5.14 Utility Failure

2023 SHMP Update Changes

- The 2023 State Hazard Mitigation Plan (SHMP) risk assessment was expanded to include human-caused hazards. The hazard profile has been created to enhance the hazard description, location, extent, previous occurrences, and probability of future occurrence (including how future conditions may impact the hazard). New and updated figures from federal and state agencies are incorporated.
- Utility failure events that occurred in the State of West Virginia (the State) from January 1, 2010, through December 31, 2022, were researched for this 2023 SHMP update.
- Information was updated regarding the current population affected by utility failure.

5.14.1 Hazard Profile

A utility interruption includes power failure, potable water service outage, telecommunication infrastructure failure, natural gas infrastructure failure, or sewer infrastructure failure. Interruptions to basic utilities (such as data/telecommunications, water, natural gas, or sewer) can have a detrimental impact on West Virginia in terms of day-to-day function. Utilities that employ aboveground wiring (power and data/telecommunications) are vulnerable to the effects of other hazards, such as high wind, heavy snow, ice, rain, and vehicular accidents to name a few.

Hazard Description

Utility failure is defined as any disruption or loss of a public service which includes but is not limited to electrical service, potable water, wastewater, and natural gas caused by disruption of power transmission which can be caused by an accident, sabotage, natural hazards, or equipment aging/failure (also referred to as a utility interruption or utility outage). A significant utility interruption is defined as any incident of a long duration, which would require the involvement of the local and/or state emergency management organizations to coordinate provision of food, water, heating, cooling, and shelter.

Failure of utilities, such as wastewater and potable water, may occur as a result of a power failure or due to equipment failure. These critical utilities are essential to community continuity, emergency services, and recovery, and their interruption of service may have cascading economic, environmental, and emergency response impacts. Interruption of utilities also leads to disruption in daily life for residents (i.e., loss of potable water for cooking) and can also have serious impacts on firefighting and emergency response capabilities.

Power failures lead to the inability to use electric-powered equipment, such as lighting; heating, ventilation, and air conditioning; communication equipment (telephones, computers, etc.); fire and security systems; appliances such as refrigerators, sterilizers, etc.; and medical equipment. This all can lead to food spoilage, loss of heating and cooling, basement flooding due to sump pump failure, and loss of water due to well pump failure. In addition, utility gas failures can lead to the widespread inability for West Virginia residents to heat their homes, as 91 percent of natural gas customers in the state are residential (U.S. DOE 2021). Current procedures of shutting off

utility gas distribution before severe weather events could also hinder the ability to provide backup power if residents have generators power by utility gas.

Location

Utility failure can take place anywhere within the state where utilities have been installed and at any time. These events are usually small-scale, localized occurrences and a secondary impact of other hazards such as serve storms or ice storms. Local outages and interruptions may be caused by traffic accidents or wind damage. However, utility failure can also be widespread, as often is the case with blackouts caused by heat waves, snowstorms, and ice storms in West Virginia. During these hazard events, the critical infrastructure supporting these utilities is impacted.

Some utility facilities are especially vulnerable to failure, including ones that rely on aging infrastructure to support them. Utilities located in hazard-prone areas are also vulnerable to those hazard impacts. For instance, potable water interruption is possible when water intakes and water control facilities are located in the floodplain.

Extent

The extent and severity of a utility interruption depends on the cause, location, duration, and time of year. It can range from a small, localized event to a regional power outage. Impacts can be significant to the State and its residents. Utility interruptions typically occur because of, or in combination with, aging infrastructure, other emergencies, or disaster incidents, such as severe weather and flooding, and can be exacerbated by such emergencies. In 2012, a heat wave caused a 6-hour power outage that impacted approximately 940,090 people in West Virginia; a 2008 power outage lasted for 59 hours, impacting 50,780 people (U.S. DOE 2021). Impacts such as these demonstrate how the scale and subsequent impacts of utilities failures can impact the state.

Warning Time

Widespread utility failure can occur without warning. Generally warning times will be short in the case of technological failure, such as a fire at a sub-station, traffic accident, human error, or terrorist attack. In cases where a power failure is caused by natural hazards, greater warning time is possible. For example, high wind events such as tornadoes and hurricanes often cause widespread power failure and are often forecasted before they affect a community. Additionally, severe winter weather conditions such as ice storms, blizzards, and snowstorms often cause power failure and are often forecasted in advance. Incidents such as these often provide an opportunity for advanced notification regarding the potential for utility failure during the hazard event. In these scenarios, utility response crews can stage resources to prepare for utility failure, and residents can make preparations.

Previous Occurrences and Losses

Federal Emergency Management Agency (FEMA) Disaster Declarations

Between 1954 and 2022, West Virginia was not included in any major disaster (DR) or emergency (EM) declarations specific to utility failure events. However, the state has been impacted by numerous natural hazard events, such as severe storms and winter weather, that received declarations that involved utility failures (FEMA

2023). For a listing of FEMA disaster declarations for each natural hazard, visit the respective hazard profiles in Section 5.

U.S. Department of Agriculture (USDA) Disaster Declarations

The Secretary of Agriculture from the USDA is authorized to designate counties as disaster areas. However, utility failure is not a potential cause of agricultural disasters (USDA 2023).

Previous Events

For this SHMP update, utility failure events were summarized between 2010 and 2022. Every year, West Virginia is susceptible to minor and major utility interruptions either through technological failure or as the result of natural hazard events.

Table 5.15-1. Utility Failure Events in the State – 2010 to 2022

Date(s) of Event	Event Type	FEMA/USDA Declarations	Counties Affected	Description
April 16, 2010	Thunderstorm Wind	N/A	Brooke, Hancock, Ohio	Severe thunderstorms led to at least 150,000 homes without power.
August 4, 2010	Thunderstorm Wind	N/A	Statewide	Thunderstorms produced widespread wind damage that left 50,000 homes without power across Pennsylvania and West Virginia.
October 26, 2010	Thunderstorm Wind	N/A	Boone, Cabell, Jackson, Hancock, Kanawha, Lincoln, Mason, Mingo, Putnam	A strong Autumn front created severe wind gusts which led to 50,000 homes without power due to knocked-over power lines.
April 4, 2011	Thunderstorm Wind	N/A	Braxton, Cabell, Gilmer, Kanawha, Lincoln, Logan, Summers	Wind gusts hit up to 60 mph and led to 29,000 homes without power in Kanawha County.
Jul 8, 2012	Thunderstorm Wind	N/A	Statewide	Large temperature fluctuations led to strong storms, which led to outages of 25,000 in Kanawha County.
October 29-31, 2012	Blizzard/High Winds	EM-3358-WV DR-4093-WV	Statewide	Blizzard-like conditions developed from a heavy snowstorm associated with Superstorm Sandy, leaving over 200,000 people without power, these outages lasted over a week in many areas. The National Guard was activated to help set up shelters and distribute food and water.
November 1, 2013	Thunderstorm Wind	N/A	Statewide	Severe storm and wind damage left nearly 50,000 people without power across Ohio, Pennsylvania, and West Virginia.
November 17, 2013	Thunderstorm Wind	N/A	Statewide	A line of isolated thunderstorms produced severe wind and knocked out power in 25,000 homes.
January 6, 2014	Wind Chill/ Extreme Cold	N/A	Statewide	Snowstorm brings extreme cold temperatures with wind chills reaching even lower. Temperatures led to frozen pipes, power outages, and furnace difficulties.
June 10, 2014	Thunderstorm Wind	N/A	Braxton, Cabell, Gilmer, Jackson, Monroe, Wayne	Storms produced severe wind, which knocked out power in 16,000 homes.
March 4, 2015	Flood	N/A	Statewide	Mixed precipitation led to prolonged power outages. A few areas waited 48 to 60 hours for their electricity to be restored. Counties set up warming shelters for their affected residents.
July 12, 2015	Flash Flood	DR-4236-WV	Statewide	Clusters of snow and thunderstorms caused power outages, and a gubernatorial state of emergency was declared for a few counties.
March 1, 2016	Strong Wind	N/A	Statewide	A storm produced wind gusts up to 55 mph and knocked out power for 11,000 people, mostly in Kanawha and Jackson Counties.

Date(s) of Event	Event Type	FEMA/USDA Declarations	Counties Affected	Description
June 23, 2016	Flood	DR-4273-WV	Statewide	Wind damage and flash flooding knocked out electricity and water use for days. The American Red Cross was called in to help distribute essentials and provide shelters.
November 6, 2018	Strong Wind	N/A	Cabell, Kanawha, Lincoln, Putnam, Wayne (Zones)	Showers created strong wind gusts which blew down trees and caused 10,000 power outages across the southwestern part of West Virginia.
February 24, 2019	Strong Wind	N/A	Statewide	Isolated storms led to downed trees and powerlines leaving a peak of 91,000 residents of West Virginia without power.
February 10, 2021	Winter Storm	N/A	Statewide	A wintry mix led to significant tree damage and made more than 45,000 residents in West Virginia lose power.
February 17, 2021	Heavy Snow	DR-4603-WV	Cabell, Lincoln, Mason, Putnam, Wayne	A winter storm produced heavy snow and ice accumulations, which led to over 500 broken power poles and yards of wire in need of replacement. This caused significant power outages.

Sources: FEMA 2023; NOAA NCEI 2023
EOC Emergency Operations Center

Probability of Future Hazard Events

Overall Probability

While the probability of future utility failure incidents in West Virginia is difficult to predict, the historic record indicates that significant failures have occurred because of extreme temperatures, high winds, lightning, severe weather, winter weather, technological failures, and age of utility infrastructure. Minor utility interruptions may occur several times a year throughout the state with varying duration. As infrastructure ages beyond its intended lifespan, it is likely to become less reliable, leading to a higher likelihood of failure. In addition, new infrastructure designed to withstand hazardous weather will have a higher likelihood of success.

Projected Future Conditions

As described in earlier sections, future conditions are making hazardous weather more extreme and exacerbating storm impacts. This trend can be expected to continue as the global climate continue to warm throughout the 21st century. Heat waves tend to present challenges to the electrical grids of West Virginia. The temperature in West Virginia has increased by 1°F since the beginning of the 20th century, with more variability in precipitation (NCEI 2022). As conditions continue to evolve over time, projected longer periods of intense heat will result in more residents running air conditioning and fans for longer periods of time which increases the strain on electrical utilities and possibly resulting in widespread outages or brownouts. An additional strain on water utilities may be caused as a result of an increase in the intensity of naturally occurring droughts due to temperature-caused increases and moisture loss in soil during dry spells (NCEI 2022).

Increased wind from thunderstorms, tornadoes, and other wind events threatens aboveground utilities such as power lines. As these severe storms increase in occurrence and intensity, outages to residents and businesses can be expected more frequently, particularly in areas where the average age of the infrastructure is greatest.

5.14.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area. For utility failure, the entirety of West Virginia has been identified as the hazard area. Therefore, all assets in the state (population, structures, critical facilities, and lifelines), as described in the State Profile, are vulnerable. The impacts on population, existing structures, critical facilities, and the economy are presented below.

State Assets

For the purposes of this risk assessment, an asset is considered potentially vulnerable if it is in an identified hazard area. As stated previously, utility failure impacts and affects the entire area of West Virginia is the hazard area; therefore, a total of 1,117 State facilities are vulnerable to utility failure. The total replacement cost value for all 1,117 structures is $6,103,990,956. Kanawha County has the most structures (200) while Monongalia County has the highest total RCV ($1,605,027,842) of State facilities in comparison to all the counties in the state.

Critical Facilities and Community Lifelines

All critical facilities are vulnerable to utility interruptions, especially the loss of power. The establishment of reliable backup power at these facilities is extremely important to continue to provide for the health, safety, and well-being of West Virginia's population. In total, there are 185 critical facilities that may be impacted by utility

failure, with Kanawha County having the greatest number of critical facilities (75) and therefore having the greatest vulnerability.

POPULATION

For the purposes of this SHMP, the entire population of West Virginia (1,807,426) is exposed to utility failure (U.S. Census 2023). Residents might be displaced or require temporary to long-term sheltering due to interruptions to their daily lives as a result of utility failure. Loss of utilities to support access to heating, cooling, and potable water can result in increased health impacts. The population adversely affected by utility failure may also include those beyond the disaster area that rely on communication lines or water lines that run through the state.

Impacts on Socially Vulnerable Populations

Socially vulnerable populations may be impacted at a disproportionately higher rate than the rest of the population. Individuals that are socially vulnerable may have increased medical needs, which can be exacerbated due to overheating, heatstroke, or hyperthermia. Power failure leading to loss of heating and cooling in homes could exacerbate these health risks. Additionally, socially vulnerable individuals dependent upon electric-powered medical equipment could face severe impacts, including loss of life.

Economically disadvantaged residents are at high risk for bracing intense cold and hot conditions because of the potential inability to afford backup generators, which may pose health issues, such as hypothermia or heat stroke.

FUTURE CHANGES THAT MAY IMPACT STATE VULNERABILITY

Understanding future changes that impact vulnerability in the state can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The State considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of future conditions

Potential or Projected Development

Although West Virginia has not experienced significant growth, any areas of growth could be impacted by utility failure. Aging infrastructure may also be vulnerable to hazards that cause utility interruption to potential or projected development.

Projected Changes in Population

While statewide population has declined over the past 10 years, population has increased in several areas throughout the state (e.g., Berkely, Jefferson, and Monongalia Counties). From 2010 to 2019, the state's overall population decreased by 3.3 percent, and it is projected to decrease 7.8 percent by 2040 (West Virginia Department of Transportation 2020). As the population in the state continues to decrease there is the potential that less people will reside or work within the state, which means fewer people will experience utility failure.

Other Factors of Change

As discussed above, projected future conditions for West Virginia indicate more frequent extreme temperature and severe weather events could result in an increase in utility failures. Refer to Probability of Future Hazard Events for details on how future conditions can impact utility failure events.

5.14.3 Consequence Analysis

Impacts to the Public

Utility failure is particularly problematic for homes that are heated with electricity. Widespread power outages during the winter months can directly impact vulnerable populations such as older adults and medically vulnerable. Individuals with medical needs are vulnerable to power failures because medical equipment such as oxygen concentrators requires electricity to operate. Older adults and individuals experiencing economic hardships are also vulnerable to the effects of power failure in terms of exposure to extreme heat or extreme cold. During power failure events, water purification systems may also loss function. Additionally, populations on private wells will not have access to potable water. The outage events that result from storm events can lead to flooding, and without electricity, residents would be unable to pump water from their basements, potentially causing structural and content damage to their homes.

Impacts to Responders

First responders' safety may be at risk during on-scene operations, and they may not be able to respond in a timely manner due to electrical or utility fires. First responders may need to take on additional duties due to a higher-than-normal call volume and demand, traffic control, and responding to transportation incidents.

Interruption of water distribution also has a considerable impact on the firefighting capabilities of many fire departments within West Virginia. Should frequent or widespread water interruption occur, there will be an increased risk for structural fire and wildfire occurrence within the state. In some cases, displaced power lines may also block first responders from locations they may need to get to in order to help the public.

Impacts to Continuity of Operations

Downed powerlines, trees, and communications towers can block roads and inhibit businesses from continuing operations due to loss of communications and transportation of goods and services. Limited power and cell service makes it near impossible for continuity of operations unless a backup generator is present. Disrupted power can also throw off automated machines, which may take weeks to recalibrate and fix resulting in disruptions to the supply chain.

Impacts to Property, Facilities, and Infrastructure

All of the building stock and infrastructure in the state is exposed to the utility failure hazard. Impacts sustained from utility failure are likely to be secondary impacts. Should water distribution be reduced or not available, then structures could be at increased risk for structural fire since current fire suppression is dependent on accessing water supply from hydrants. Backup power is recommended for facilities and infrastructure to avoid negative

impacts from loss of power. Interruption of utility gas or water distribution could also reduce the effectiveness of facilities to operate at full capacity.

Impacts to the Environment

The most significant impact associated with utility interruptions occurs when the interruption involves a release of hazardous materials. This hazardous material may be released in a pipeline accident or when material is in transit. Section 5.6 (Hazardous Materials) includes a complete discussion on the impacts of a hazardous materials release to the environment. Disrupted power lines can also create fires which has the ability to destroy ecosystems and kill plant and animal populations.

Impacts to the Economic Condition of the State

During a utility failure event, the State may experience losses because of an interruption of critical services. Further, increased costs, such as providing shelters and costs related to cooling and heating centers, may be incurred. Extended power outages will require officials to shelter victims who require heat and power for activities of daily living. In addition, many businesses provide services locally, regionally, nationally, and internationally. Disruption in any of these services would mean that many workers and residents may be without a job for an extended period of time which may affect their ability to afford food and shelter. Industrial and commercial use accounts for 65 percent of electric consumption in the state; power failures would have significant impacts (U.S. DOE 2021).

Power interruptions can also cause economic impacts stemming from spoiled food and other goods, costs to the owners/operators of the utility facilities, and costs to government and community service groups. Interruption of utility gas or potable water distribution could also cause significant economic impacts, such as additional costs for bringing in water tenders to maintain fire suppression capabilities and distribution of potable water for public consumption.

Impacts to Public Confidence in State Governance

The public confidence in state governance primarily depends on how effective the State has been in the past at preparing for and responding to utility failure events. Public confidence also depends on the size of the event and the preparation the State takes for each potential event. In general, if the State is transparent in sharing relevant information with the public regarding utility failures, then the public is more apt to trust the State and feel as if it has the capability to support the residents of West Virginia if utility failure occurs.