages and were aware of system developments during the time period leading up to both 2006 major outages.

As a normal part of their duties, the distribution dispatchers monitor the weather using the contract service and other weather services available to them such as the Weather Channel, AccuWeather®, Intellicast®, the National Weather Service, and local television weather reports. The contracted weather service at the time of the 2006 storms initiated contacts with the Distribution Dispatch Operations concerning weather threats. This process was in place and was functioning in the pre-storm period of the 2006 storms, and the distribution dispatchers were aware of the weather forecasts and developments in the hours preceding the onset of the major outage.

The Emergency Operations Center (EOC) personnel responsible for the Ameren-IL service area at the time of the 2006 storms monitored the approaching weather systems as well as system outages, were aware of developments during the time period leading up to both of the 2006 major outages, and communicated this information to the Ameren-IL operating divisions.

2. The weather forecasts and major storm predictions as furnished by Ameren's contracted weather service lacked the specificity and accuracy needed for Ameren to properly prepare in advance for a major outage event. Ameren did not aggressively interact with SSI in an attempt to gain as much information as possible about the probability of a major outage event. (Recommendation IV-1)

Key Ameren response personnel described the performance of the contracted weather service as "poor," "pretty good," and very "unspecific." The only favorable rating was for the July 21 storm that hit while Ameren was repairing the damage from the July 19 storm. In the case of the July 19 event, SSI forecasted the system to weaken when, in fact, it intensified, and in the November storm, SSI advised Ameren that there would not be significant icing, only to see the system re-organize and bring heavy icing to a larger area than originally forecast. While it is apparent that most if not all weather services did not forecast the severity of the July 19 storm, there is obvious room for improvement in the performance of the contracted weather service.

Ameren may have been able to mitigate this deficiency on the part of the contracted weather service through a more aggressive approach in interacting with the service. The use of conference calls and probing, follow-up questions with weather services is a utility best practice that Ameren should implement.

3. Ameren's decision not to use predictive modeling in its pre-storm preparations and ongoing response planning in the 2006 storms restricted its ability to determine the number of resources needed and to provide an early prediction as to the length of the restoration. (Recommendation IV-2)

Predictive modeling is in use by many utilities, has proven to be very beneficial, and is a best practice. Ameren does not believe that such models provide sufficient benefit. Liberty disagrees.

4. The process used by Ameren-IL to alert its response organization, while somewhat effective, has room for improvement. (Recommendation IV-3)

The stated alert process used by Ameren in the 2006 storms was telephone calls from the person responsible for a particular response function to the others involved in that function. All responders "became aware" of the threat or onset of a major event in the 2006 storms through different sources. There were some delays reported in receiving notice, and several interviewees did not recall how someone alerted them. The process used by Ameren is also labor-intensive for key response leaders, who might put their time to better use in the early notification stage of a major outage response.

5. The November 2006 activation of Ameren's corporate Emergency Operations Center (EOC) was not structured, timely, or efficient. (Recommendation IV-4)

The activation of the Ameren corporate Emergency Operations Center (EOC) in the July 2006 storm did not occur until after the outages began because the weather forecasts did not predict a major storm. The activation of the corporate EOC in the November 2006 storm did not occur until after the outages began earlier that evening, and a number of EOC team members did not report to the EOC until the next morning. This was due in part to Ameren's "collaborative"

approach to managing major outage events during the 2006 storms. Considering Ameren's experience just four months earlier with the July 2006 storm, and the fact that they had ample advance notice of the potential of a major storm, Ameren should have activated the corporate EOC in a more structured, timely, and efficient manner.

6. Ameren-IL activated its division command centers and operations center storm rooms in the 2006 storms in an effective manner.

Division command centers and operations center storm rooms activated at the time outages began in July and November 2006. These activations went well and the appropriate people were in place at the command centers and storm rooms in a timely manner.

7. The mobilization of the Ameren-IL first responders and repair crews in the 2006 storms, although negatively affected by erroneous weather forecasts, was appropriate and effective given the information available.

Because the July 2006 storm caught Ameren-IL by surprise and unprepared, there was no pre-storm mobilization of any first responders or repair crews. The only exception to this was at the Peoria Operations Center, where management held over crews and contractors at the end of the normal workday on July 19 in anticipation of outages.

On November 30, 2006, as the weather system moved across the Ameren-IL service area from west to east, the anticipated time of impact varied between those areas in the western part of the service area from those to the east. Accordingly, management made different decisions as to whether to hold over crews and first responders at the end of the normal workday or to send them home for rest. In the case of both storms, after the storm hit, all Ameren-IL operating divisions mobilized in an "all hands on deck" manner.

8. Pre-storm preparations in mobilizing field checkers and key support functions by Ameren-IL in the November 2006 storm were appropriate and effective.

The field checking (damage assessment) process is essential to a successful response to a major outage event. As soon as the severe weather has passed and there is enough daylight to be able to make an assessment, the field checkers should be in place and making their initial assessments. Ameren notified field checkers on November 30 about when and where they were to report.

Each of the support functions had advance notice of the approaching storm and made the appropriate pre-storm preparations. The stores/material function implemented continuous 12-hour shifts at the Ameren-IL Material Distribution Facility (MDF) and moved a stores trailer from Decatur, IL to Belleville, IL prior to the onset of the storm.

9. The mobilization of outside resources in the November 2006 storm should have been more proactive, procuring and mobilizing these resources to come to the aid of the Ameren-IL operating divisions prior to the onset of the event. (Recommendation IV-5)

With advance notice of a coming winter storm on November 30, Ameren called tree contractors prior to the event to determine the amount of resources available not presently working on Ameren's property. Ameren did not target a specific amount of additional tree crew resources prior to the onset of the event. With regard to contract line crews and Mutual Assistance utility crews, Ameren did not initiate calls until December 1, after the storm had hit.

5. Recommendations

IV-1 Improve service level agreements with weather service providers. Engage weather service providers more aggressively. (See Chapter II – The Storms, Recommendation II-1)

Liberty's evaluation of Ameren-IL's pre-storm preparations re-emphasized the need to improve service level agreements with weather service providers and engage weather service providers more aggressively as recommended in Chapter II of this report. If not already in place, Ameren-IL should implement the practice of engaging the weather service provider more proactively within two months of the date of this report.

In its comments on the draft report, Ameren-IL accepted this recommendation.

IV-2 Implement predictive modeling to forecast the scope and severity of potential major outage events.

Liberty's evaluation of Ameren-IL's pre-storm preparations re-emphasized the need to implement predictive modeling as discussed in Chapter II of this report. As a number of utilities use predictive modeling, have proven it to be very beneficial, and consider it a best practice, Liberty recommends that Ameren-IL implement predictive modeling within 18 months of the date of this report.

In comments on the draft report, Ameren-IL proposed a study of the value of obtaining predictive modeling capabilities. Liberty believes it is clear that Ameren-IL would benefit from predictive modeling and that a commitment only to study its value is insufficient. However, Liberty agrees to review and consider an Ameren-IL cost-benefit analysis in the verification stage of this investigation, provided that Ameren-IL completes such a study within 12 months of the date of this report.

IV-3 Implement a notification process to alert the response organization of the threat or onset of a major outage event.

Ameren should implement a notification process to advise designated response personnel of the threat or onset of a major outage event. It should identify notification groups and specific messages sent to each group. Ameren-IL should implement this process within six months of the date of this report.

In comments on the draft report, Ameren-IL indicated that it had established a formal notification process using a broadcast e-mail system to all Ameren-IL emergency response stakeholders' Blackberry devices and personal computers. Ameren-IL said that a minimum of five primary stakeholders in each operating division receive these notices. This process appears to meet the intent of Liberty's recommendation.

IV-4 Implement an activation process for the Ameren corporate Emergency Operations Center (EOC) that will ensure that key EOC team members are in place at the EOC in advance of the onset of an outage event.

Ameren should identify "core" EOC team members and establish an activation process for notifying and assembling these team members at the EOC at a set time in advance of the anticipated onset of the outage event when adequate advance notice is available. Ameren-IL should implement this process within six months of the date of this report.

In comments on the draft report, Ameren-IL proposed an activation process that would have EOC team members "assume their roles" when there is significant, predictable, sufficient, and reliable notification of an emergency event. However, the most efficient way to respond adequately to a possible major outage event under such circumstances is to get key team members together early on at the EOC. Liberty does not agree with Ameren-IL's proposed activation process.

IV-5 Establish a more proactive, aggressive approach in procuring and mobilizing outside resources in advance of the onset of a major outage event.

The Ameren corporate Electric Emergency Restoration Plan (EERP) should clearly describe an aggressive approach to mobilizing outside resources. Ameren-IL should determine the anticipated number of outside resources needed and make contacts with contractors and Mutual Assistance utilities in advance. Ameren-IL should move resources in advance and stage them near the projected impact area when possible and as appropriate. Ameren-IL should implement this approach within six months of the date of this report, with the necessary modifications to the Electric Emergency Restoration Plan.

In its comments on the draft report, Ameren-IL proposed that it establish and implement an aggressive initial damage assessment process at the onset of a major outage event that facilitates early identification of the number of personnel needed to effect timely restoration of service.

Liberty strongly disagrees with this approach. One of Ameren-IL's most significant deficiencies was the lack of a predictive model to anticipate damage so that it could make requests for outside help in advance of the onset of a major weather event. In its proposal, Ameren-IL would make an actual damage assessment after the storm has hit before determining how much help it needs and initiating any efforts to recruit outside help. Ameren-IL's concern about impacts of Ameren's membership in Mutual Assistance organizations is unwarranted. Moreover, nothing in Liberty's recommendation suggests that Ameren-IL should not seek a "balance between proactive response and financial stewardship." Despite the unsatisfactory experience encountered by Ameren-IL in July 2006 in seeking outside help, and despite the fact that it had considerable advance warning of the approaching winter storm in the last week in November 2006, it did nothing to contact other utilities and try to line up any help in advance.