

report also stated that a meltdown would likely cause less than one fatality or injury. This low hazard rating is due to diverse and redundant barriers and numerous safety systems in the plant, the training and skills of the reactor operators, testing and maintenance activities, all the added safety engineered instrumentation used to monitor and shut down nuclear plant systems before any severe damage occurs, and the regulatory requirements and oversight of the U.S. Nuclear Regulatory Commission. The probability is thus noted as <1-percent.

Changing Future Conditions Considerations

Generally, an incident involving a nuclear reactor would not have an impact on climate change, nor would climate change have a measurable effect on the impacts of a nuclear power plant incident. An influx of population or development in the areas around the plants would create added risk. The production of nuclear power requires access to large volumes of water to cool the reactor and a supply of energy to move the water. For this reason, nuclear power plants are typically sited near large bodies of water, often seas or estuaries. It is this attachment to water that makes nuclear power vulnerable to changing future conditions.

One cause for concern is floods. All nuclear power plants are designed to withstand a certain level of flooding based on historical data, but these figures do not take changing climate conditions into account. Floods due to heavy rain are likely to increase in frequency. Loss of power, loss of communications, blockage of evacuation routes and equipment malfunction are all safety issues associated with flooding and nuclear power plants.

Heat waves are another serious concern, for two reasons. One, the colder the cooling water entering a reactor, the more efficient the production of electricity. And two, once the cooling water has passed through the system it is often discharged back where it came from in a much warmer state. Heat waves may lead to a shut down or reduction in power production due to regulations governing receiving water temperatures and the protection of aquatic ecosystems.

The final concern is drought. Climate models predict droughts will become longer and larger in the future. Prolonged drought could impact water levels causing issues for water intake pipes that are necessary for reactor cooling systems. Furthermore, legal battles may also ensue over scarce water resources.

Vulnerability

Vulnerability Overview

An accident involving radioactive materials could occur in Missouri from a variety of sources: nuclear reactors, transportation accidents, industrial and medical uses, and lost or stolen sources where the public could be exposed, or contaminated, with a high level of radiation.

Although the chance of a nuclear power plant release is unlikely, radiological accidents have the potential to cause injury or death, contaminate property and valuable environmental resources, as well as disrupt the functioning of communities and their economies. Local and state governments, federal agencies, and the electric utilities have emergency response plans in place in the event of a nuclear power plant incident. The plans define two “emergency planning zones.” One zone covers an area within a 10-mile radius of the plant, where it is possible that people could be harmed by direct radiation exposure. The second zone covers a broader area, usually up to a 50-mile radius from the plant, where radioactive materials could contaminate water supplies, food crops, and livestock.

The potential danger from an accident at a nuclear power plant is exposure to radiation. This exposure could come from the release of radioactive material from the plant into the environment, usually characterized by a plume (cloud-like formation) of radioactive gases and particles. The major hazards to people in the vicinity of the plume are radiation exposure to the body from the cloud and particles deposited on the ground, inhalation of radioactive materials, and ingestion of radioactive materials.

There are several Missouri counties included in 10-mile and 50-mile emergency planning zones (EPZ) for nuclear power plants. Counties within the 10-mile EPZ for the Callaway nuclear power plant have a relatively higher radiological risk than other counties, but the potential for an incident is extremely low. These counties include portions of Callaway, Osage, and Montgomery for the Callaway plant, and Atchison and Holt for the Cooper plant.

Counties within the 50 mile ingestion pathway are at lower risk. For the Callaway plant, counties within the 50 mile ingestion pathway include Audrain County, Boone County, Crawford County, Cole County, Cooper County, Franklin County, Gasconade County, Howard County, Lincoln County, Maries County, Miller County, Monroe County, Moniteau County, Pike County, Randolph County, Ralls County, St. Charles County, and Warren County.

The area of Warren County within the 50-mile radius of the Callaway nuclear power plant could impact Missouri state-owned facilities to the order of \$125K in losses.

Impact of Previous and Future Development

None of the counties within the 10 mile EPZ for the Callaway plant are in the top 10 counties for housing unit and population gains between 2010 and 2015. Boone and St. Charles Counties are within the 50 mile ingestion pathway for the Callaway plant and are among the top 10 counties for housing and population gains from 2010 to 2015. Lincoln County, in the Callaway 50-mile ingestion pathway is in the top 10 for population gains between 2010 and 2015.

Hazard Summary by Jurisdiction

Communities most at risk are those within the 10 mile EPZ. The planning area has no communities located within the 10 mile EPZ.

Problem Statement

The counties most at risk of radioactive fallout from the Callaway nuclear plant are Callaway and Montgomery. Emergency Management Agencies from the “at risk” counties coordinate their Emergency Operations Plans with those of the Callaway Nuclear plant. If unforeseen circumstances require portions of Warren County to be evacuated due to a release of radiative material, Warren County is prepared to respond using its planned evacuation scenarios.

3.4.13 Terrorism

Hazard Profile

Hazard Description

Federal Bureau of Investigation (FBI) defines Terrorism as “the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.” Terrorism causes loss of life, injuries to people and properties, and disruptions in services. According to the State Hazard Mitigation Plan, potential terrorist actions include the following; Bombings, airline attacks, weapons of mass destruction (WMD) attacks, infrastructure attacks, cyber-terrorism, agro-terrorism, arson, kidnappings, and assassinations.

Domestic terrorism is another form of threat which comes from white supremacists, black separatists, animal rights / environmental terrorists, anarchists, prolife extremists, and self-styled militia. According to the FBI, international terrorism has been a major challenge for the United States. This threat can be categorized into three groups; loosely affiliated extremists operating under the radical jihad movement, formal terrorist organizations, and state sponsors of terrorism.

After the attacks on September 11, 2001, parts of 22 domestic agencies were consolidated into one department, the U.S. Department of Homeland Security (DHS), to protect the nation against future terrorist threats. Depending on the necessity communities may receive assistance from state and federal agencies operating within the existing Integrated Emergency Management System. FEMA is responsible for supporting state and local response to the consequences of terrorist attacks.

Geographic Location

Warren County is unlikely to be a target of international terrorism; however, all areas of the planning area are susceptible to domestic terrorism.

Strength/Magnitude/Extent

According to the State Hazard Mitigation plan, the threat of terrorism in the United States remains a concern. The level of acts committed in the United States has increased steadily. According to the FBI, two known or suspected terrorist acts were recorded in the United States in 1995, 3 in 1996, 4 in 1997, 5 in 1998, and 12 in 1999. In addition to the 12 acts in 1999, an additional 7 planned acts of terrorism were prevented in the United States. Although several different extremist groups have been identified in Missouri, there have been no indications of any specific recent terrorist activities. The potential does remain, however, for new extremist and/or terrorist groups to move into the State at any time.

An open society such as ours, which depends on technology for its continued smooth operation, remains a potential target for terrorists. Large cities with a variety of news media outlets represent the most likely locations for terrorist acts because terrorists generally want their acts to reverberate in the news media and reach the largest audience possible. Since Missouri does not have large media markets compared to some states, it is not as likely a target for terrorist activity as those other states. However, the Oklahoma City bombing debunked the idea that rural America is completely safe from terrorists. With this in mind, it appears that a terrorist attack could occur in Missouri.

Warren County has potential targets for terrorist activities as well; including Federal, state, county and municipal government facilities and structures; military installations; HAZMAT Facilities; medical

facilities; religious facilities; businesses and manufacturing centers; airports, railroads, highways and navigable rivers; pipelines, power plants, public utilities, landmarks, large public gatherings, and agriculture. Extent is reliant on the type of attack and other parameters. Terrorism is usually attempted to kill or injure persons, destroy property or impact critical functions, and affect public confidence and instill fear.

There are 9 Homeland Security regions in the State of Missouri with Warren County being part of Region F. Region F has completed a Threat and Hazard Identification and Risk Assessment (THIRA) which is updated every three years. Currently, there are no terrorism incidents identified within the county and certainly, if Missouri rates itself a tier below the nation in threat probability, Warren County should rate its chances of a terrorist attack even lower.

Previous Occurrences

The following section highlights noteworthy terrorist-related threats and actual attacks that have occurred in the United States since 1970. The French Revolution provided the first uses of the words "Terrorist" and "Terrorism." Use of the word "terrorism" began in 1795 in reference to the Reign of Terror initiated by the Revolutionary government. The agents of the Committee of Public Safety and the National Convention that enforced the policies of "The Terror" were referred to as "Terrorists." The French Revolution provided an example to future states in oppressing their populations. It also inspired a reaction by royalists and other opponents of the Revolution who employed terrorist tactics such as assassination and intimidation in resistance to the Revolutionary agents. The Parisian mobs played a critical role at key points before, during, and after the Revolution. The following section highlights noteworthy terrorist-related threats and actual attacks that have occurred in the United States since 1970.

In 1972, members of a U.S. fascist group called Order of the Rising Sun were found in possession of 30 to 40 kilograms of typhoid bacteria cultures, which they planned to use to contaminate water supplies in Chicago, St. Louis, and other large Midwestern cities.

In 1984, two members of an Oregon cult headed by Bhagwan Shree Rajneesh cultivated Salmonella bacteria and used it to contaminate restaurant salad bars in an attempt to affect the outcome of a local election. Although approximately 751 people became ill and 45 were hospitalized, there were no fatalities.

In February 1993, an improvised bomb exploded in a rental van parked on the second level of the World Trade Center's parking basement. The bomb contained approximately 1,200 to 1,500 pounds of a homemade fertilizer-based explosive, urea nitrate. The blast produced a crater 150 feet in diameter and five floors deep. Although the motive for the attack was never confirmed, it is believed that the suspect who masterminded the bombing was either backed by a loose network of militant Muslims or directed by Iraq. The incident, which killed 6 people and injured more than 1,000, was the most significant international terrorist act that had ever been committed on U.S. soil at that time.

In April 1995, a massive bomb exploded inside a rental truck parked near the Murrah Federal Building in Oklahoma City, destroying half the nine-story building and killing 168 people. The incident was traced to Timothy McVeigh, who was convicted of the bombing and executed by lethal injection in June 2001. He was the first federal prisoner to be executed in 38 years. McVeigh was a survivalist who believed individual rights (e.g., gun control) were being deprived by government agencies. Consequently, he was convinced he acted to defend the Constitution and saw himself as a crusader and hero. This was the worst terrorist event, either domestic or international in origin that had ever occurred in the United States at that time.

In March 1995, four members of the Minnesota Patriots Council, a right-wing militia organization advocating the violent overthrow of the U.S. government, were convicted of conspiracy charges under the Biological Weapons Anti-Terrorism Act of 1989 for planning to use ricin, a lethal biological toxin. The four men allegedly conspired to assassinate federal agents who served papers on one of them for tax violations.

In May 1995, a member of the neo-Nazi organization Aryan Nations was arrested in Ohio on charges of mail fraud. He allegedly misrepresented himself when ordering three vials of freeze-dried *Yersinia Pestis*, the bacteria that causes bubonic plague, from a Maryland biological laboratory.

In October 1995, the Amtrak Sunset Limited passenger train derailed near Hyder, Arizona. It was determined that the train track had been sabotaged, causing the train to derail and topple 30 feet from a bridge. A letter signed by the Sons of Gestapo was left at the scene. One person was killed and 83 others were injured in this incident.

In November 1995, members of the Tri-States Militia (a group composed of militia from at least 30 states) were arrested after being linked to five would-be terrorists whose bomb plots were thwarted by federal and state law enforcement agencies. The plots involved blowing up the Southern Poverty Law Center, offices of the Anti-Defamation League, federal buildings, abortion clinics, and gay community locations.

In December 1995, an Arkansas man was charged with possession of ricin in violation of the Biological Weapons Anti-Terrorism Act. The man was arrested and subsequently hanged himself in his jail cell the next day.

In July 1996, a pipe bomb exploded in Atlanta's Centennial Olympic Park as the city was hosting the summer Olympic Games. One person was killed and dozens were wounded. It was later determined that the bomb had been planted by Eric Robert Rudolph, who was also suspected of being responsible for a double bombing at the Sandy Springs Professional Building in Atlanta in January 1997 and a double bombing at the Otherside Lounge in Atlanta in February 1997. Rudolph was arrested in May 2003 after five years on the run. He is a former soldier and survivalist with extreme right-wing views and is also reported to have ties to white supremacist groups.

On September 11, 2001 there were a series of coordinated terrorist suicide attacks by Islamic extremists upon the United States of America. Nineteen terrorists affiliated with al-Qaeda hijacked four commercial passenger jet airliners. Each team of hijackers included a trained pilot. The hijackers intentionally crashed two of the airliners (United Airlines Flight 175 and American Airlines Flight 11) into the World Trade Center in New York City, one plane into each tower (1 WTC and 2 WTC), resulting in the collapse of both buildings soon afterward and extensive damage to nearby buildings. The hijackers crashed a third airliner (American Airlines Flight 77) into the Pentagon in Arlington County, Virginia, near Washington, D.C. Passengers and members of the flight crew on the fourth aircraft (United Airlines Flight 93) attempted to retake control of their plane from the hijackers; that plane crashed into a field near the town of Shanksville in rural Somerset County, Pennsylvania.

In addition to the 19 hijackers, 2,974 people died as an immediate result of the attacks, and the death of at least one person from lung disease was ruled by a medical examiner to be a result of exposure to WTC dust. Another 24 people are missing and presumed dead. The victims were predominantly civilians. The New York City Fire Department lost 341 New York City Fire Department firefighters and two paramedics, while 23 New York Police Department, 37 Port Authority Police Department officers, and 8 private ambulance personnel were killed. There were 125 victims in the Pentagon. The dead included eight children. The youngest victim was a two year-old child on Flight 175, the oldest an 82 year-old passenger on Flight 11.

According to the Associated Press, the city identified over 1,600 bodies but was unable to identify the rest (about 1,100 people). They report that the city has "about 10,000 unidentified bone and tissue fragments that cannot be matched to the list of the dead." Bone fragments were still being found in 2006 as workers prepared the damaged Deutsche Bank Building for demolition. The average age of all the dead in New York City was 40.

The attacks created widespread confusion across the United States. All international civilian air traffic was banned from landing on US soil for three days; aircraft already in flight were either turned back or redirected to airports in Canada or Mexico. Unconfirmed and often contradictory reports were aired and published throughout the day. One of the most prevalent of these reported that a car bomb had been detonated at the U.S. State Department's headquarters, the Truman Building in Foggy Bottom, Washington, D.C.

Between early October and early December 2001, five people died from anthrax infection, and at least 13 others contracted the disease in Washington, DC; New York City; Trenton, New Jersey; and Boca Raton, Florida. Anthrax spores were found in a number of government buildings and postal facilities in these and other areas. Most of the confirmed anthrax cases were tied to contaminated letters mailed to media personalities and U.S. senators. Thousands of people were potentially exposed to the spores and took preventive antibiotics. Numerous mail facilities and government buildings were shut down for investigation and decontamination.

In the wake of these incidents, federal, state, and local emergency response agencies across the United States responded to thousands of calls to investigate suspicious packages, unknown powders, and other suspected exposures. Almost all of the incidents turned out to involve no actual biohazard. Nevertheless, emergency responders typically treated each call as a potentially serious health and safety risk.

During this tense time, in Missouri, the Department of Health and Senior Services (DHSS) issued numerous health alert advisories to local officials and the public, providing guidance on how to handle anthrax or suspicious letters and packages during a time of extremely heightened tensions. DHSS also instituted a surveillance system, contacting health providers to obtain public health information twice weekly, while also working to improve the public health infrastructure, information sharing, health communication networks, and hospital surge capabilities.

In October 2002, a month-long sniper spree terrorized the entire Washington DC area as a sniper duo gunned down ten people at random. The shooters were later arrested while sleeping in their modified vehicle.

In 2005, the FBI arrested 11 people in relation to 17 attacks that included \$12 million in arson damage to Vail Ski Resort in Vail, Colorado.

In March 2008, a homemade bomb damaged an Armed Forces Recruiting Office in Times Square in New York City. No suspect was caught.

In April 2013, two explosions occurred at the finish line of the Boston Marathon, killing three people and injuring more than 180. The attack resulted in a three-day manhunt for two suspects, one of which was apprehended and the other killed by police. A "shelter in place" order was given for residents in the Boston area as the search weaved in and out of area neighborhoods.

In December 2013, a 58 year old avionics technician in Wichita, Kansas was arrested for attempting a suicide bombing at Wichita Mid-Continental Airport. The perpetrator became radicalized after

reading propaganda on the Internet. He was arrested while driving a vehicle into the airport with what he believed to be an active explosive device.

In June 2015, a mass shooting took place at an Episcopal church in Charleston, South Carolina, one of the oldest black churches in the country and a site for community organization around civil rights. Nine people were killed, and a tenth victim was shot but survived. The perpetrator was later arrested, and confessed that he was trying to initiate a race war.

In June 2016, a lone gunman opened fire at a gay nightclub in Orlando, Florida. Almost 50 people were killed and 53 were injured in what is one of the deadliest mass shootings in modern American history.

Probability of Future Occurrence

The threat of terrorism in the United States remains a concern. Over the past few years, the level of acts committed in the United States has increased steadily with attacks ranging from mass shootings to improvised explosive devices to cyber-attacks.

Although several different extremist groups have been identified in Missouri, there have been no indications of any specific recent terrorist activities. The potential does remain, however, for new extremist and/or terrorist groups to move into the State at any time.

An open society such as ours, which depends on technology for its continued smooth operation, remains a potential target for terrorists. Large cities with a variety of news media outlets probably represent the most likely locations for terrorist acts because terrorists generally want their acts to reverberate in the news media and reach the largest audience possible. Since Missouri does not have large media markets compared to some states, it is not as likely a target for terrorist activity as those other states. However, the Oklahoma City bombing debunked the idea that rural America is completely safe from terrorists. With this in mind, it appears that a terrorist attack could occur in Missouri; the probability of such an attack is low, and noted as <1-percent.

Changing Future Conditions Considerations

Changing future conditions in terms of climate and weather patterns are not expected to have a direct impact on the probability or severity of potential terrorism events. However, there are extreme environmental groups that may resort to forms of terrorism in their protests.

Vulnerability

Vulnerability Overview

Terrorist acts could easily undermine the confidence that people have in their own security and in their government's ability to protect them from harm. Because bombs can be made so easily, the threat of a bomb should not be taken lightly. The threat of a bomb can disrupt a community almost as effectively as an actual bomb, while creating far fewer risks for the persons making the threat. Therefore, no matter how large or small the incident, a terrorist act can have a major impact on a community.

A strategic biological, or chemical attack on the United States could have the most devastating and far-reaching consequences. The potential for traditional war-related attacks, using conventional weapons, is a scenario that is more likely to occur, based on currently available information, however even attacks of that variety are rare. Attackers are likely to have either very specific targets

such as Women's clinics, or desire large publicity from the attacks.

Impact of Previous and Future Development

As more and more large public events are held in Missouri, and as the population increases, more potential exists for these venues to become targets of a terrorist attack.

Hazard Summary by Jurisdiction

The planning area is largely rural and the possibility of a terrorist attack is very slim. A more likely scenario, though still remote, is the possibility of domestic acts of violence against employers, and others known to the attacker. These incidents are typically associated with higher population density communities.

Problem Statement

Using population and major transportation corridors as key indicators, the data suggests that counties at most risk are St. Louis, Jackson, St. Charles, St. Louis City, Greene, Clay, Jefferson, Boone, Jasper and Franklin. Mitigation strategies and limited resources allocated in these counties first could prove most beneficial.

2018 risk assessment data and mapping is available through the Missouri Hazard Mitigation Viewer: <http://bit.ly/MoHazardMitigationPlanViewer2018>.

3.4.14 Transportation Disruption

Hazard Profile

Hazard Description

For the purpose of this plan, mass transportation is defined as the means, or system, that transfers large groups of individuals from one place to another. This profile addresses only transportation accidents involving people, not materials. Thus, mass transportation accidents include public airlines, railroad passenger cars, metro rail travel, tour buses, city bus lines, school buses, riverboat casinos, and other means of public transportation. This hazard addresses only those accidents that involve passenger air, road, or rail travel that results in accident death or injury.

Interstate 70 is the only interstate facility in the county and comprises of four lanes through the planning area with annual average daily traffic (AADT) volumes reaching 52,400 vehicles. State Highway 47 is a two-lane minor arterial with AADT of 23,371. State Highway 94 is a two lane minor arterial with AADT of 521.

There is one Class I Railroad running through the county; Norfolk Southern Railway (NS) Although no passenger service is offered in the county, Amtrak offers scheduled service to the south of the region across the Missouri River in both Washington and Herman on the Union Pacific line.

OATS Inc. founded in 1971, which is one of the largest public transportation providers in the nation, is a private, not-for profit organization serving 87 of Missouri's 114 counties. In the past year OATS operated in Warren County with a total of 4,171 one-way trips and a total of 53,497 miles. The majority of para-transit services within the county are needs-specific services offered by an array of non-profit human service providers. These services are generally in-house and are limited to the

clients or customers of the particular agency, though OATS often provides transportation services for agencies without in-house transportation options.

Airlines

Missouri serves as a transportation crossroad for the United States. Missouri is centrally located in the nation making it a natural hub for many major airlines (five primary airports in the State offer commercial service) and other types of tourist and business travel. Many cross-country travelers use Missouri terminals to connect with transport changes. The state's airways, railways, and highways are used as nonstop thoroughfares as well. Although Warren County has no major nor feeder airport, a mid-air collision is a remote possibility.

Commercial Vehicles

Tour bus travel in the State is on the increase, and more bus traffic can be expected. The Passenger Carrier Inspection Division of the Missouri Department of Transportation has developed a comprehensive passenger carrier safety inspection program. Passenger carrier safety is a primary concern for the Division because Missouri, and especially Branson, is among the top tourist destinations in North America. Division inspectors conduct safety inspections at destinations or carrier terminals when buses do not have passengers on board.

The Passenger Carrier Inspection Division has two classifications of passenger carriers: for-hire and private. For-hire passenger carriers provide service to the general public and are required to register with the division. Private carriers provide passenger service in furtherance of a commercial enterprise. Examples include, but are not limited to, hotel courtesy buses, airport passenger shuttle services, buses operated by professional musicians, and buses for civic and other groups such as scout groups where no fees are collected.

Railroads

Amtrak, the State's major passenger rail carrier, uses tracks that cross the entire state from east to west, with stations in Hermann, Kansas City and St. Louis. Although Amtrak has experienced a decline in passengers since the year 2000, it continues to carry a large number of passengers daily. Peak periods for rail companies in North America is somewhere between April and September of any given year.

Geographic Location

Transportation related events are normally associated along major transportation routes but can occur anywhere in the planning area.

Strength/Magnitude/Extent

There is no uniform extent rating for a mass transportation incident, as different modes of transportation have unique characteristics. Depending on the parameters of the incident, it is reasonable to assume that a large-scale mass transportation incident involving a train derailment or a plane crash could cause hundreds of fatalities, hundreds of injuries, millions in property damage and a potentially long-term loss of service.

Previous Occurrences

Airlines

Information from the Federal Aviation Administration regarding primary, non-primary commercial service and general aviation airports found at http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/ shows that

there are a total of 127 airports in Missouri that are considered public use, of which eight are considered commercial. Of these, the top five are listed below including the number of enplanements for calendar year 2015.

Table 3.46 Top Five Missouri Airports by Enplanements, 2015

Airport	County	2015 Enplanements
Lambert St. Louis International	St. Louis	6,239,248
Kansas City International	Platte	5,135,127
Springfield – Branson National	Greene	447,843
Columbia Regional	Boone	64,707
Joplin Regional	Kiowa	28,306

Source: Federal Aviation Administration,
https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/

The National Traffic Safety Board records aircraft incidents involving fatalities in the United States. The NTSB records one such incident in Missouri, in 2004. On October 19, 2004, a plane flying between St. Louis and Kirksville crashed on the approach to the Kirksville Airport, killing thirteen people and injuring two.

Railroads

On May 14, 1997, about 9:00 pm, a Missouri and Northern Arkansas Railroad (M&NA) train, the Cotter North local, was traveling northbound in non-signaled territory when it entered a siding track and collided with an unattended and unoccupied Branson Scenic Railway (BSR) excursion train. The collision occurred in downtown Branson, Missouri, on the M&NA Aurora Subdivision at milepost (MP) 447.3. When the collision occurred, the lead locomotive unit of the striking train derailed and caught fire. Also, both locomotive units of the parked train derailed. Both train crewmembers of the M&NA train sustained minor injuries. The costs associated with the accident were \$410,625.

On July 29, 2001, an Amtrak train derailed in on a section of rural track that had been undermined by heavy rains. A locomotive and three cars derailed near Sabula in Iron County. Ten people were treated for minor injuries at local hospitals.

An Amtrak train carrying 103 people on September 29, 2005 derailed in eastern Missouri near Blackwell after striking boulders from a rockslide; approximately 20 people sustained minor injuries. The severity of the derailment was mitigated by the slow speeds required to wind through the area; slow speeds were attributed as the reason no cars were overturned.

Commercial Vehicles

Commercial motor vehicles have been involved in a significant number of Missouri traffic accidents. Statistics from the Missouri State Highway Patrol Statistical Analysis Center show that from 2016-January 1, 2021 there are 401 incidents involving a commercial vehicle.

Probability of Future Occurrence

A major accident can occur at any time, even though all safety precautions are in place. Accidents involving commercial vehicles occur on an annual basis, however these are usually considered minor in nature. Based on the latest available information for different modes of transportation, the probability of a mass transportation accident is 100%.

Changing Future Conditions Considerations

Changing future conditions with respect to climate are not likely to impact the probability or severity of this hazard. The exception would be accidents caused by precipitation or other severe weather, such as high changes in precipitation patterns, particularly more extreme precipitation events and drought, have the potential to affect transportation systems across the country. Storm drainage systems for highways, tunnels, airports, and city streets could prove inadequate, resulting in localized flooding. Bridge piers are subject to scour as runoff increases stream and river flows, potentially weakening bridge foundations.

Vulnerability

Vulnerability Overview

Mass transportation systems have strict plans and protocols in place to ensure the safety and security of their passengers. Even with these protocols in place, a major accident could occur at any time. Mass transportation systems can also serve as attractive targets for terrorism, with high numbers of people congregated in small spaces and the potential for disruption in daily lives.

It is impossible to predict what losses Warren could suffer due to a major transportation incident, however, the table below; taken from the 2018 State Plan, lists some generalized state-wide estimated losses.

Table 3.47 State-Wide Annual Loss Estimates, Mass Transportation Accidents, 2015

Type of Vehicle	Injuries	Cost per Injury	Fatalities	Cost per Fatality
Bus (Small / Large)	354	\$12,744,000	3	\$7,800,000
Limousine	1	\$36,000	0	\$0
School Bus	187	\$6,732,000	1	\$2,600,000
Passenger Van	38	\$1,368,000	3	\$7,800,000
Totals	580	\$20,880,000	7	\$18,200,000

Sources: Missouri State Highway Patrol Statistical Analysis Center, 2015 data
<http://www.mshp.dps.missouri.gov/MSHPWeb/SAC/Compendium/TrafficCompendium.html>

Impact of Previous and Future Development

As the amount of tourism increases and personal travel through Missouri via mass transit increases, the number of accidents can be expected to increase. Costs increase each year as well.

Hazard Summary by Jurisdiction

Transportation disruptions can occur anywhere and at any time. The most serious disruptions will likely be in areas adjacent to major transportation routes.

Problem Statement

Using the major transportation corridors for the State as key indicators, the counties at most risk for serious transportation disruptions are Jackson, St. Louis, Buchanan, Clay, Boone, St. Charles, Jefferson, Franklin, Green and Jasper. Mitigation strategies and limited resources would best be allocated in these counties.

3.4.15 Utilities Disruption

Hazard Profile

Hazard Description

Description/Location

Utility Interruptions and failures may involve electrical power, internet/telecommunications systems, natural gas, and public water and wastewater systems. These systems or combinations of these utility systems exist virtually throughout the State. Many utilities are localized and serve only one community, while other utilities serve a regional area.

Disruption of any of these services could result from many of the natural or human-caused / technological hazards described in this plan. In addition to a secondary or cascading impact from another primary hazard, utilities and infrastructure can fail because of geomagnetic storms, faulty equipment, lack of maintenance, degradation over time, or accidental damage such as damage to buried lines or pipes during excavation.

Geomagnetic storms can cripple communications that rely on the ionosphere. Many communications systems use the ionosphere to reflect radio signals over long distances. While TV and commercial radio stations are not typically affected by solar activity, ground-to-air, ship-to-shore, shortwave broadcast and amateur radio (mostly the bands below 30 MHz) are frequently disrupted. Users of these bandwidths include some military detection early warning systems, submarine detection systems, and aircraft.

Solar disturbances also damage communications satellites. Increased solar ultraviolet emissions heat the earth's upper atmosphere causing it to expand. The heated air rises and the density at the orbit of the satellites increases. This creates increased drag on the satellite which in turn causes the satellite to slow and change orbit slightly. Also, during a storm, the number and energy of electrons and ions increases. As a satellite travels through this environment, charge accumulates and can harm the satellite's electrical systems. Damage to communications satellites can disrupt non-terrestrial telephone service, television, radio, and internet service.

Electric Power

Disruption of electric power supply can be a cascading impact of several other hazards profiled in this plan including: flood, tornado, windstorm, and wither weather. These hazards can cause damage to power infrastructure. To a lesser extent, extreme temperatures, dam failure, levee

failure, lightning, and terrorism could cause power disruption as well. Extreme heat can disrupt power supply when air conditioning use spikes during heat waves which can cause brownouts. Like flood, dam and levee failure can impact power infrastructure. Lightning strikes can damage substations and transformers, but is usually isolated to small areas of outage. Many forms of terrorism could impact power supply either by direct damage to infrastructure or through cyber-terrorism targeting power supply networks. Geomagnetic storms, faulty equipment, lack of maintenance, degradation over time, or accidental damage such as damage to buried power cables can also cause disruption to electric power.

Electrical utilities in Missouri prepare for disasters and power outages by developing written plans to follow when events cause outages to customers. Power outages caused by severe weather have prompted the creation of tree-trimming plans to ensure above ground power lines are free of potential limbs that could fall on power lines and cause interruptions of power if knocked down. In addition, ongoing reviews of emergency plans and training for such events have been implemented. Many utilities also use emergency batteries or generators to provide back-up power for high priority equipment. After the 2002 ice storm that struck western and northern Missouri, an automated outage reporting system was created. The Public Service Commission also advised utility companies to provide feedback to customers that their outage report was recorded.

Electricity is provided to residents of Warren County by Ameren UE.

Missouri's electric cooperatives are non-profit power suppliers owned by their members. Each is governed by a board of directors elected from among the membership. There are 40 distribution cooperatives which provide electricity to individual homes, farms, and businesses. Some of these co-ops are quite large while others may serve just one county. Missouri's smallest electric cooperative has just over 2,000 member-owners while the largest has more than 40,000 members. In addition to the 40 distribution cooperatives, there are six transmission cooperatives and Associated Electric Cooperative, the wholesale power provider to the distribution and transmission cooperatives. These cooperatives contribute to a comprehensive hazard mitigation plan which contains information pertaining to all 47 of the state's electric cooperatives. Due to sensitive data relating to the power grid in the State, this plan is not available to the public.

Regardless of size, each electric cooperative operates in similar fashion. Each member-owner has one vote at an annual membership meeting at which bylaws are approved and board members are elected. The board members, each a member of the cooperative, set policy for the co-op to direct day to day operations.

Missouri's electric distribution cooperatives buy wholesale power from Associated Electric Cooperative, headquartered in Springfield, Missouri. Like the local electric cooperatives, Associated Electric Cooperative operates on a not-for-profit basis and is owned by those who use the services it provides—in this case, Missouri's distribution and transmission cooperatives. Missouri's six transmission cooperatives deliver wholesale electricity from Associated to local distribution cooperatives over high-voltage transmission lines. For more information about specific cooperatives, visit the Association of Missouri Electric Cooperatives at <http://www.amec.org>.

Internet / Telecommunications

Internet and telecommunications infrastructure and service can be impacted by the same hazards that can impact electric power supply. Land line telephone lines often utilize the same poles as electric lines. So, when weather events such as windstorm or winter weather cause lines to break, both electricity and telephone services experience outages. With the increasing utilization of cellular telephones, hazard events such as tornado that can damage cellular repeaters can cause outages. In addition, during any hazard event, internet and telecommunications systems can become

overwhelmed due to the surge in call usage/volume.

Vulnerability of buried telecommunications cables has always been a problem. Cables may be subject to accidental or intentional cuts. However, legislation and mitigation procedures have been taken to prevent such events. Missouri law provided for the creation of the “One Call” call center to locate and mark buried utilities when requested prior to any digging/excavating. Most Local Exchange Carriers have their facilities on record with One Call. Missouri Revised Statute Chapter 319, “underground Facility Safety and Damage Prevention Act” is the legislation governing requirements to have utilities identified prior to digging or excavation. Additional steps to prevent cutting of buried telecommunications cables include clearly marking cable routes with above ground pedestals and poles, as well as patrolling the routes by vehicle and air. In addition to these precautions, most companies have constructed fiber rings for the fiber optic routes to provide for continuity of service in the event of an accidental cut.

Since floods pose a threat to telephone service, most companies with buried cables in floodplains are replacing conventional telephone pedestals with flood resistant telephone pedestals, which protect the cables during floods of short duration.

In 1990, the Missouri Public Service Commission requested that all Local Exchange Carriers submit plans for disaster recovery. Every LEC in the state submitted a plan detailing practices and procedures for service restoration in the event of a disaster. Additionally, to mitigate damage of earthquakes or other disasters, the Local Exchange Carriers added bracing to their central offices for their switching equipment and batteries. Many companies have also obtained on-site generators or made contingency arrangements to acquire them in response to an outage.

Natural Gas

Primary hazards that can impact natural gas pipelines are earthquake, land subsidence, human error/digging accidents, infrastructure degradation, and acts of terrorism/vandalism. All natural gas system operators in the State operate under the jurisdiction of the Missouri Public Service Commission. These operators must comply with the commission’s pipeline safety regulations which include emergency response procedures to pipeline emergencies and natural disasters. Natural gas operators have plans on file with the Missouri Public Service Commission. These include indexes of utilities and their locations in the State.

In 1989, Missouri House Bill 938 provided the commission with additional legal power to enforce the Pipeline Safety Regulations. In 1990, due in part to the Iben Browning earthquake projection, all utilities were mandated by the commission to develop natural disaster plans (to include potential impacts of earthquakes) and file the plans with the commission. The commission also developed its own plan to respond to a disaster causing an interruption or failure of a utility service. The Iben Browning earthquake projection created a new awareness for the necessity for such disaster response and recovery plans. Several natural gas companies have since stored emergency equipment and survival rations in protected locations. This also resulted in a new demand for excess flow and motion sensing valves on natural gas service lines. Operators also reviewed, updated or increased their mutual aid agreements with other utilities and contractors.

According to the Pipeline and Hazardous Materials Administration, in 2015, there were 50,771 miles of natural gas pipelines in Missouri as shown in the following table.

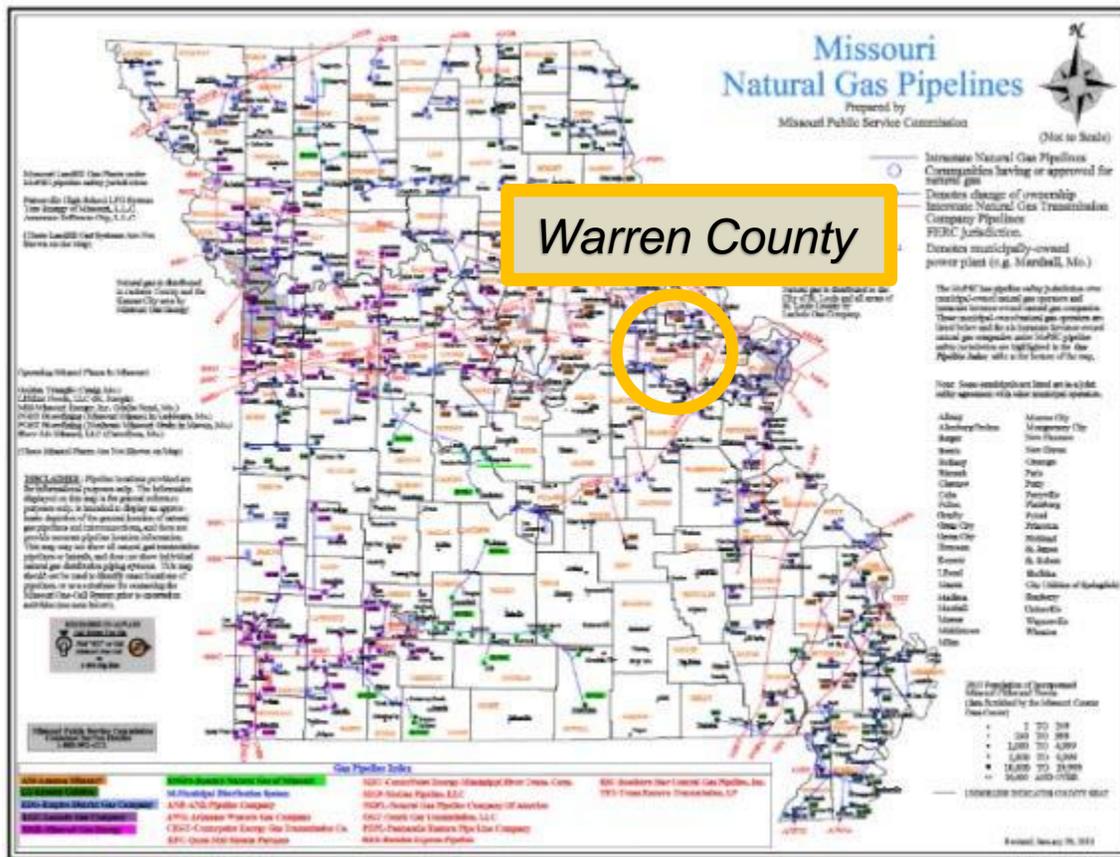
Table 3.48 Natural Gas Pipelines in Missouri By Type

Type	Miles
Gas Distribution Mail Miles	27,348
Gas Distribution Service Miles	18,811
Gas Transmission	4,612
Gas Gathering	0
Total	50,771

Source: Pipeline and Hazardous Materials Administration,
<https://hjp.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages>

The distribution pipelines are operated by 50 different companies. Over 3,600 miles of Interstate transmission lines are operated by 12 companies and over 1,000 miles of intrastate transmission lines are operated by 13 companies. Missouri law requires all owners and operators of underground pipeline facilities to participate in the One Call notification center. This participation provides for the location of underground pipelines after notification by the excavator and before any excavation begins. Missouri's natural gas pipelines are shown in the figure below.

Figure 3.25. Missouri Natural Gas Pipelines



Geographic Location

Every area of Warren County is served by one or more utilities including electricity, natural gas, telecommunications, water and sewer; and is therefore subject to adversity due to the absence of these utilities.

Strength/Magnitude/Extent

In many cases, utility interruptions are small, isolated events that are within the capabilities of the local utility to address. Therefore, the degree of severity of the day-to-day events may be considered low. Due to long- range planning, regulation, and diligence of the utility operators, major interruptions resulting in a high degree of severity are few and far between. In some instances, utility outages and interruptions can impact a larger area and be for a prolonged period. Utility outages can also often be a cascading impact of a primary hazard such as flooding, severe thunderstorm, severe winter weather, and cyber disruptions.

Previous Occurrences

Because utilities exist everywhere in the State, damage to utilities may occur frequently. Causes of damage can range from a backhoe cutting a buried line, an accident involving a motor vehicle, a flood, a geomagnetic storm, or another hazard event. Many of these interruptions or failures go unreported and no comprehensive system is in place to capture historical outages. Therefore, limited information is available to develop statistical analysis of previous events for all utility types.

For electric utility interruptions, Inside Energy has compiled a database of 15 years of power outages compiled from annual data available from the Department of Energy.

The table below provides the outages that included the State of Missouri Warren County inclusive of January 2000 through December 2014. Data was not available prior to 2000. It is likely parts of Warren County are included in some of these outages.

Table 3.49 Power Outages in Missouri, 2000 - 2014

Event Description	Date Began	Time Began	Date End	Time End	Outage Area	Residents Affected
Severe Weather - Snow/Ice	2/20/2014	4:40 PM	2/21/2014	11:59 PM	Missouri, Illinois	66,000
Physical Attack - Vandalism	1/21/2014	12:14 PM	1/21/2014	12:39 PM	Missouri	Unknown
Severe Weather - Tornadoes	11/17/2013	12:35 PM	11/20/2013	11:00 AM	Central Missouri, Central Illinois	200,000
Physical Attack; Vandalism	8/29/2013	9:50 AM	8/29/2013	9:50 AM	Joplin, Missouri	Unknown
Severe Weather - Thunderstorms	5/31/2013	7:30 PM	6/1/2013	8:00 PM	St. Louis Metro Area Missouri	100,000
Severe Weather - Winter Storm Nemo	2/26/2013	1:00 PM	3/1/2013	10:00 AM	Northern Missouri	56,444
Severe Thunderstorms	6/27/2011	12:00 AM	6/29/2011	1:00 AM	Illinois; Missouri	80,000
Severe Weather	5/23/2011	12:30 PM	5/25/2011	12:30 PM	St. Louis County	70,000
Severe Weather	5/22/2011	5:09 PM	5/31/2011	12:01 PM	Joplin, Sarcoxie, and Wentworth	20,000
Severe Weather	4/22/2011	9:00 PM	4/22/2011	11:00 PM	Metro St. Louis area, Missouri	55,000
Severe Thunderstorm	5/8/2009	7:30 AM	5/8/2009	9:00 a.m.	SW Missouri	83,000
Winter Storm	1/28/2009	12:10 AM	1/30/2009	9:20 p.m.	East Central Missouri	1
Winter Storm	1/27/2009	11:00 AM	1/30/2009	6:00 p.m.	South Central and Southeast	62,500
Fire/Load Shedding	12/2/2008	4:30 AM	12/2/2008	7:00 a.m.	St. Louis, Missouri	53,000
Hurricane Ike	9/14/2008	7:30 AM	9/18/2008	3:00 p.m.	Missouri and Illinois	107,000
Severe Thunderstorm	8/13/2007	1:30 AM	8/14/2007	12:00 a.m.	State of Missouri	63,000
Ice Storm	1/13/2007	5:00 AM	1/19/2007	12:00 p.m.	Missouri and Illinois	225,000
Ice Storm	11/30/2006	9:00 PM	12/9/2006	6:00 p.m.	Missouri and Illinois	550,000
Severe Storms (3) (Many experienced multiple outages.)	7/19/2006	6:00 PM	7/31/2006	8:00 a.m.	Greater St. Louis Metropolitan area (MO and IL)	2,500,000
Ice Storm	1/30/2002	4:00 PM	2/10/2002	9:00 AM	Missouri	95,000

Source: Inside Energy, <http://insideenergy.org/2014/08/18/data-explore-15-years-of-power-outages/>, compiled from Annual reports from the Department of Energy

Narratives of additional notable previous occurrences of various utility interruptions/failures are provided below.

On March 13, 1989, a geomagnetic storm caused the Hydro-Québec power grid to fail. On March 10, an explosion on the sun released a billion-ton cloud of gas that headed towards earth at a million miles per hour. The solar flare that followed the explosion caused short-wave radio interference immediately. The magnetic disturbance was so intense that it created electrical currents in the ground beneath North America. These currents found a weakness in the Québec power grid and millions of people were without power for 12 hours. The power outage closed schools and

businesses, Dorval Airport and the Montreal Metro during morning rush hour. U.S. electrical utilities were also affected. There were 96 electrical utilities in New England interrupted while other reserves of electrical power were brought online. Across the United States, over 200 power grid problems were reported within minutes of the storm but none caused a blackout (NASA, 2009).

During the flood of 1993, telecommunications companies proved their adaptability by using cellular service to replace wire line service in areas where service could not be restored in a timely manner. One local exchange company used a trailer with cellular pay phones where the land lines were interrupted. Another company temporarily replaced analog subscriber carrier service with site-based cellular service. Short-haul portable microwave was also used to replace copper lines lost during the flood.

On January 30, 2002, a severe ice storm struck portions of western and northern Missouri leaving devastation and darkened homes and businesses. Many news articles referred to this ice storm as the worst in Missouri's history. During the ice storm, ice accumulated on any object that was at or below freezing, and the weight of the ice broke utility poles, conductors, tree limbs, and other that could not withstand the weight of the ice. Ice accumulations over an inch were reported in many areas. Many tree branches could not withstand the added weight of the ice and fell to the ground, striking whatever was in their path. Cars, homes, streets, properties, and electric power facilities were recipients of the falling trees and limbs. When the ice began to melt, the falling ice caused additional outages. Some electric customers experienced outages more than once during that period, as power was restored but interrupted again by falling limbs. At the peak of outages, over 400,000 customers were without power. Within three days, most of these customers were returned to service, but many customers in more heavily damaged areas were without power for over a week. Utilities affected by the ice storm quickly mobilized all their available crews and sought outside assistance. Work crews from 16 different states came to western Missouri to rapidly restore power to as many customers as possible.

On July 19-20, 2006, severe storms with high winds and possible tornado activity struck St. Louis and the counties of St. Louis, Dent, Iron, Jefferson, Oregon, St. Charles, and Washington. Because of the storms, approximately 500,000 AmerenUE customers were without electrical power. Over 3,600 utility workers from AmerenUE and outlying utility companies were involved in restoration efforts, the largest in company history. High priority projects included restoring power to 14 nursing homes, cooling stations, hospitals, city services, and utility and fuel terminals. Compounding the power outage problems, a heat advisory with heat index values as high as 104 degrees Fahrenheit plagued recovery efforts for several weeks.

In January 2009, over two-and one-half inches of snow covered most of the southeast portion of the state. Heavy ice accumulations caused over 3,800 AmerenUE transmission and distribution poles to break. Similar breakages were experienced by municipal and electric cooperative systems and transmission operators. Because of the extent of damage, some locations were without power for up to three weeks.

In January 2011, record amounts of snow that caused blizzard conditions across the state resulted in widespread power outages.

Sunday, May 22, 2011, a devastating weather event struck Joplin, Missouri, continuing through the cities of Duquesne, Diamond, Granby, Sarcoxie and Wentworth. The National Weather Service identified the event as an EF-5 tornado with winds more than 200 miles per hour. The tornado took a direct route through the heart of Joplin's residential and retail district, resulting in hundreds of injuries, deaths and the loss of thousands of homes and businesses. In addition, the storm also affected electrical power, natural gas, water and communications services.

July 13, 2016, Major power outages occurred across the St. Louis metro area due to powerful storms. At the height of the storm, winds were clocked as high as seven miles per hour. As a result, approximately 128,000 Missouri AmerenUE customers were without power.

Probability of Future Occurrence

Because utilities exist throughout the State and are vulnerable to interruptions or failures and because of multiple primary, secondary/cascading hazards, there is a very high probability that utility failures can occur at any time or location throughout the state. In most cases, these are small isolated events well within the capabilities of the local utility to address. But, occasionally, utility interruptions/failures are widespread, relying on coordinated response efforts to restore function. As previously noted, Inside Energy compiled a list of 20 power outage events within Missouri over a 15-year period which calculates to a 100% probability.

Changing Future Conditions Considerations

Deteriorating infrastructure is a current nationwide problem that is likely to be exacerbated by changing future conditions. Higher future temperatures, for example, would increase the demand for cooling homes, businesses, and public buildings, placing greater stress on power systems.

Existing storm water systems were designed based on past conditions that are now changing; many systems may quickly become inadequate if storms continue to become more frequent and/or intense. Communities should prepare for even greater stress on infrastructure systems that may already be outdated. Although declining infrastructure is a serious problem, it also presents an opportunity to improve and integrate existing systems so that they serve communities better and more efficiently.

Vulnerability

Vulnerability Overview

Utilities and infrastructure are vulnerable to damage from many natural hazards. Public health and safety and potential impacts on the economy are primary concerns with this hazard. Power and telephone lines are the most vulnerable infrastructure asset; but water supply, wastewater facilities and communications towers are also vulnerable. Typically, the events that cause the most damages are flood, lightning, winter storm, tornado, and wind storm. The electrical grid is vulnerable in periods of extreme heat when air conditioning use peaks. Underground utilities can also be damaged by expansive soils, erosion, earthquake and intentional or unintentional human actions. The [Missouri Underground Facility Safety and Damage Prevention Act](http://www.moga.mo.gov/mostatutes/chapters/chapText319.html) (<http://www.moga.mo.gov/mostatutes/chapters/chapText319.html>) helps prevent accidental damage of underground facilities. This statute makes it illegal to excavate without first giving notice and obtaining information concerning the possible locations of underground facilities.

Table 3.50 Potential Loss Estimates for Utility Failure in Warren County

Population	Potentially Affected Population (10%)	Electric (\$126)	Drinking Water	Wastewater Treatment (\$41)
33,513	3,351	\$422,264	\$311,671	\$137,403

Source: FEMA BCA Reference Guide, June 2009, Appendix C; U.S. Census Bureau 5-year American Community Survey, 2015

Impact of Previous and Future Development

Future development can increase vulnerability to this hazard by placing additional strains on existing infrastructure and by increasing the size and thus the exposure of infrastructure networks. In addition, utility and infrastructure development and expansion should be minimized or mitigated in known hazard areas to ensure the vulnerability to this hazard is not increased as a secondary impact to other hazard events.

Hazard Summary by Jurisdiction

No jurisdiction was found to be more vulnerable to utilities disruption than others.

Problem Statement

Using the Potentially Affected Population from 2018 Missouri State Hazard Mitigation Plan as the key indicator for Utility Disruptions, the most at-risk counties are St. Louis, Jackson, St. Charles, St. Louis City, Greene, Clay, Jefferson, Boone, Jasper, Franklin and Cass Counties. Mitigation efforts and dollars focused on these counties first would be beneficial.