5.4.9 Critical Infrastructure Failure

This section provides a profile and vulnerability assessment for the critical infrastructure failure hazard.

5.4.9.1 Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

This hazard profile focuses specifically on the failure of energy infrastructure. It discusses power outages and fuel shortages.

Power Outages

Power outages are defined as any interruption or loss of electrical service caused by disruption of power transmission caused by accident, sabotage, natural hazards, or equipment failure. A significant power failure 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.

Widespread power outages can occur without warning or as a result of a natural disaster. 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 tornados 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. In most cases, incidents such as these have plenty of warning time, allowing power response crews to stage resources in preparation for power failure.

Power outages can cause secondary hazards that have an effect on the health of residents. One potential secondary hazard is chemical accidents that occur after power is restored to industrial facilities. Power interruptions at chemical handling plants are of particular concern because of the potential for a chemical spill during restart (EPA 2001). Chemical spills can have significant health and environmental impacts.

Another secondary hazard that can result from power outages is a loss of communications capability by first responders, which may in turn have negative impacts on public safety. Backup systems such as amateur radio operators may be required during disaster to augment communications capabilities.

Wastewater and potable water utility interruption may occur as a result of a power failure. These critical utilities are essential to community continuity and recovery. The interruption of service may have cascading economic and environmental impacts.

Power outages can have vast impacts on the health of the community. During periods of extreme heat or extreme cold, vulnerable populations such as the elderly and medically frail can be affected and are susceptible to hypothermia or heat stroke. Additionally, power outages can lead to food spoilage, which also has negative impacts on public health.

Power outages may also lead to an increase in traffic accidents. The number of traffic accidents may increase because of the lack of functioning traffic control devices such as stoplights and railroad crossing advisory

signals. Power outages lasting a long duration will force law enforcement officials to man traffic control points to prevent accidents.

Fuel Shortages

A fuel shortage occurs anytime the supply of fuel does not meet the demand. For the purpose of this HMP, fuel shortages are limited to region-wide or national-level shortages. These incidents may be caused by natural hazards, as was the case when Hurricane Sandy in 2012 caused a fuel shortage in the New York-Metro Region. They may also be caused by non-natural events, such as the oil embargo that affected the entire nation in 1973.

The fuel infrastructure in the United States is expansive. It includes a network of facilities, rail lines, roadways, and pipelines to transport and distribute petroleum products. Most of Westchester County receives its natural gas from Consolidated Edison (Con-Ed) (New York State Energy Planning Board, 2009). The Algonquin Gas Transmission Company, Con-Ed, and the Tennessee Gas Pipeline Company all have natural gas pipelines that run through the County (PHMSA, 2015). A fuel shortage can be caused by a failure in any part of that network.

Programs in Place to Reduce Impacts

Plans, Training, and Exercises

Westchester County maintains a Comprehensive Emergency Management Plan (CEMP) that includes procedures for utility preparedness and coordination. Preparedness activities include regular communications with utility companies regarding local events. County emergency services personnel and utility representatives meet each quarter to discuss coordination and preparedness issues, and utility representatives attend quarterly emergency managers' meetings with the municipal representatives. Utility companies host annual meetings with local officials to review preparedness efforts, and periodically host debriefs with local officials after storm events.

Responders identified in these plans train regularly to carry out their responsibilities, and participate in emergency exercises to test their capabilities and the effectiveness of the emergency plans. Utility representatives participate in the County's EOC training sessions, conduct local drills and exercises with local response agencies, and participate in County EOC exercises each year.

Response Resources

Utilities provide representatives to the County EOC and County Communications Center as requested for major events. They also provide liaisons to local jurisdictions, to assist city, town, and village EOCs with utility-related issues. Generally, resources to repair damaged utility infrastructure are maintained by the utility companies themselves or are contracted at the time of need. However, local response agencies also report to the scene of damaged utility lines (such as the fire department responding to an area with downed power lines) to maintain public safety. Infrastructure failure incidents will be coordinated by the County EOC.

Extent

This section describes the range of incidents that may stem from critical infrastructure failures. According to the U.S. Census, 31,448 housing units or approximately 9.2% of housing units in Westchester County rely on electricity to power in-home heating systems. 152,882 housing units (44.5%) use utility gas (that is, gas that comes directly to the housing unit), and another 149,438 units (43.5%) use fuel oil, kerosene, etc. Should there be a failure of critical infrastructure in the County, nearly 334,000 households could be without heat or cooling.

Power Outages

Impacts from an outage can be significant to the County and its residents. The extent and severity of a power outage depends on the cause, location, duration, and time of year. An incident can range from a small, localized event to a countywide or region-wide power outage. They typically last only a few hours to a few days, and it takes less than one day to recover. Power outages typically occur because of, or in combination with, other emergency or disaster incidents, such as severe weather and flooding, and can exacerbate such emergencies. Severity of an incident will also depend on the electrical distribution system affected.

Power failures lead to the inability to use electric-powered equipment, such as lighting; heating, ventilation, and air conditioning (HVAC) and necessary equipment; communication equipment (telephones, computers, etc.); fire and security systems; small appliances such as refrigerators, sterilizers, etc.; and medical equipment. Interruption of service for any of this equipment can lead a number of issues including food spoilage, loss of heating and cooling, basement flooding due to sump pump failure, and loss of water due to well pump failure. These effects are especially severe for individuals with functional needs and the elderly.

Westchester County's worst power outage was in August of 2003, when 50 million people across the northeastern United States (including all of Westchester County) and parts of Ontario, Canada were out of power for 2 days. This outage resulted in over $5 million in damages, not including economic losses.

Fuel Shortages

Given how extensive the nation's fuel infrastructure is, for the purpose of this HMP, fuel shortages are regional- or national-level events. Local fuel shortages can be addressed by bringing fuel in from outside the immediate areas. A fuel shortage may increase the cost of fuel, putting economic burden on individuals, families, and businesses. As the nation saw in the fuel shortages caused by the 1973 oil embargo, fuel shortages can lead to long lines at gas stations, disruptions in freight traffic, and a shortage of heating fuels.

Recently, Hurricane Sandy (2012) caused a fuel shortage limited to Westchester County and other areas of the New York-Metro Region. Governor Cuomo issued an executive order to suspend normal gasoline distribution requirements to bring fuel back into the impacted areas.

Location

Power outages in Westchester County are possible anywhere electrical service is provided. Outages are usually localized events. They are typically the result of a natural hazard event, such as severe storms or ice storms. Fuel shortages will affect the entire County.

Previous Occurrences and Losses

Known critical infrastructure failure events that have affected Westchester County between 1992 and 2014 are identified in Table 5.4.9-1. The table may not include all events that have occurred in the County.

Table 5.4.9-1. Critical Infrastructure Failure Events in Westchester County between 1965 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
November 9, 1965	Power Outage	N/A	N/A	30 million people in New York, Connecticut, Massachusetts, Rhode Island, northern Pennsylvania, north-eastern New Jersey, and areas of Ontario, Canada suffered a 13-hour power outage.
1973-1974	Fuel Shortage	N/A	N/A	The 1973 Oil Embargo by the Organization of Petroleum Exporting Countries (OPEC) strained the world economy, including those of the United States, New York State, and Westchester County.
July 13, 1977	Power Outage	N/A	N/A	A lightning strike at a tower line in the County triggered the separation and total collapse of the power system for up to 26 hours. 9 million people were affected.
December 11-14, 1992	Coastal Storm, High Tides, Heavy Rain, Flooding	DR-974	Yes	Over 20,000 power failures occurred throughout the County.
January 17, 1994	Heavy Snow	N/A	N/A	Accumulations ranged between six and 12 inches however some isolated amounts of 17 inches were reported. Trees and power lines were snapped from the weight of the snow. This closed roads and knocked power off to thousands of residents.
March 3, 1994	Snow/Ice Storm	N/A	N/A	Downed trees and branches left thousands without power.
March 7-8, 1996	Winter Storm	N/A	N/A	Ice accumulated on trees, power lines, and roadways. Total accumulations of sleet and snow caused tree branches to snap off and power lines to fall.
March 31, 1997	Winter Storm	N/A	N/A	Strong gusty winds (to at least 40 mph) combined with heavy wet snow caused numerous trees and power lines to fall. Many roads were closed due to fallen trees and power lines.
March 9, 1998	Flood	N/A	N/A	Scattered power outages.
January 15, 1999	Winter Storm	N/A	N/A	Heavy rain showers along with wind gusts from 30 to 40 mph occurred along the Long Island Sound shore of Westchester County. This downed additional scattered ice-laden tree limbs that caused some power outages.
March 14-15, 1999	Heavy Snow	N/A	N/A	Heavy wet snow downed many tree limbs and power lines across the region.
July 4-6, 1999	Extreme Heat	N/A	N/A	On July 4th, temperatures soared into the mid and upper 90s. The combination of high temperatures and moderate humidity caused most heat indices to range from 100 to 105 degrees. On July 5th, heat indices peaked from 110 to 115 degrees. "Rolling" electrical blackouts occurred across the Metropolitan Region. Widespread blackouts occurred across the Metro area, including Westchester County's sound shore from Pelham Manor to Port Chester.
September 14-17, 1999	Hurricane Floyd	DR-1296; EM-3149	Yes	Significant power outages were reported.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
December 14, 2000	Ice Storm	N/A	N/A	Power outages resulted as tree limbs fell due to significant ice accretion.
January 20-21, 2001	Winter Storm	N/A	N/A	Ice accumulations ranged from 0.25 to 0.50 inches. This accretion of ice on tree limbs caused some tree branches to fall, and led to power outages.
March 5-6, 2001	Winter Storm	N/A	N/A	The combination of very heavy wet snow and strong winds with this prolonged coastal storm produced scattered power outages across southeast New York.
August 8-10, 2001	Excessive Heat	N/A	N/A	Heat indices ranged from 105 to 110 degrees. Scattered power outages spread across the suburbs.
August 14, 2003	Power Outage	EM-3186	Yes	50 million people across Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, New Jersey, and Ontario, Canada were out of power for up to 2 days. $5 million in damages were reported, not including economic losses.
September 2, 2006	Remnants of Tropical Storm Ernesto	N/A	N/A	Remnants of Tropical Storm Ernesto brought heavy rain and gusty winds across Long Island and Southeast New York State. This resulted in many trees and power lines down with hundreds of thousands of people without power.
April 15-16, 2007	Severe Storms and Inland and Coastal Flood (also identified as a Nor'Easter)	DR-1692	Yes	High winds downed many trees and power lines.
July 17, 2009	Thunderstorm Wind	N/A	N/A	In Westchester County, in the Town of Somers, trees and wires were reported down along Route 100. At Sparkle Lake (Town of York Town), State Route 35 was closed between Broad Street and Brookside Avenue due to downed trees and wires.
August 10, 2009	Thunderstorm Wind	DR-1857	No	Several severe thunderstorms impacted in the Lower Hudson Valley, including Westchester County. Numerous trees were reported down throughout the County. Some trees took down power lines with them, causing sporadic power outages.
March 13-15, 2010	Severe Storms and Flooding	DR-1899	Yes	This storm caused seven deaths in Northeast U.S. and more than 300,000 customers were without power. Con Ed reported that more than 86,000 customers were without power in New York City and Westchester County.
July 19, 2010	Thunderstorm Wind; Lightning	N/A	N/A	Multiple trees and power lines were reported down in Yonkers. Damages of $43,500 were reported.
July 21, 2010	Thunderstorm Wind	N/A	N/A	Multiple power lines were reported down.
September 22, 2010	Thunderstorm Wind	N/A	N/A	Severe thunderstorms in Westchester County downed a large tree and power lines on Anderson Hill Road in the City of White Plains. The storm caused approximately $7,500 in damages.
September 30, 2010	Strong Wind	N/A	N/A	Strong winds were responsible for the loss of power to 1,200 customers in Westchester County due to downed power lines and trees. Approximately $100,000 in property damage.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
March 6 – 7, 2011	Heavy Rain and Flooding	N/A	N/A	Power outages were reported in several areas of Westchester County.
July 29, 2011	Microburst	N/A	N/A	A large three to four foot diameter tree fell on Route 9 near Eagle Bay Drive in Ossining. It took down power lines and snapped telephone poles. The County had approximately $241,000 in damages from this event.
August 28, 2011	Hurricane Irene	DR-4020; EM-3328	Yes	Widespread power outages of up to one week followed the storm.
October 29-30, 2011	Heavy Snow	N/A	N/A	Thousands of people lost power during this event as heavy snow accumulated on trees causing the trees and limbs to fall, damaging power lines. Storm totals in Westchester County ranged from 6.5 inches in Hastings-on-Hudson to 12.5 inches in Armonk.
October 28, 2012	Hurricane Sandy	DR-4085; EM-3351	Yes	Sustained wind speeds reached over 80 mph, with higher gusts. The storm caused 3 fatalities and more than 300,000 customer power outages in Westchester County. General power outages in the County lasted from 5.5 hours to over 8 days. Power outages occurred at 8 radio tower sites, lasting from 1.5 hours to more than 16 days. Con-Ed and NYSEG together replaced nearly 1,500 utility poles. Numerous critical facilities had to function on backup power. Gas service outages were also reported. Widespread damages also resulted in a fuel shortage throughout Westchester County and other areas of the New York-Metro Region. Governor Cuomo signed an executive order to suspend normal gasoline distribution requirements, to bring fuel into impacted areas. The County EOC coordinated operations among local agencies, the State, and FEMA to address response agencies' fuel shortages. By November 1, 2012, 171 out of 339 service stations surveyed reported being out of fuel.
July 14-19, 2013	Heat Wave	N/A	N/A	A week-long heat wave struck the New York City metropolitan area. In Westchester County, more than 7,600 customers were without power.

Source: NOAA-NCDC, 2015; NYCOEM 2014; USDOS 2013; Brutell 2012; Westchester County DES

Probability of Future Events

The overall probability of a failure of critical infrastructure is considered "frequent" (likely to occur within 25 years).

Power Outages

While the probability of future power outages incidents in Westchester County is difficult to predict, the historic record indicates that power outages have occurred as a result of high winds, extreme heat, lightning, and winter weather. Section 5.3 of this HMP lists the ranking of all identified hazards of concern for Westchester County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for power outages in the County is considered 'frequent' (likely to occur within 25 years).

Fuel Shortages

A major fuel shortage could develop in the future due to tension between the United States and oil-producing countries. Alternative energies, conservation, and improvements to technology that relies on petroleum products have reduced the demand for fuel, thus reducing the probability of another widespread fuel shortage. Localized fuel shortages, such as those resulting from disasters that affect the County, are likely to continue, but cannot be quantified.

5.4.9.2 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable in the identified hazard area. For the critical infrastructure failure hazard, all of Westchester County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4 of this HMP), are vulnerable to a failure of critical infrastructure. This section discusses the potential impact of the critical infrastructure hazard on the County. Specifically, this section addresses:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on (1) life, health and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

The entire County is vulnerable to the critical infrastructure failure hazard. Loss of power can have serious impacts on the health and welfare of residents, continuity of businesses, and the ability of public safety agencies to respond to emergencies. According to the U.S. Census, 31,448 housing units or approximately 9.2% of housing units in Westchester County rely on electricity to power in-home heating systems. 152,882 housing units (44.5%) use utility gas (that is, gas that comes directly to the housing unit), and another 149,438 units (43.5%) use fuel oil, kerosene, etc.

Data and Methodology

Data were collected from Westchester County and the Planning Committee. Insufficient data were available to model the long-term potential impacts of a failure of critical infrastructure on the County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

For the purposes of this HMP, the entire population in Westchester County is considered vulnerable to critical infrastructure failure events. Section 4 of this HMP includes a summary of population statistics for the County. Power failures have potential health impacts including injury and death. Other issues from power outages include food safety from lack of refrigeration and carbon monoxide poisoning from misuse of generators.

Individuals with medical needs are vulnerable to power failures, because medical equipment such as oxygen concentrators requires electricity to operate. The elderly are also vulnerable to the effects of power failure, as power failure has the potential to expose older residents to extreme heat or extreme cold. During power failure events, water purification systems may not be functioning. Many power outage events are caused by storm events that can lead to flooding. Without electricity, residents would be unable to pump water from their basements potentially causing structural and content damage to their homes.

Impact on General Building Stock and Critical Facilities

The entire building stock of Westchester County is exposed and is considered vulnerable to critical infrastructure failure. Operation of all critical facilities relies on energy to power essential systems (such as HVAC). Even critical facilities with backup generators rely on fuel for those generators.

Impact on Economy

Infrastructure failure can cause economic impacts stemming from lost income and spoiled food and other goods, costs to the owners/operators of the utility facilities, and costs to government and community service groups. These costs would be related to providing shelter to individuals who require heat and power for the activities of daily life. FEMA's benefit-cost analysis (BCA) methodology measures the loss of electrical service on a per-person-per-day-of-lost-service basis for the service area affected. For the electrical utility, the standard value is $131 per person per day (BCA module version 5.1).

Fuel shortages can have major impacts on the economy, as was seen in the 1973 oil embargo. Fuel prices may increase dramatically, having a major economic impact on household and business budgets.

Future Growth and Development

As discussed in Sections 4 and 9 of this HMP, areas targeted for future growth and development have been identified across Westchester County. Any areas of growth could be potentially impacted by the critical infrastructure failure hazard because the entire County is exposed and vulnerable. Specific areas of development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Effects of Climate Change on Vulnerability

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011).

Climatologists predict an increase in the number and intensity of severe weather events. More storms with higher winds will increase the chance that the power infrastructure will be impacted. Extreme temperatures are predicted to increase as well. During the hot summer months, the potential for power overload will increase as the demand for power increases. Additionally, climatologists predict an increase in precipitation, which may lead to more winter weather thus causing additional power failures.

Additional Next Steps

For future plan updates, the County can track data on critical infrastructure failure events and obtain additional information on past and future events, particularly in terms of any injuries, deaths, economic ramifications, and other impacts. This data will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated infrastructure failure events may be feasible as data are gathered and improved.