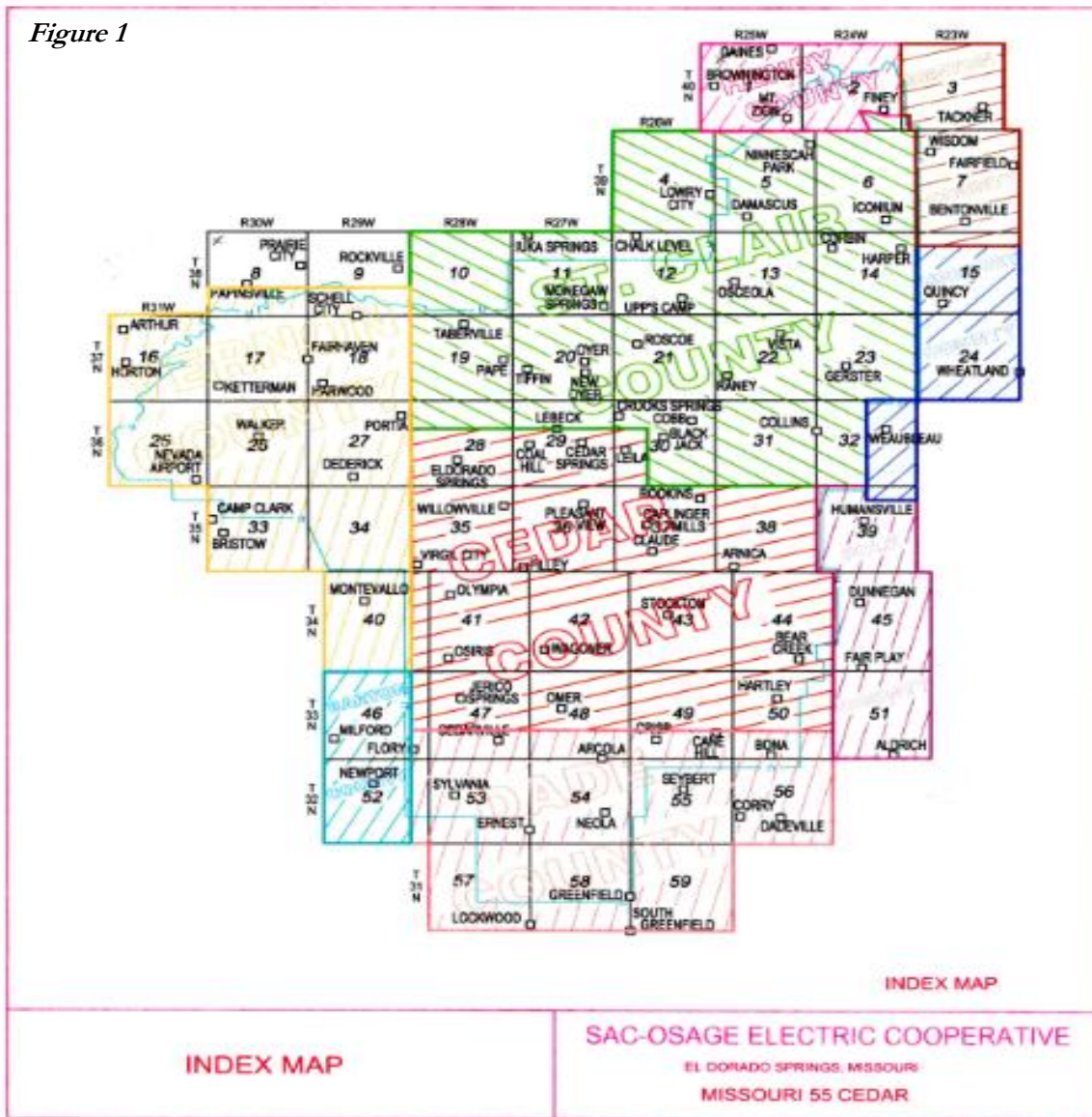


## Section 1: Introduction

Sac Osage Electric Cooperative (SOEC) was established in 1940 to provide electric service to the rural areas of west-central Missouri. A Touchstone Energy Cooperative, SOEC is headquartered in El Dorado Springs Mo, and provides service to customers in St. Clair, Vernon, Cedar, and Dade, as well as parts of Barton, Polk, Hickory, Benton, and Henry Counties in Missouri. The cooperative is run by a board of nine directors which approve the company's mission and internally developed business policy:

“Sac Osage Electric’s (the Cooperative) primary mission is to make the Cooperative the provider of choice for all of its customers. This mission requires that the Cooperative function as a financially sound business enterprise committed to the following:

1. **Voluntary and Open Membership** — Cooperatives are voluntary organizations, open to all persons able to use their services and willing to accept the responsibilities of membership, without gender, social, racial, political, or religious discrimination.
2. **Democratic Member Control** — Cooperatives are democratic organizations controlled by their members, who actively participate in setting policies and making decisions. The elected representatives are accountable to the membership. In primary cooperatives, members have equal voting rights (one member, one vote) and cooperatives at other levels are organized in a democratic manner.
3. **Members’ Economic Participation** — Members contribute equitably to, and democratically control, the capital of their cooperative. At least part of that capital is usually the common property of the cooperative. Members usually receive limited compensation, if any, on capital subscribed as a condition of membership.
4. **Autonomy and Independence** — Cooperatives are autonomous, self-help organizations controlled by their members. If they enter into agreements with other organizations, including governments, or raise capital from external sources, they do so on terms that ensure democratic control by their members and maintain their cooperative autonomy.
5. **Education, Training, and Information** — Cooperatives provide education and training for their members, elected representatives, managers, and employees so they can contribute effectively to the development of their cooperatives. They inform the general public, particularly young people and opinion leaders, about the nature and benefits of cooperation.
6. **Cooperation among Cooperatives** — Cooperatives serve their members most effectively and strengthen the cooperative movement by working together through local, national, regional, and international structures.
7. **Concern for Community** — while focusing on member needs, cooperatives work for the sustainable development of their communities through policies accepted by their members.



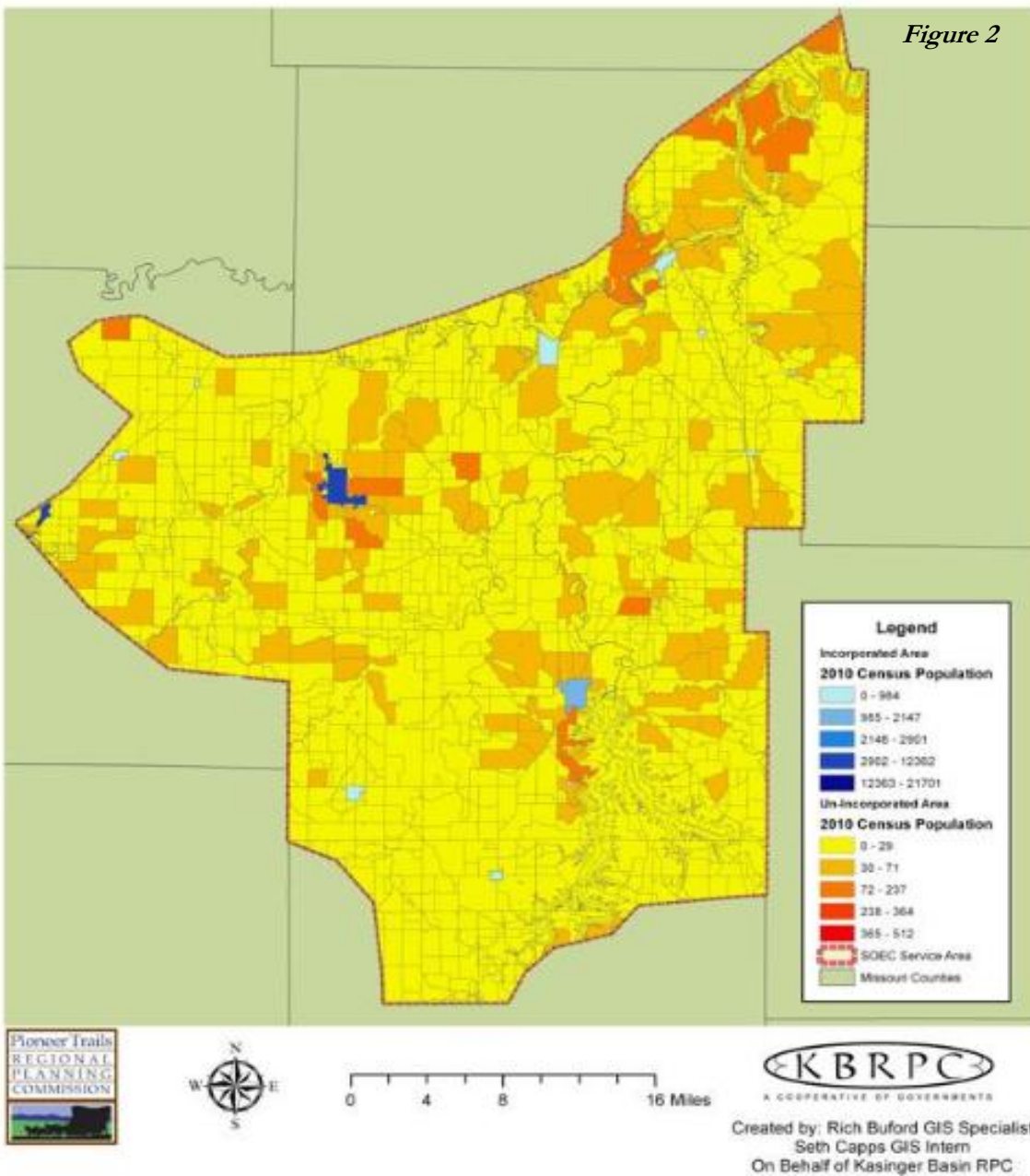
SOEC’s service boundaries within the state of Missouri include all of Cedar County, three quarters of St. Clair County, and portions of Barton, Benton, Dade, Henry, Hickory, Polk and Vernon counties. The cooperative owns 2,419 miles of service line within these counties. Figure 1 depicts the geographic boundaries of the cooperative in relation to USGS local quadrangles within the state of Missouri. (Map sources: [www.usgs.gov](http://www.usgs.gov), Association of Missouri Electric Cooperatives, Sac Osage Electric Cooperative.)

The customer base of SOEC is approximately 19,623 members in nine counties in Missouri. Residential customers account for 96% of memberships (18,446 members) while nonresidential customers make up the remaining 4% (784 members). Table 1.1 provides the summary of metered

County	Meters by Missouri County
Barton	13
Benton	215
Cedar	8,366
Dade	1,304
Henry	942
Hickory	35
Polk	77
St. Clair	6,469
Vernon	2,202

customers by Missouri County.

The average daily customer usage for SOEC is 37.3 kilowatt-hours (kWh). Annual total usage of SOEC customers in 2010 was 144,392,646 kWh of service. Population density for the cooperative service area is depicted in Figure 2 (*Map source: U.S. Census 2010*)



## Section 2: Planning process

Through a partnership between the Association of Missouri Electric Cooperatives and the Missouri Association of Councils of Government, the Kaysinger Basin Regional Planning Commission was contracted to facilitate a hazard mitigation planning process for SOEC. The initial meeting between the two entities was held on February 8, 2011 as part of a regional kick-off meeting for central Missouri. This informational meeting provided the basic responsibilities for each agency and allowed for initial discussion concerning the project timelines, data collection and other pertinent topics.

Three additional planning meetings were held at the SOEC offices in Eldorado Springs during the month of August, September, and October. Table 1.2 summarizes the attendees and topics of each meeting. Meeting minutes are available in the chapter appendix.

Table 1.2		SOEC Planning Meeting Synopsis
Meeting Date	Attendees, Title, Organization	Topics of discussion
August 11, 2011	Michael Cheek, Coop member Lila Foster, City of Osceola Sara Peters, Coop member Ralph Bland, Financial & Admin. Mgr. (SOEC) Tom Killibrew, General Mgr. (SOEC) Jim Davis, Asst. Mgr. (SOEC) Rodger Culbertson, Line Supt. (SOEC) Nolan Davis, Crew Foreman (SOEC) Dan Hackleman, Staking Engineer (SOEC) Tom Hutchings, KBRPC Sam Dingfelder, KBRPC	SOEC business structure Asset inventory by type and location Purpose and structure of plan Data collection assignments Question and answer session
August 31, 2011	Tom Killibrew, General Manager (SOEC) Jim Davis, A.M./Engineer (SOEC) Rodger Culbertson, Line Supt (SOEC) Nolan Davis, Crew Foreman (SOEC) Tom Hutchings, KBRPC Sam Dingfelder, KBRPC	Data collection review Current business procedures Establishment of goals, actions and objectives
October 13, 2011	Tom Killibrew, General Manager (SOEC) Jim Davis, A.M./Engineer (SOEC) Rodger Culbertson, Line Supt (SOEC) Nolan Davis, Crew Foreman (SOEC) Tom Hutchings, KBRPC Sam Dingfelder, KBRPC	Review of DRAFT plan including format and statistics

### *Public Involvement*

As with all public hazard mitigation plans, public involvement was encouraged through a variety of methods. SOEC posted their local chapter on the company's website, inviting both cooperative members and the general public to provide comment. A news announcement was submitted to every SOEC county newspaper and radio station. Additionally, SOEC's mitigation plan will be included in the plans posted on KBRPC's website for comment. ([www.kaysinger.com](http://www.kaysinger.com)) Comments from neighboring jurisdictions were also solicited using the standardized KBRPC letter which was mailed to the appropriate contacts, including:

- Barton County Commission
- Dade County Commission
- Cedar County Commission
- Henry County Commission
- Hickory County Commission
- Polk County Commission
- St Clair County Commission
- Vernon County Commission;
- Cities within the SOEC service area,
- Local emergency management directors; and
- County health departments.

SOEC also provides service to the following critical facilities Truman Nursing Home, St. Clair County, communication towers in Lowry City, Osceola and Stockton, power for KMOS radio and at television station, KRDK in Stockton.

**Section 3: Asset inventory**

Sac Osage Electric Cooperative has a wide variety of assets by type. Real estate owned by the company includes office buildings and other outbuildings throughout the service area. Twenty-five vehicles provide access to customers and infrastructure. SOEC does not own any electric generation or transmission infrastructure. More than 2,300 miles of distribution lines are owned and maintained by SOEC. Table 1.3 provides information concerning total asset valuation.

Asset	Total Replacement Cost	Cost Breakdown
Total SOEC Assets	\$258,425,750	Buildings and vehicles \$8,700,000 Overhead Assets \$249,725,750
Distribution Lines	\$164,540,846	OH Single-Phase lines - \$100,700,894 OH Three-Phase lines - \$63,839,952
Supporting Infrastructure	\$85,184,904	Meters \$3,207,000 Poles \$59,833,404 Transformers \$14,374,500 Regulators \$3,060,000 Capacitors \$262,500 Breakers \$4,447,500
Office Buildings	\$6,000,000	
Warehouses	Included in office buildings	
Vehicles	\$2,700,00	
<i>Source: Internal Sac Osage records 2011</i>		

Ensuring quality distribution to its customers, Sac Osage maintains not only distribution lines, but also the supporting infrastructure as well. Table 1.4 includes a list of asset types, emergency replacement cost per unit or mile, and the asset inventory by service and county and total infrastructure numbers.

<b>Assets</b>	<b>Replacement Cost per unit or mile</b>	<b>No. Units / Miles Barton</b>	<b>No. Units / Miles Benton</b>	<b>No. Units / Miles Cedar</b>	<b>No. Units / Miles Dade</b>	<b>No. Units / Miles Henry</b>	<b>No. Units / Miles Hickory</b>	<b>No. Units / Miles Polk</b>	<b>No. Units / Miles St. Clair</b>	<b>No. Units / Miles Vernon</b>	<b>Total number of units or miles</b>
Meter Cost per count	\$300/unit	8	130	4,671	693	447	21	44	3,483	1,193	10,690
Poles	\$1,156.00 / unit (Avg)	82	1,096	22,094	4,415	1,128	213	294	15,160	7,277	51,759
Single Phase Distribution Line	\$49,778/mile	2	11	764	225	46	10	14	653	298	2,023
Three Phase Distribution Line	\$161,212/mile	0	2	165	34	10	10	0	111	64	396
Transformers	\$1,500/unit	8	105	4,192	631	365	20	42	3,113	1,107	9,583
Regulators	\$30,000/unit	0	1	46	10	4	0	0	30	11	102
Capacitors	\$2,100/unit	0	1	48	8	4	0	0	45	19	125
Breakers	\$7,500/unit	0	3	281	38	17	0	0	166	88	593
<b>Total Replacement Value by County</b>		<b>\$208,748</b>	<b>\$2,388,058</b>	<b>\$101,448,636</b>	<b>\$23,541,198</b>	<b>\$6,143,376</b>	<b>\$2,392,428</b>	<b>\$1,112,956</b>	<b>\$78,878,426</b>	<b>\$36,611,924</b>	<b>\$249,725,750</b>
Source: Internal Sac Osage Accounting and Maintenance records Note: Cost for overhead and underground transmission line are the same, and no breakdown between the two was provided by SOEC.											

## Section 4: Identified Hazards and Risk Assessment Methodology

Natural hazards in west central Missouri vary dramatically with regard to intensity, frequency, and the scope of impact. Some hazards, like earthquakes, happen without warning and do not provide any opportunity to prepare for the threat. Other hazards, such as tornadoes, flooding, or severe winter storms, provide a period of warning which allows for public preparation prior to their occurrence. Regardless, hazard mitigation planning can lessen the negative of any natural disaster regardless of onset time. The following natural hazards have been identified as potential threats for the service region of the Sac Osage Electric Cooperative:

- Tornadoes
- Severe Thunderstorms, Hail, and High Winds
- Flood and Levee Failure
- Severe Winter Weather
- Earthquakes
- Dam Failure
- Wildfire

Likewise, a number of hazards may be eliminated from consideration in their local plan due to the state's geographic location including tsunamis, hurricanes, coastal storms, volcanic activity, avalanche, and tropical storms. Additionally, a number of hazards may be eliminated specifically for SOEC because of asset types and geographic location in the state of Missouri. Those hazards eliminated for the SOEC service region include:

- Drought
- Heat Wave
- Severe land subsidence
- Landslides

Although drought can potentially impact west-central Missouri, water availability does not directly impact the delivery of electric services to SOEC customers. Similarly, heat wave has been eliminated. Though it may result in additional usage and potentially tax the system, heat waves do not usually cause infrastructure damage to cooperative assets. The results of a heat wave in the SOEC service area may be considered cascading events rather than damage caused directly by the hazard itself. Land subsidence and landslides have also been eliminated based upon local soil structure categorization by the USGS. Limestone, carbonate rock, salt beds, and other naturally dissolving rock which are most susceptible to the formation of sinkholes randomly spread throughout the soil in the seven counties.

For the purpose of this risk assessment, the identified hazards for the SOEC service area have been divided into two categories: **historical and non-historical hazards**.

**Historical Hazards** are those hazards with a measurable previous impact upon the service area. Damage costs per event and a chronology of occurrences are available. The associated vulnerability assessments utilize the number of events and cost of each event to establish an average cost per incident. For SOEC, hazards with historical data include tornadoes, severe thunderstorms/high wind/hail, flood and levee failure, severe winter weather, and wildfire.

**Non-historical Hazards** are hazards with no previous record of impact upon local service area. As such, the associated vulnerability assessments for each of these hazards will have an occurrence probability of less than 1% in any given year, but the extent of damage will vary considerably. For SOEC, hazards without historical data include earthquakes and dam failure.

### *Probability of Occurrence*

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard. For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-99% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

The number of occurrences was further refined to focus on damage-causing events. Those occasions which had reported damages were divided by the total number of recorded events to obtain a percentage of total storms which result in infrastructure damage. (Formula: Number of damage-causing events / total number of events = Percentage of occurrences which cause damage.)

### *Potential Extent of Damage*

Vulnerability Assessment matrices for each hazard are included on the following pages. These worksheets detail loss estimates for each hazard affecting the cooperative's service area. Loss estimates were calculated using the asset summary created by internal SOEC accounting records. Each hazard has a unique impact upon the service area, requiring each hazard to utilize a different valuation amount depending upon the level of impact.

Non-historical hazards assume damage to all general assets. For Historical Hazards, assets were divided into two groups based upon historical impact which were utilized in the hazard damage analysis:

- Overhead infrastructure assets and buildings
  - Used for tornado damage assessments
  - Valued at \$255,725,750
- Overhead infrastructure assets only
  - Used for:
    - Severe Thunderstorm / High Wind / Hail
    - Flood
    - Severe Winter Weather
  - Valued at \$249,725,750

- In addition, historical hazards with recorded damages were used to identify an average cost per event. (Formula: Total cost of damages / total number of events = Average damage cost per event.) When discussing the extent of potential damages for all hazards, the following scale was utilized:

- Less than 10% potential damages to total cooperative infrastructure
- 10-25% potential damages to total cooperative infrastructure
- 25-50% potential damages to total cooperative infrastructure
- More than 50% potential damages to total cooperative infrastructure

Regardless of hazard categorization, the following matrix (Table 1.5) will be utilized to identify the potential damage extent and likelihood of occurrence for each natural hazard type.

Table 1.5 Sample Sac Osage Electric Cooperative Sample Infrastructure Vulnerability Assessment Matrix Hazard: _____		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

In many instances, natural hazard events occur without causing significant damage to the cooperatives infrastructure. The more significant impact of natural hazard episodes comes in the form of reported customer outages. The infrastructure may not be significantly harmed by an ice storm, but may result in prolonged and widespread outages in the cooperative’s service area. In considering the potential impact of a hazard, loss of function provides a more concise picture for comparison of events and geographic regions of the state. In addition to system damage, each hazard will be evaluated on the average number of reported or estimated outages per event occurrence. (Formula: Average number of outages reported / Total number of customers = Average percentage of outages reported per event)

Table 1.6 Sample Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix-Hazard: _____		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers report outages				
	26-50% of customers report outages				
	More than 50% of customers report outages				

**Section 5: Risk Assessment**

**A) Historical Hazards:**

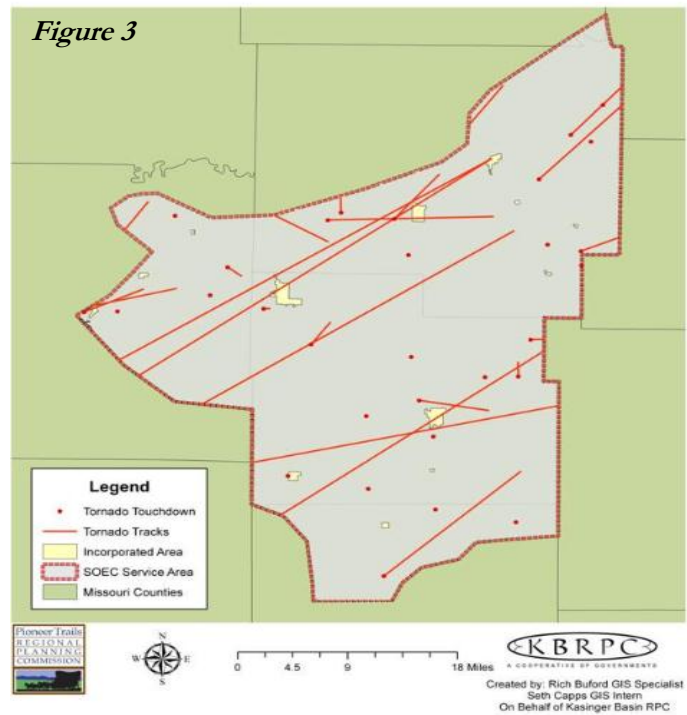
*Tornadoes*

In the last 60 years, 32 tornadoes have been reported within the Sac Osage Electric Cooperative boundaries. Figure 3 provides a pictorial representation of all recorded tornado touchdown sites and recorded path. (Map source: NOAA.)

A data insufficiency exists, however, between 1950 and 1982 in both historical hazard records and cooperative records concerning damage estimates. For the purpose of this assessment, the years for which records exist for both data sets have been used.

From 1982-2011, Sac Osage Electric Cooperative’s service area within the state of Missouri has experienced a total of 32 tornadic events. Using the previously described methodology, the probability of a tornadic event in the Sac Osage Electric Cooperative service area in any given year is near 100% (32 events / 29 years = 110%). Estimated cooperative material damages associated with each of these events were compiled by SOEC staff. 5 of the 32 occurrences caused damage to

**Tornadoes in the SOEC Service Area, 1951-2010**



cooperative assets, resulting in 15.6% (5 events / 32 occurrences = 15.6%) probability that any given tornadic occurrence will produce damage. Table 1.7 provides a summary of event dates, EF-scale ratings, damage cost estimates and outages reported.

Date of Event	EF Scale Rating	Damage Estimates	Customers Without Power
03/15/1982	F3	\$50,000.00	1,800
05/04/2003	F3	\$473,909.00	5,000
05/26/2004	F2	\$7,020.00	161
03/12/2006	F2	\$199,057.00	0
06/16/2009	F1	\$71,246.87	4,408
<i>Data provided based on internal SOEC records which reflect cost from the referenced year.</i>			

Based upon the last 29 years of historical event records, the average tornado to affect the cooperative will include an EF-1 to EF-3 Rating, causing an average damage cost of \$160,247 per event (\$801,232 / 5 events = \$160,246.40). This averaged amount accounts for less than 1% of SOEC’s total overhead assets and building valuation (\$160,247 / \$255,725,750 = 0.063%). Table 1.8 demonstrates the probability of occurrence in conjunction with the potential extent of damage.

		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

An average of 2,274 customers were affected during recorded tornadoes since 1982. (11,369 customers / 5 events = 2,274). When compared with the total number of customers served by SOEC, it can be projected that 12% (2,274 / 19,623 = 11.58%) of all customers may report outages during any given tornadic event. Table 1.9 demonstrates the probability of occurrence in conjunction with the potent extent of impact upon local customers.

Table 1.9 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Tornado		Probability of Damage Causing Hazard Occurrence			
		Less than 1% chance in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% chance in any given year
Potential Extent of Impact	Less than 10% of customers affected				
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers effected				

*Severe Thunderstorms, High Wind, and Hail*

From 1997-2011 Sac Osage Electric Cooperative’s service area within the state of Missouri has experienced a total of 172 thunderstorm / high wind events. The probability of a thunderstorm/high wind event in any given year is near to 100% (172 occurrences / 14 years = 1228%). Estimated material damages associated with each of these events were compiled by the SOEC staff.

Sac Osage Electric has no reported customer interruption or infrastructure damage due to “hail events” with in their service area. Thus 172 thunderstorms / 0 hail damage events results in less than 1% probability of damage from hail events.

Table 1.10 provides information for thunderstorm / high wind events. Of the 172 occurrences caused damage to cooperative assets, resulting in a 4% probability that any given thunderstorm / high wind occurrence will produce damage. (7 events / 172 occurrences = 4.07%)

Event Date	Damage Estimates	Customers Affected
06/13/1997	\$22,000	2,519
06/13/1998	\$13,400	1,378
07/05/2004	\$57,532	2,376

Based upon historical records, the average thunderstorm / high wind event to affect the cooperative will cause an average damage cost of \$13,276 (\$92,932 cost / 7 events = \$13,276).

This averaged amount accounts for less than 1% of SOEC’s overhead asset valuation (\$13,276 / \$249,725,750 = 0.0053%). Table 1.11 demonstrates the probability of occurrence in conjunction with the potential extent of damage from thunderstorm / high wind events.

Table 1.11 Sac Osage Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: Thunderstorm/High Wind		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

An average of 896 customers ( $6273 / 7 = 896$ ) were affected during recorded thunderstorm, and high wind events since 1997. When compared with the total number of customers served by SOEC, it can be projected that 5% ( $896 / 19,623 = 4.566\%$ ) of all customers may report outages during any given hail, thunderstorm, or high wind event. Table 1.12 demonstrates the probability of occurrence in conjunction with the potent extent of impact upon local customers.

Table 1.12 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Severe Thunderstorms, High Winds		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers affected	Hail	Thunderstorm/High Wind		
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers affected				

*Flood and Levee Failure*

Flood and levee failure carry, perhaps, the greatest ongoing potential threat to existing infrastructure of the Sac Osage Electric Cooperative. In Benton County, approximately 15% of the cooperative service area is located directly within the 100 and 500 year flood plains, 90% of Cedar County, and 30% of Dade County cooperative service area located within the Sac Osage’s service area also lie in the 100 and 500 year flood plain. Figure 4 at left depicts the 100 year floodplain in relation to the cooperative’s boundaries.

Currently, inundation data for levee failure is lacking due to issues surrounding mapping, appropriate models, and its close association with flooding events, therefore there is no current levee mapping available.

From 1991 to 2011, Sac Osage Electric’s service area has experienced 155 flooding events. Currently no data concerning levee failure damage can be separated from flood damage data. Therefore, the probability of a flood / levee failure event affecting the cooperative assets in any given year is near 100% (155 events / 20 years = 775%). Sac Osage Electric data shows that there have been no service failures, nor any infrastructure damage related to flood or levee failure events to any of their customers. As such, the probability of a damage-causing event is less than 1% (0 events / 20 years = 0%).



Table 1.13 Sac Osage Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: Flood and Levee Failure		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

An average of 0 customers reported outages during recorded flooding events since 1995. When compared with the total number of customers served by Sac Osage, it can be projected that less than 1% of all customers may report outages during any given flooding event. Table 1.14 demonstrates the probability of occurrence in conjunction with the potential extent of impact upon local customers.

Table 1.14 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Flood and Levee Failure		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers affected				
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers affected				

*Severe Winter Weather*

From 1999 to 2011, Sac Osage Electric Cooperative’s service area has experienced a total of 114 severe winter weather events, including significant snowfall and ice storms that directly impacted the Sac Osage Electric Cooperatives service area, according to the information provided by SOEC. Therefore, the probability of a severe winter weather event in the Sac Osage service area in any given year is near 100% (114 events / 12 years = 950 %). Estimated material damages associated with each of these events were compiled by SOEC staff, but damage estimates are available from 1999 to 2011 only. Table 1.15 provides a summary of event dates, types, associated damage estimates and reported customers affected. 11 of the 114 occurrences caused damage to cooperative assets, resulting in a 9.6% probability that any given severe winter weather occurrence will produce damage. (11 / 114 = 9.649%)

Table 1.5 Severe Winter Weather Events		
Event Date	Damage Estimates	Customers Affected
01/01/1999	\$50,000	2,239
01/12/2007	\$65,000	1,202
12/09/2007	\$546,136	9,901
01/20/2007	\$27,000	382

Based upon these historical records, the average severe winter weather event to affect the cooperative will cause an average damage cost of \$66,066 ( $\$726,728 / 11 \text{ events} = \$66,066.18$ ). This averaged amount accounts for less than 1% of SOEC's total overhead asset valuation ( $\$66,066 / \$249,725,750 = 0.026\%$ ) Table 1.16 demonstrates the probability of occurrence in conjunction with the potential extent of damage.

Table 1.16 Sac Osage Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: Severe Winter Weather		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

An average of 201 customers reported outages, during recorded severe winter weather events since year 1999. When compared with the total number of customers served by SOEC, it can be projected that .56 % ( $114 \text{ events} / 201 \text{ customers} = .56\%$ ) of all customers may report outages during any given severe winter weather event. Table 1.17 demonstrates the probability of occurrence in conjunction with the potent extent of impact upon local customers.

Table 1.17 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Severe Winter Weather		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers affected				
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers report outages				

*Wildfire*

The incidence of wildfire in the SOEC service area presents a unique risk assessment. Wildfire events have occurred in five of the counties that SOEC serves have suffered wildfires between 1999 and 2011. Table 1.18 summarizes the incidences of wildfire within the five counties. Therefore, the probability of a wildfire event in the Sac Osage Electric service area in any given year is near 100% (41 events / 12 years = 342%). However, for the purposes of this assessment, wildfire and its associated impacts cannot be eliminated from the realm of possibility.

County	# of wildfires, 2000-11	Avg. annual # of wildfires	Likelihood (1-5)	Acres burned	Avg. annual acres burned	Total buildings damaged	Vulnerability
Barton	0	0	0	0	0	0	Low
Benton	10	.9	1	113	10.3	0	Low for SOEC
Cedar	1	.09	1	1	1	0	Low
Dade	3	.27	2	3	.25	0	Medium-High
Henry	11	.91	3	476	34.66	0	Medium -High
Hickory	5	.41	2	5	.41	1	Medium
Polk	0	0	0	0	0	0	Low
St. Clair	10	.83	3	10	.83	0	Medium
Vernon	1	.09	1	126	10.5	0	Low
Totals	41	3.41	1.44%	729	57.54	1	

*Source: Missouri Department of Conservation Fire Reporting*

The potential extent of damage caused by wildfire is difficult to determine. Like earthquakes and dam failure, wildfires have had no measurable impact upon the SOEC service area. To date, 41 wild fires have burned a total of 734 acres, for an average of 17.90 acres affected per event.

SOEC sustained 0 damage related to wildfires in its service area during this time period. Cooperative assets are located throughout the service area rather than being located at a single central site. With an average of 17.90 acres per fire in the service area, it is unlikely that infrastructure damage would exceed 1% based upon asset location and unlikeliness of an uncontrollable wildfire. This initial assessment assumes a limited impact upon electric distribution infrastructure of less than 1% (Table 1.19). Further study will be required to create a model for damage assessments related to wildfire.

<b>Table 1.19</b> <b>Sac Osage Electric</b> <b>Cooperative Infrastructure</b> <b>Vulnerability Assessment</b> <b>Matrix</b> <b>Hazard: Wildfire</b>		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

No customers have reported outages during recorded wildfires between 2000 and 2011. When compared with the total number of customers served by SOEC, it can be projected that less than 1% of all customers may report outages during any given wildfire event. Table 1.20 demonstrates the probability of occurrence in conjunction with the potent extent of impact upon local customers.

Table 1.20 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Wildfire		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers affected				
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers report outages				

**B. Non-Historical Hazards**

*Earthquakes*

The closest source of earthquake risk in Central Missouri is the NeMaha Fault, which runs through Oklahoma City, Oklahoma north to Lincoln, Nebraska. In 1993, the NeMaha fault produced a discernible earthquake that was felt in the region, rating a 2.9 on the Richter Scale of Earthquake intensity. Additional quakes took place February 11, 1995 (3.1 rating); July 16, 2004 (3.5 rating); March 23, 2003 (3.1 rating). More recently, an earthquake rating 3.6 was recorded on December 17, 2009. Although a relatively quiet fault system, the NeMaha fault has the potential to produce a damaging earthquake, profoundly impacting the Sac Osage Electric Cooperative service area.

The region is also subject to effects of the New Madrid Fault located in extreme southeast Missouri, which has the potential to produce the largest earthquakes in North America. Undoubtedly, this fault has the potential to affect the SOEC service area in its entirety. In addition, there have been several small, virtually undetectable earth movements in the region in recent history, which may or may not be attributed to the aforementioned fault lines or other, very small faults located nearby.

While the NeMaha fault is geographically closer and geologically active, C.E.R.I. records demonstrate the limited impact of said earthquakes, with no quakes to date exceeding a 5.5 on the Modified Mercalli Scale. Its cascading effects have been largely restricted to more localized regions, but even then the damage caused has been minimal. By contrast, the New Madrid fault has the potential to cause damage throughout the state of Missouri, including the SOEC service

area. Scientist from the U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) at the University of Memphis has estimated the probability of a magnitude 6.0 or greater earthquake from the New Madrid Fault is 25-40 percent through the year 2053. The probability of an earthquake increases with each passing day.

The projected earthquake intensity ratings for the cooperative region changes based upon the Modified Mercalli Scale. Given a new Madrid Earthquake with a 6.7 rating, the region would experience level V intensity characteristics. In the event of an earthquake with a 7.6 rating, the region would experience Level VI intensity characteristic while an earthquake with an 8.6 rating would most likely cause Level VII intensity characteristics.

In the event of an earthquake with a 7.6 rating, the SOEC service area would most likely experience minor building damage as well as damage to the electrical distribution system. This damage, however, would most likely be relatively minimal and localized when compared with the southeast corner of the state. Distribution lines overhead and underground could become disconnected or severed, and transformers could be damaged. Though the probability of occurrence is very small, the potential extent of damage could significantly impact both the cooperative and its customers as demonstrated in table 1.21.

Table 1.21 Sac Osage Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: Earthquakes		Probability of Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

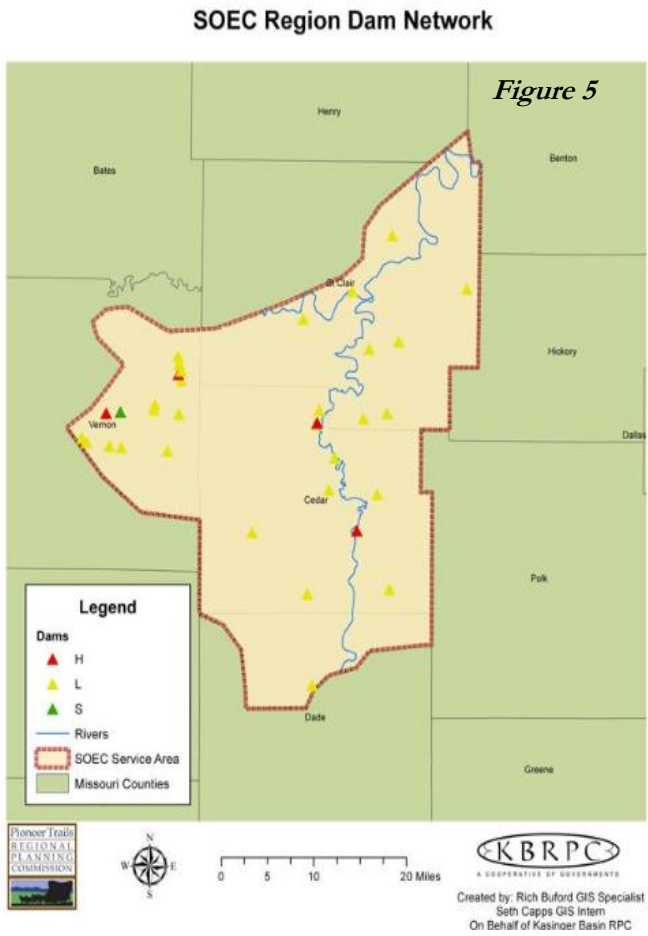
Based upon information from CERI, FEMA, and SEMA, it may be estimated that up to 1,962 of customers could be affected related to an earthquake event. When compared with the total number of customers served by SOEC, it can be projected that 10% of all customers may report outages during any given seismic event. Table 1.22 demonstrates the probability of occurrence in conjunction with the potent extent of impact upon local customers.

Table 1.22 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Earthquakes		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers report outages				

*Dam Failure*

Like earthquakes, dam failures have had no measurable impact upon the SOEC service area to date. According to Missouri DNR’s Dam Safety Division, 220 dams currently exist within the cooperative boundaries: 41 in Barton County, 26 in Benton County, 11 in Cedar County, 11 in Dade County, 52 in Henry County, 7 in Hickory County, 13 in Polk County, 15 in St. Clair County, and 44 in Vernon County. . Of these 220 dams, 7 are regulated by the state due to the fact that they are non-agricultural, non-federal dams which exceed 35 feet in height. Figure 5 shows the locations of all known dams located within Sac Osage’s service area. (Source: <http://msdis.missouri.edu/> )

26 dam failures have occurred within the state of Missouri over the past 100 years. However, no such event has occurred within or near the cooperative’s boundaries. For the purposes of this assessment, dam failure and its associated impacts cannot be eliminated from the realm of possibility. In order to



allow for a risk assessment, the probability of this event has been included as less than 1%.

Table 1.23 Sac Osage Electric Cooperative Infrastructure Vulnerability Assessment Matrix Hazard: Dam Failure		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Damage	Less than 10% of damage to system				
	10-25% of damage to system				
	26-50% of damage to system				
	More than 50% of damage to system				

Determining the potential extent of dam failure is currently impossible due to a lack of data concerning inundation zones. Further study concerning existing dams and their impact is required to make a more comprehensive assessment of potential damages. This initial assessment assumes a limited impact upon downstream electric distribution infrastructure of less than 1% for both infrastructure damage and service interruption. (Tables 1.23 and 1.24).

Table 1.24 Sac Osage Electric Cooperative Service Interruption Vulnerability Assessment Matrix- Hazard: Dam Failure		Probability of Damage-causing Hazard Occurrence			
		Less than 1% in any given year	1-10% chance in any given year	10-99% chance in any given year	Near 100% probability in any given year
Potential Extent of Impact	Less than 10% of customers report outages				
	10-25% of customers affected				
	26-50% of customers affected				
	More than 50% of customers affected				

## Section 6:

### Mitigation Strategies

#### *Previous efforts at mitigation*

For organizations like SOEC, mitigation is considered to be part of prudent business operations. In order to ensure the delivery of a quality product and minimize service interruptions, a number of mitigation strategies are continually utilized. Routine maintenance and upgrades to existing equipment are completed as part of daily tasks. Vegetation management is utilized to limit the cascading effects of natural hazards. Safety and reporting information are disseminated to the public through various types of media. Mutual aid agreements and partnerships create relationships which provide for future support in the event of a natural disaster.

Additionally, mitigation is considered prior to any expansion of service into special hazard areas. Before any service is built, it is first “staked out” in coordination with local builders and property owners. This process, completed by the Line Superintendent and contracted engineers, identifies and addresses foreseeable hazards and safety issues before any new service line area is constructed. USDA-RUS specifications regarding operation and safety are utilized in every step of the process. Steps are taken to practically minimize the exposure of equipment to loss due to foreseeable hazards, particularly flooding. Customers who reside in the floodplain are not charged for repairs or losses associated with flooding unless they purposefully destroy or restrict the cooperative from protecting their distribution system assets.

#### *Existing and potential resources*

As stated above, mitigation is a key component of good business practices. Sac Osage Electric Cooperative includes mitigation strategies as part of regular work activities to ensure service with minimal interruptions. Funding for these activities is provided through the cooperative’s normal budgetary process for maintenance.

In order to expand mitigation efforts beyond normal maintenance, it is likely that SOEC will need to seek outside funding sources. These may include private, state, or federal programs which provide grant and loan funding. Upon passage of this plan, SOEC will be eligible for funding through FEMA in the following categories:

- Hazard Mitigation Grant Program
- Flood Mitigation Assistance Program
- Pre-Disaster mitigation Program
- 406 Stafford Act

#### *Development of goals, objectives, and actions*

Establishing mitigation goals, objectives, and actions for a business entity requires a slightly different approach than public agencies. Certainly, a number of similarities exist; both entities must consider which hazards most commonly occur and have the greatest potential for causing disruption to members or residents. They must also consider which types of actions will

maximize benefits and minimize costs, how mitigation strategies will be implemented, who will enforce implementation, and how the overall plan will be maintained and updated.

The SOEC mitigation planning committee with assistance from Kaysinger Basin RPC staff, worked to identify goals, actions, and objectives which addressed hazard mitigation issues. The committee first identified ongoing mitigation strategies as well as potential strategies which seek to improve service and limit disruptions resulting from natural hazards. Action items were then analyzed for common characteristics and summarized to create nine objectives. Likewise, these nine objectives were grouped into similar categories and used as the basis for the four overarching goals. Table 1.25 provides a simple synopsis of the goals and objectives before prioritization.

Traditionally, STAPLEE (Social, Technical, Administrative, Political, Legal, Environmental, and Economic) method is used to prioritize mitigation actions. These categories, however, do not necessarily align with the private sector in the same way they are applicable to governmental agencies. A number of action items could be included with multiple goals and objectives, for example. As a result, the committee chose to use a different method to prioritize their mitigation strategy.

Identified Goals	Identified Objectives
<b>Goal 1:</b> Protect the safety of the customers and public.	<b>Obj. 1:</b> Upgrade/mitigate for potential population increase.
	<b>Obj. 2:</b> Create community storm shelter to protect the public, computers/employees.
<b>Goal 2:</b> Reduce future losses due to natural hazard events.	<b>Obj. 1:</b> Relocate inaccessible line to a more easily accessible area/terrain.
	<b>Obj. 2:</b> Add storm anchors to poles
	<b>Obj. 3:</b> Replace existing copperweld conductors with aluminum.
	<b>Obj. 4:</b> Increase maintenance on 'right of way' (outages are 75% tree related).
	<b>Obj. 5:</b> Convert certain overhead lines to underground lines.
	<b>Obj. 6:</b> Increase number of electronic recloser circuits and number of protected circuits.
	<b>Obj. 7:</b> Upgrade systems and equipment inventory programs to increase awareness of current equipment verses needed equipment
<b>Goal 3:</b> Reduce time spent on finding root of problem in a major natural hazard event	<b>Obj. 1:</b> GIS/GPS coordinates on power houses, buildings, transformers, and substations on cell phones, iPads and computers.
	<b>Obj. 2:</b> Upgrade maintenance of SCADA
	<b>Obj. 3:</b> Move computer servers off site
<b>Goal 4:</b> Increase ways to provide service to critical facilities	<b>Obj. 1:</b> Increase the number of high voltage generators for use in critical facilities outages
	<b>Obj. 2:</b> Maintain and increase mutual aid agreements
	<b>Obj. 3:</b> Increase county Emergency Management partners.

After identifying ongoing and potential action items, the committee created three priority tiers:

- **First tier** actions focus on physical infrastructure protection and improvements which ensure continued, quality service and seek to reduce power outages. These types of actions are the highest priority of SOEC.
- **Second tier** actions create and maintain working relationships to reduce and prevent the impact of power outages. These include improvements to safety and reporting information, mutual aid agreements, and other efforts which seek to expand and improve both customer service and disaster planning.
- **Third tier** actions identify potential projects for other system improvements. These include mapping efforts, technological improvements, and research related to the expansion of mitigation efforts.

Actions within each tier may be funded through regular budgetary methods or identified outside sources. Tables 1.26, 1.27, and 1.28 provide lists of action items by tier as well as the goals and objectives identified with each.

<b>Tier 1</b>			
Action Item:	Goal/Objective	Timeframe for completion	<i>Cost-benefit score</i>
Increase maintenance on “right of way” (outages are 75% tree related)	Goal 2/Obj. 4	Ongoing/dependent upon available money	High benefit, high cost Score 7
Add storm anchors to poles to cut down on pole costs replacement especially when trees are involved.	Goal 2/Obj. 2	Ongoing effort	Med benefit, low cost Score 6
Replace existing copper weld conductors with aluminum for economical benefit. <ul style="list-style-type: none"> <li>• Aluminum is stronger</li> </ul>	Goal 2/Obj. 3	Dependent upon available money	Med benefit, high cost Score 4
Move computer servers off site	Goal 3/Obj. 3	Ongoing effort	High benefit, high Cost Score 7
Upgrade and maintenance of SCADA <ul style="list-style-type: none"> <li>• Monitors lines and power, allows for quicker reaction to an outage</li> </ul>	Goal 3/Obj. 2	Dependent upon additional money	Low cost, high benefit Score 1
Convert certain overhead lines to underground lines <ul style="list-style-type: none"> <li>• Limestone is hard to drill when burying underground lines</li> </ul>	Goal 2/ Obj. 5	Ongoing effort, extra funding always help speed the process	High cost, high benefit Score 7

**Table 1.27 Prioritized Mitigation Actions for Osage Sac Osage Electric Cooperative-Tier 2**

Tier 2			
Action Item:	Goal/Objective	Timeframe for completion	Cost-benefit score
Increase the number of high voltage generators for use in critical facility outages.	Goal 4/Obj. 1	Dependent upon additional funding	High benefit, High Cost Score 5
Maintain and increase mutual aid agreements	Goal 4/Obj. 2	This will be a continuing effort	Medium benefit, low cost Score 6
Increase County Emergency Management partners	Coal 4/Obj. 3	Also a continuing effort	Medium benefit, low cost Score 6

**Table 1.28 Prioritized Mitigation Actions for Sac Osage Electric Cooperative-Tier 3**

Tier 3			
Action Item:	Goal/Objective	Timeframe for completion	Cost-benefit score
GIS/GPS coordinates on power houses, buildings, transformers, and substations on phones and iPads and computers	Goal 3/Obj. 1	Dependent upon additional funding	High benefit, Med. Cost Score 4
Increase number of electronic recloser circuits.	Goal 2/Obj. 6	Dependent upon additional funding from FEMA	Med benefit, high cost Score 5
Upgrade maintenance of SCADA	Goal 3/Obj. 2	Dependent upon available money mixed with additional funding	High benefit, high cost Score 4
Reduce future losses due to natural hazard events	Goal 2/ Obj.7	Upgrade systems and equipment inventory programs to increase awareness of current equipment verses needed equipment	
Monitor developments in data availability concerning the impact of dam failure and wildfire upon the Sac Osage service area through local, state, and federal agencies.	Goal 1 / Obj. 1 Goal 2 / Obj. 1	Ongoing effort.	Low cost Low benefit Score: 3

**Section 7- Plan Implementation and Maintenance**

**Plan incorporation**

The goals, objectives, and actions of the previous section identify both ongoing efforts at mitigation and potential methods for expanding efforts. The plan has been reviewed and adopted by the Board of Directors as part of the company’s operations policy. This mitigation plan necessitates involvement from every SOEC employment level as the organization strives to ensure quality service to their customers.

*Other Local Planning Mechanisms*

Beyond the SOEC plan, few planning mechanisms exist at the local level. The Missouri counties of Barton, Benton, Cedar, Henry, Hickory, Polk, St. Clair and Vernon each have a FEMA approved Natural Hazard Mitigation Plan in place. County emergency management directors have Local Emergency Operations Plans which seek to mitigate the same hazards for residents. These same counties are also included in the Regional Transportation Plan (RTP) as well as a Comprehensive Economic Development Strategy (CEDS). SOEC's plan can be easily incorporated into these local plans and allow for coordination across agencies in the event of an emergency.

SOEC is located within the rural portions of third-class counties which are prohibited from enforcing building codes and zoning by the state of Missouri. They do not provide service to any municipality within these counties. Comprehensive plans and Capital Improvement plans do not exist inside of the SOEC service areas.

#### *Plan Maintenance*

Sac Osage Electric Cooperative will conform to the requirements established by the Association of Missouri Electric Cooperatives (AMEC) for monitoring, evaluating and updating the plan.

#### *Continued Public Involvement Opportunities*

Sac Osage Electric Cooperative will conform to the requirements established by the Association of Missouri Electric Cooperatives (AMEC) for continued public involvement. Opportunities for public comment will continue to be offered through various media outlets, the cooperative's website, and the physical office SOEC.

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Appendix A  
**MEETING ATTENDANCE**







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## **Appendix B**

# **PUBLIC SERVICE ANNOUNCEMENT**

AN ECONOMIC DEVELOPMENT DISTRICT  
KAYSINGER BASIN REGIONAL PLANNING COMMISSION  
BATES BENTON CEDAR HENRY HICKORY ST. CLAIR VERNON



## Public Service Announcement

Contact: Samantha Dingfelder / Tom L. Hutchings  
Phone: (660) 885-3393

**FOR IMMEDIATE RELEASE**  
July 29, 2011

### COMMENT SOUGHT ON RURAL ELECTRIC COOP HAZARD MITIGATION PLAN

Sac Osage Electric Cooperative in conjunction with Kaysinger Basin Regional Planning Commission is hosting a “kick-off” meeting for the stakeholders of Sac Osage REC. Topics that will be covered include; the creation of an electric cooperative natural hazard mitigation plan, federal disaster mitigation fund opportunities, mitigation funds and actions. This plan will be created to reduce losses to stakeholders from damage caused by natural hazards events.

Taxpayers pay billions of dollars each year for disaster recovery. Some events are predictable and often damages can be reduced or eliminated. The State of Missouri is taking preventative measures to ensure electric cooperatives are eligible for receiving Federal Emergency Management Agency (FEMA) and SEMA grant funding through this natural hazard mitigation plan.

The time, location and date of this public meeting is as follows:

**Meeting # 1**  
**Date:** Thursday, August 11  
**Time:** 10:00 am  
**Place:** Sac Osage Headquarters  
4815 E. Hwy 54  
El Dorado Springs, MO 64744

-End-

908 North Second Street - Clinton, Missouri 64735 - (660) 885-3393 phone - (660) 885-4166 fax