



5.4.10 Disease Outbreak

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the disease outbreak hazard in Morris County.

2015 Plan Update Changes

- The disease outbreak hazard profile is new to the 2015 HMP Update

5.4.10.1 Profile

Hazard Description

An outbreak or an epidemic exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time. An aggregation of cases in a given area over a particular period, regardless of the number of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause (Center for Disease Control [CDC] 2004).

Of particular concern in Morris County are arthropod-borne viruses (arboviruses), which are viruses that are maintained in nature through biological transmission between susceptible hosts (mammals) and blood-feeding arthropods (mosquitos and ticks). More than 100 arboviruses can cause disease in humans; over 30 have been identified as human pathogens in the western hemisphere (New Jersey Department of Health and Senior Services 2008). Morris County has been impacted by various past and present infestations including: high population of mosquitoes (mosquito-borne diseases) and deer ticks (tick-borne diseases).

Mosquito-borne diseases are diseases that are spread through the bite of an infected female mosquito. There are over 40 species of mosquitos in Morris County and have the potential to spread mosquito-borne diseases throughout the County (Morris County Mosquito Commission 2013). Tick-borne diseases are bacterial illnesses that spread to humans through infected ticks. The most common tick-borne diseases in New Jersey are: Lyme disease, Ehrlichiosis, Anaplasmosis, Rocky Mountain spotted fever, and Babesiosis. These types of diseases rely on ticks for transmission. Ticks become infected by microorganisms when feeding on small infected mammals (mice and voles). Different tick-borne diseases are caused by different microorganisms, and it is possible to be infected with more than one tick-borne disease at a time. Anyone who is bitten by an infected tick may get a tick-borne disease. People who spend a lot of time outdoors have a greater risk of becoming infected. The three types of ticks in New Jersey that may carry disease-causing micro-organisms are the deer tick, lone star tick, and the American dog tick (New Jersey Department of Health 2013b).

In addition to arboviruses, Morris County has been impacted by influenza outbreaks in the past five years. Most recently, Morris County has been monitoring the Ebola virus; however, there have been no cases in Morris County or New Jersey. For the purpose of this HMP Update, the following disease outbreaks will be discussed in further detail: mosquito-borne (West Nile Virus), tick-borne (Lyme, anaplasmosis, and Rocky Mountain spotted fever), Campylobacter enteritis, influenza, mumps, and Ebola.



West Nile Virus

West Nile Virus (WNV) encephalitis is a mosquito-borne viral disease, which can cause an inflammation of the brain. WNV is commonly found in Africa, West Asia, the Middle East and Europe. For the first time in North America, WNV was confirmed in the New York metropolitan area during the summer and fall of 1999. WNV successfully over-wintered in the northeastern U.S. and has been present in humans, horses, birds, and mosquitoes since that time. WNV is spread to humans by the bite of an infected mosquito. A mosquito becomes infected by biting a bird that carries the virus (New Jersey Department of Health 2014). In Morris County, September is the peak season for WNV (Morris County Office of Health Management 2013).

Tick-Borne Diseases

The following provides information regarding the tick-borne diseases that have impacted residents of Morris County: Lyme, anaplasmosis, and Rocky Mountain spotted fever.

Lyme Disease

Lyme disease is an illness caused by infection with the bacterium *Borrelia burgdorferi*, which is carried by ticks. The infection can cause a variety of symptoms and, if left untreated, can be severe. Lyme disease is spread to people by the bite of an infected tick. In New Jersey, the commonly infected tick is the deer tick. Immature ticks become infected by feeding on infected white-footed mice and other small mammals. Deer ticks can also spread other tick-borne diseases. Anyone who is bitten by a tick carrying the bacteria can become infected (New Jersey Department of Health 2012b).

Anaplasmosis

Anaplasmosis is a tick-borne disease caused by the bacterium *Anaplasma phagocytophilum*. It was previously known as human granulocytic ehrlichiosis (HGE) and has more recently been called human granulocytic anaplasmosis (HGA). Anaplasmosis is transmitted to humans by tick bites primarily from the black-legged tick and the western black-legged tick (CDC 2013).

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever (RMSF) is a tick-borne disease caused by the bacterium *Rickettsia rickettsii*. This organism is a cause of potentially fatal human illness in North and South America, and is transmitted to humans by the bite of infected tick species. In the United States, the ticks that carry RMSF include the American dog tick, Rocky Mountain wood tick, and the brown dog tick.

Campylobacteriosis (*Campylobacter*)

Campylobacteriosis is an intestinal infection caused by *Campylobacter* bacteria. Most human illness is caused by one species, called *Campylobacter jejuni*, but one-percent of human Campylobacteriosis cases are caused by other species of the bacteria. Most cases of Campylobacteriosis are associated with handling raw poultry or eating raw or undercooked poultry meat. As little as one drop of juice from raw chicken meat can be enough to infect a person. One way to become infected with *Campylobacter* is to cut poultry meat on a cutting board, and then use the unwashed cutting board or utensil to prepare vegetables or other raw or lightly cooked foods. The *Campylobacter* bacteria from the raw meat can then spread to the other foods. The bacteria are not typically spread from person to person. Although outbreaks due to *Campylobacter* are infrequent, large outbreaks due to *Campylobacter* are usually related to drinking unpasteurized milk or contaminated water (NJDOH 2012).



Campylobacter is one of the most common causes of diarrheal illness in the United States. Most cases occur as isolated, sporadic events, not as part of recognized outbreaks. Active surveillance through the Foodborne Diseases Active Surveillance Network indicates that about 14 cases are diagnosed each year for each 100,000 persons in the population. Many more cases go undiagnosed or unreported, and Campylobacteriosis is estimated to affect over 1.3 million persons every year. Campylobacteriosis occurs much more frequently in the summer months than in the winter (CDC 2014).

Influenza

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza. In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict. Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic could change daily life for a time, including limitations on travel and public gatherings (Barry-Eaton District Health Department 2013).

At the national level, the CDC's Influenza Division has a long history of supporting the World Health Organization (WHO) and its global network of National Influenza Centers (NIC). With limited resources, most international assistance provided in the early years was through hands-on laboratory training of in-country staff, the annual provision of WHO reagent kits (produced and distributed by CDC), and technical consultations for vaccine strain selections. The Influenza Division also conducts epidemiologic research including vaccine studies and serologic assays and provides international outbreak investigation assistance (CDC 2011).

Mumps

Mumps is caused by a virus and causes swelling of one or more of the parotid salivary glands located within a person's cheek, near their jaw line and below the ears. Anyone who has not been infected with mumps or who has not received the mumps vaccine can get the disease. It is a common childhood disease but adults can get it as well. The disease in adults causes more complications; more than half of the deaths due to mumps happen among people over 19 years of age. There are still cases of mumps around the world where populations are not vaccinated against the disease (NJDOH 2013).

Mumps is spread from person to person and humans are the only ones who can carry and spread the disease to another human. When an infected person talks, coughs or sneezes, the virus is released into the air and enters another person's body through the nose, mouth or throat. People can also become sick if they come in contact with the mucus or saliva (spit) from an infected person (NJDOH 2013).

Ebola Virus

Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains. According to the CDC, the 2014 Ebola epidemic is the largest in history affecting multiple countries in West Africa. Two imported cases, including one death, and two



locally-acquired cases in healthcare workers have been reported in the United States. CDC and partners are taking precautions to prevent the further spread of Ebola in the United States (CDC, 2014).

Location

Morris County's geographic location and demographic characteristics make it vulnerable to importation and spread of infectious diseases. The County has experienced the effects of a pandemic or diseases outbreak, including influenza. There are some densely populated municipalities in Morris County, leading to the spread of influenza and mumps more quickly than less densely populated communities. Additionally, due to the County's abundance of waterbodies and forested land provide breeding ground for infected mosquitos and ticks.

Mosquito-Borne Diseases

The most severe mosquito potential in the County is the production of *Aedes vexans* and *Aedes trivittatus* in approximately 20,000 acres of floodplain areas adjacent to the Passaic River during periods of above normal rainfall. This area of the County has been estimated to have a breeding potential of two million female *Aedes vexans* and *Aedes trivittatus* per acre. Over 280,000 residents, nearly 70% of the total population, live within the migration range of this species (Morris County Mosquito Commission 2013).

There are two additional mosquito species, *Aedes stictius* and *Aedes cinereus*, are found in the wooded floodplains of the Passaic, Pompton and Rockaway Rivers. They are very abundant and aggressive in the Borough of Chatham, Denville, East Hanover, parts of Hanover, Lincoln Park, Long Hill, Montville, eastern Parsippany-Troy Hills, Pequannock, and most of Rockaway Township. As development has spread into the wooded areas of these municipalities, problems caused by *Aedes stictius* and *Aedes cinereus* have increased. Other areas of Morris County have low-lying, wet areas that yield permanent water and flood water mosquitos in close proximity to its residents (Morris County Mosquito Commission 2013). The Asian Tiger mosquito (*Aedes albopictus*) has been detected in the county is a known vector for the transmission of chikungunya and dengue fever in Asia and the Pacific Islands.

Tick-Borne Diseases

Disease-carrying ticks can be found throughout Morris County. Deer ticks, who carry Lyme disease, can be found in shady, moist areas at ground level. They can also be found in lawns, gardens, and at the edge of wooded areas. Deer ticks will cling to tall grasses, brush and shrubs.

Anaplasmosis is most frequently reported from the upper Midwestern and northeastern United States. Six states (New York, Connecticut, New Jersey, Rhode Island, Minnesota, and Wisconsin) account for nearly 90% of all reported cases of anaplasmosis. In New Jersey, the annual reported incidence for this disease was 3.1 to 136 cases per million persons (CDC 2013).

RMSF has been reported throughout most of the contiguous United States; however, five states (North Carolina, Oklahoma, Arkansas, Tennessee, and Missouri) account for over 60% of RMSF cases. In New Jersey, the annual reported incidence for this disease was 1.5 to 19 cases per million persons (CDC 2013).

Extent

The extent and location of disease outbreaks depends on the preferred habitat of the species, as well as the species' ease of movement and establishment. The magnitude of disease outbreaks species ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already



stressed, such as periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted to an infestation. The presence of disease-carrying mosquitoes and ticks has been reported throughout Morris County.

Mosquito-Borne Diseases

Since it was discovered in the western hemisphere, WNV has spread rapidly across North America, affecting thousands of birds, horses and humans. WNV swept from the New York City region in 1999 to almost all of the continental U.S., seven Canadian provinces and throughout Mexico and parts of the Caribbean by 2004 (USGS, 2012). The CDC has a surveillance program for WNV. Data is collected on a weekly basis and reported for five categories: wild birds, sentinel chicken flocks, human cases, veterinary cases and mosquito surveillance (CDC, 2011).

In 2013, there was one reported human case of WNV and 22 mosquito pools tested positive for WNV. County and local mosquito commissions are working with local health departments to monitor and control the spread of WNV in the mosquito population (Borough of Madison 2014).

Morris County monitors mosquito population levels and for presence of WNV in mosquitos and birds. Control efforts will be intensified if the disease shows up, first targeting the aquatic stage of the mosquito then the adult mosquito (Morris County Mosquito Commission 2014).

Tick-Borne Diseases

Lyme disease is the most commonly reported vector-borne illness in the U.S. In 2009, it was the fifth most common nationally notifiable disease. In 2013, 95% of Lyme disease cases in the U.S. were reported from 13 states, which included New Jersey (CDC 2014). Between 2007 and 2011, there were 2,114 confirmed cases of Lyme disease in Morris County (CDC 2013). The Yale School of Public Health mapped Lyme disease risk for the northeast United States. According to their work, Morris County is at high risk for Lyme disease in humans (Yale School of Public Health 2014).

Influenza, Campylobacter, Mumps and Ebola

The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness. The Ebola virus is spread to others through direct contact; it is not spread through the air like influenza.

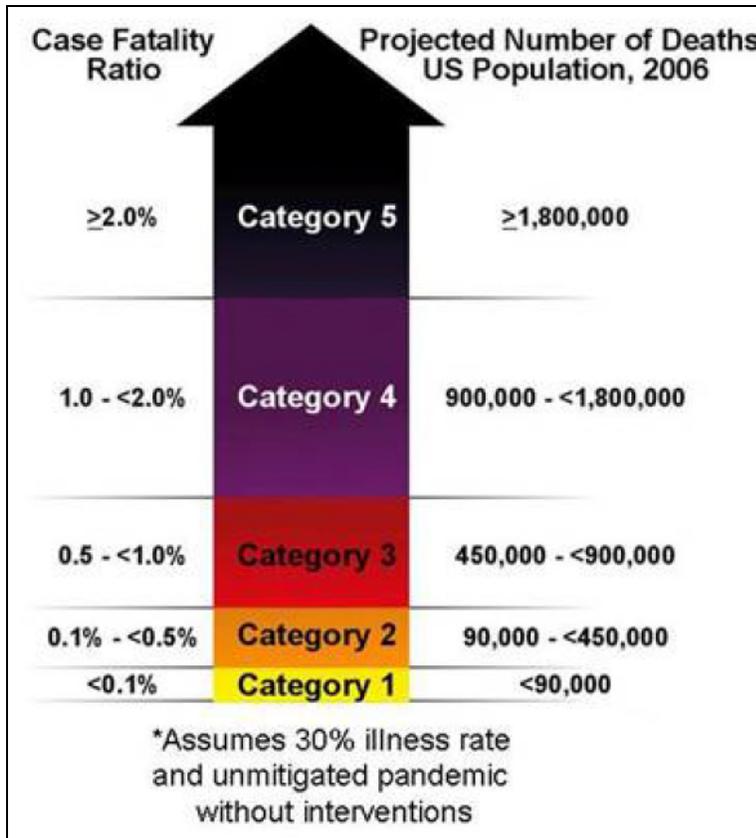
The severity and length of the next pandemic cannot be predicted; however, experts expect that its effect on the United States could be severe. Based on previous pandemics and without medications or vaccines available, it is estimated that a severe pandemic could cause almost 2 million deaths in the United States, more than nine million hospitalizations, and more than 90 million people ill (New Jersey Department of Health [NJDOH] 2012).

The CDC and Prevention Community Strategy for Pandemic Influenza Mitigation guidance introduced a Pandemic Severity Index (PSI), which uses the case fatality ratio as the critical driver for categorizing the severity of a pandemic. The index is designed to estimate the severity of a pandemic on a population to allow better forecasting of the impact of a pandemic, and to enable recommendations on the use of mitigation interventions that are matched to the severity of influenza pandemic. Pandemics are assigned



to one of five discrete categories of increasing severity (Category 1 to Category 5) (NJDOH 2012). Figure 5.4.13-7 illustrates the five categories of the PSI.

Figure 5.4.10-1. Pandemic Severity Index



Source: NJDOH 2012

In New Jersey, health and supporting agency responses to a pandemic are defined by the WHO phases and federal pandemic influenza stages, and further defined by New Jersey pandemic situations. The State’s situations are similar, but not identical to the United States Department of Homeland Security federal government response stages. Transition from one situation to another indicates a change in activities of one or more New Jersey agencies. Table 5.4.13-2 compares the federal and New Jersey pandemic influenza phases and situations.

Table 5.4.10-1. Federal and New Jersey Pandemic Phases and Situations

Federal Pandemic Influenza Stage		New Jersey Situations	
0	New domestic outbreak in at-risk country (WHO Phase 1, 2, or 3)	1	Novel (new) influenza virus in birds or other animals outside the U.S.
		2	Novel (new) influenza virus in birds or other animals in the U.S./NJ
1	Suspected human outbreak overseas (WHO Phase 3)	3	Human case of novel (new) influenza virus outside of the U.S.
2	Confirmed human outbreak overseas (WHO Phase 4 or 5)	4	Human-to-human spread of novel (new) influenza outside the U.S. (no widespread human transmission)
		5	Clusters of human cases outside the U.S.



Table 5.4.10-1. Federal and New Jersey Pandemic Phases and Situations

Federal Pandemic Influenza Stage		New Jersey Situations	
3	Widespread human outbreak in multiple locations overseas (WHO Phase 6)		
4	First human case in North America (WHO Phase 6)	6	Human case of novel (new) influenza virus (no human spread) in the U.S./NJ
5	Spread in the U.S. (WHO Phase 6)	7	First case of human-to-human spread of novel (new) influenza in the U.S./NJ
		8	Clusters of cases of human spread in the U.S./NJ
		9	Widespread cases of human-to-human spread of novel (new) influenza outside the U.S./NJ
6	Recovery and preparation for subsequent waves (WHO Phase 5 or 6)	10	Reduced spread of influenza or end of pandemic

Source: Homeland Security Council 2006; NJDOH 2012
 NJ New Jersey
 U.S. United States
 WHO World Health Organization

Previous Occurrences and Losses

For this 2015 Plan Update, known disease outbreaks that have impacted Morris County between 2008 and 2014 are identified in Appendix G. Between 1954 and 2014, the State of New Jersey was included in one disease outbreak-related emergency (EM) declaration, classified as a virus threat due to West Nile Virus impacting the State (EM-3156, May – November 2000). Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Morris County was included in this declaration (FEMA 2014). Please note that not all events that have occurred in Morris County are included due to the extent of documentation and the fact that not all sources may have been identified or researched. Loss and impact information could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP Update.

Probability of Future Occurrences

Predicting the future occurrences of disease outbreaks is difficult to predict; however, based on the history of occurrences in Morris County, the likelihood of a disease outbreak impacting the County is possible. Additionally, increases in population and population density in Morris County have the potential to increase exposure and susceptibility of its residents to outbreaks. Infected mosquitos and ticks will continue to inhabit and impact Morris County.

In Section 5.3, the identified hazards of concern for Morris County were ranked. 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 disease outbreaks in the County is considered ‘frequent’ (likely to occur within 25 years, as presented in Table 5.3-3).

Climate Change Impacts

The State of New Jersey has observed an increase in average annual temperatures of 1.2°F between the period of 1971-2000 and the most recent decade of 2001-2010 (ONJSC 2011). Winter temperatures





across the Northeast have seen an increase in average temperature of 4 °F since 1970 (Northeast Climate Impacts Assessment [NECIA] 2007). By the 2020s, the average annual temperature in New Jersey is projected to increase by 1.5°F to 3°F above the statewide baseline (1971 to 2000), which was 52.7°F. By 2050, the temperature is projected to increase 3°F to 5°F (Sustainable Jersey Climate Change Adaptation Task Force 2013).

ONJSC indicates that northern New Jersey, which includes Morris County, has become wetter over the past century. Northern New Jersey's 1971-2000 precipitation average was over five inches (12%) greater than the average from 1895-1970. Average annual precipitation is projected to increase in the region by 5% by the 2020s and up to 10% by the 2050s. Most of the additional precipitation is expected to come during the winter months (New York City Panel on Climate Change [NPCC] 2009). In addition, heavy precipitation events have increased in the past 20 years.

Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active long, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The changes in climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resources Defense Council 2015).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters led to an increase in influenza cases. During warm winters, fewer people contract influenza which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Spross 2013).



5.4.10.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For disease outbreaks, all of Morris County is considered exposed to the hazard. Therefore, all assets in the County, as described in the County Profile (Section 4), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of disease outbreaks on Morris County including:

- 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
- Effect of climate change on vulnerability
- Change of vulnerability as compared to that presented in the 2010 Morris County Hazard Mitigation Plan
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

Disease outbreaks are a significant concern to Morris County, mainly due to its impact on public health and natural resources. Estimated losses are difficult to quantify; however, disease outbreaks can impact Morris County’s population and economy. Areas with a higher population density will have a higher exposure to disease outbreaks, especially those populations living in areas prone to mosquitoes and ticks. Additionally, vulnerable populations such as the young and elderly are considered at higher risk.

Data and Methodology

Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

The entire population of Morris County is vulnerable to the disease outbreak hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations.

Impact on General Building Stock and Critical Facilities

No structures are anticipated to be directly affected by disease outbreaks.

Impact on Economy

The impact disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. Instead, activities and programs implemented by the County to address this hazard are described below, all of which could impact the local economy.

In Morris County, the Department of Public Works, Division of Mosquito Control, is responsible for the mosquito control program. For more information on this program see Section 5.4.12.2 (Infestation).



Effect of Climate Change on Vulnerability

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. Climate change accelerates may likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

Impact of Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed and vulnerable.

Change of Vulnerability

A disease outbreak analysis was not conducted as part of the 2010 HMP risk assessment.

Additional Data and Next Steps

For the Plan Update, any additional information regarding historic costs incurred to conduct surveillance, prevent, treat and eradicate disease outbreaks may help with quantifying losses, given a margin of uncertainty. This data will be developed to support future revisions to the plan. Mitigation efforts could include building on existing New Jersey, Morris County, and local efforts.