

5.4.7 Chemical, Biological, Radiological, or Nuclear (CBRN) Incidents

This section provides a profile and vulnerability assessment for the CBRN hazard.

5.4.7.1 Hazard Profile

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

Description

A CBRN incident is one that involves a chemical, biological agent, radioactive material, or nuclear explosion. These incidents can be accidental or intentional in nature. Each of these types of incidents has the potential to cause injuries and death, and all but the biological incidents have the potential to damage property as well.

Chemical

Many chemicals that exist are considered hazardous materials that pose risk to people, structures, and the environment. The U.S. Department of Transportation (DOT) classifies hazardous materials into nine classes based on the chemical characteristics producing the risk. The nine classifications are listed below:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable liquids
- Class 4: Flammable solids
- Class 5: Oxidizers and organic pesticides
- Class 6: Poisons and etiologic materials
- Class 7: Radioactive materials
- Class 8: Corrosives
- Class 9: Miscellaneous (DOT 2013)

Hazardous materials may affect individuals who are exposed to them. Exposure can occur through inhalation, ingestion, injection, and absorption into the skin. The effects of hazardous materials varies by chemical, and to some extent, by individual.

Biological

Biological agents are toxins or microscopic organisms that can injure or kill people, animals, and crops (Ready 2021). They consist of toxins, bacteria, and viruses, that can be spread through person-to-person contact, contamination of food or water, dispersed in the air as aerosols, or by animals such as mice, fleas, and mosquitos. Biological attacks are usually detected well after the attack occurs, through monitoring the symptoms reported by hospitals and other healthcare facilities.

Radiological

A radiological incident is one in which radioactive materials contaminate people, structures, or the environment, causing negative health effects. Radiological incidents can range from a transportation accident that damages cargo that contains radioactive sources, to incidents at laboratory or research facilities, to incidents at nuclear power plants (specifically the Indian Point Energy Center within the County), to Radiological Dispersion Devices (RDD). Radioactive cargo may include larger sources, such as radiography sources and ground density meters.

An RDD is a device that spreads radioactive materials using a conventional explosion. While the explosive itself will cause deaths and injuries in the blast area, the radioactive contamination spread by the explosive is usually too low to cause direct health effects unless it is taken into the body. RDDs may not be recognized as such initially if emergency personnel responding to an explosion do not suspect and monitor radiation levels early in the response.

Nuclear

Nuclear blasts are immense explosions with destructive pressure waves, intense heat, a blinding flash of light, and radioactive contamination (FEMA 2013). Nuclear blasts release approximately 1 million times the energy of conventional explosives (Services 2010). They are not the same as radiological incidents described above, though both incident types include the release of radioactive contamination. The threat of nuclear blasts is primarily based on the threat of a terrorist organization obtaining and deploying a small nuclear weapon without being intercepted.

Programs in Place to Reduce Impacts

Plans, Training, and Exercises

Westchester County maintains a Comprehensive Emergency Management Plan (CEMP) that includes an annex specific to hazardous materials emergency response. The County is also required to maintain facility-specific off-site emergency response plans for the Indian Point Energy Center and any facility that uses or stores chemicals that have been deemed Extremely Hazardous Substances (EHS) by the US EPA. The Westchester County Department of Health also maintains plans and procedures to guide the response to biological incidents, as well as to address the health effects of all hazards.

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.

Response Resources

The Westchester County Local Emergency Planning Committee (LEPC) maintains a list of all response assets in the County that could respond to a chemical, biological, radiological, or nuclear incident. These include the hazardous materials response teams maintained by the County and by the City of Yonkers; additional teams through a response partnership with Dutchess and Westchester Counties; Weapons of Mass Destruction (WMD) Squads maintained by several of the County's fire departments; the County's bomb squad; and a response unit maintained by the County Department of Health.

Responses to nuclear detonations will be coordinated by federal assets, with County and local assets providing a support role as needed.

Location

Westchester County is home to over 3,200 miles of public roadways. Interstate (I)-95 runs through southern Westchester County parallel to the Long Island Sound, connecting New York City and New England. I-87 runs north-south on the western side of the County and links Westchester with New York City and upstate New York and Canada. I-287 runs east-west across the center of the County and connects I-87, the Tappan Zee Bridge, and I-95. I-684 runs north from White Plains into Westchester County through the central and northern suburbs and provides a connection to I-84 (Planning 2010). US Route 9 runs along the Hudson River on the western edge of the County. US Route 1 connects Connecticut with New York City in the southeastern part of the County. U.S. Routes 6 and 202 connect Peekskill with the counties to the northeast. CBRN materials can be transported on any of these major roadways, as well as a number of New York State routes, railroads, ferries and

other boats, pipelines, and aircraft, through Westchester County and/or to destinations within the County. Any of these routes may be used to transport CBRN materials. In addition, widespread contamination that deposits on crops, livestock feed, and the livestock itself may result in contamination of the food chain after a release of contamination due to a CBRN incident.

Chemical

The Westchester County LEPC maintains a listing of all facilities that report the hazardous materials they store or use. These locations are spread throughout the County. Between the fixed facilities, the transportation routes described above, and the prevalence of gas stations and heating oil deliveries, the entire County can be considered vulnerable to chemical releases.

Biological

Biological incidents can affect anywhere from a small portion of the County to the entire County and beyond. The geographic area affected by a biological incident will depend on the biological agent, the mode of transmission, population density, and the degree of interaction among people in the area. Denser urban areas are more conducive to the spread of disease.

Radiological

Radiological incidents may occur from radioactive materials in or being transported to or from medical facilities with radiology departments, or from industry utilizing equipment and facilities with radiological sources.

Westchester County is home to the Indian Point Energy Center, a nuclear power plant just south of Peekskill; however, the facility shut down on April 30, 2021. While the plant is no longer operating, the County still utilizes emergency planning zones. A 10-mile Plume Exposure Pathway Emergency Planning Zone (EPZ) is established around the plant. Municipalities and individuals within this EPZ may be vulnerable to the immediate release of radiation from an incident at the plant. A 50-mile Ingestion Exposure Pathway EPZ has also been established around the plant, reflecting the area in which contamination of the food chain may occur. In the event of an emergency, the County utilizes sirens and the public notification system.

Nuclear

A nuclear explosion could be detonated anywhere in Westchester County, assuming that a nuclear device could be constructed in or transported into the County without being detected. A nuclear explosion within Westchester County could result in radioactive contamination of the entire County. The impacts of radioactive fallout resulting from a nuclear detonation may be felt from the physical impact zone in the form of radiation burns and radiation sickness. The area affected by the heat and pressure waves generated by the explosion would depend on the strength of the explosion and where it is centered.

Extent

This section describes the range of incidents that may stem from each of the CBRN types.

Chemical

Chemical releases can range from minor petroleum spills to large, facility-based incidents that have the potential to lead to loss of life, property, environment, and economy. Product release into the local environment can be generated from a fixed facility or along any location on a route of travel, and may be the result of carelessness, technical failure, external incidents, or an intentional act against the facility or container. The volatility of products being stored or transported, along with the potential impact on a local community, may increase the

risk of intentional acts against a facility or transport vehicle. The release of certain products considered to be hazardous materials can have an immediate adverse impact on the general population, ranging from the inconvenience of evacuations, to personal injury, and even death. In addition to human impacts, any release can compromise the local environment through the contamination of soil, groundwater, or local flora and fauna.

Biological

Biological incidents may affect anywhere from 1 person to the entire population of Westchester County. The degree to which a biological agent can spread throughout the population depends on the nature of the agent involved, transmissibility, at-risk populations (which may vary from agent to agent), incubation period, time before detection, and other factors.

Radiological

The severity of a radiological incident depends on the type of incident. Most incidents that involve radiological materials will be relatively small incidents at fixed facilities (such as a hospital's radiology department) or in transport. Terrorist attacks may include the detonation of an RDD, which spreads radioactive contamination using an explosion. RDDs may not be recognized as such initially if emergency personnel responding to an explosion do not suspect and monitor radiation levels early in the response.

For nuclear power plants, the U.S. Nuclear Regulatory Commission (NRC) classifies incidents as follows (NRC 2014):

- “Notification of Unusual Event (NOUE) – Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs. [Note: This term is sometimes shortened to Unusual Event (UE). The terms Notification of Unusual Event, NOUE and Unusual Event are used interchangeably.]
- Alert – Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guides (PAGs).
- Site Area Emergency (SAE) – Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or hostile action that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary.
- General Emergency – Events are in progress or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity or hostile action that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PAG exposure levels offsite for more than the immediate site area.”

Incidents classified as an Alert, Site Area Emergency, or General Emergency may result in the release of radiological materials, though the materials may not present a threat to the population (depending on the classification). Regardless of the incident classification, a release of radiological materials may not necessarily present a threat to the population.

Nuclear

The size of a nuclear explosion is expressed in terms of the number of tons of trinitrotoluene (TNT) that it would take to create an explosion of the same magnitude. Nuclear weapons maintained by the military may be able to generate explosions equivalent to millions of tons of TNT; for instance, a 10 megaton nuclear explosion is equivalent to 10 million tons of TNT. Even a nuclear explosion that is only as strong as 10 thousand tons (10 kiloton) of TNT would cause massive damage and numbers of injuries and fatalities.

In addition to injuries and fatalities related to the nuclear blast, radioactive fallout can deposit on wide areas around the blast site, outside of the zone of physical impact. Fallout will contaminate buildings and equipment, and may cause radiation burns and radiation sickness in thousands of people.

Previous Occurrences and Losses

Between 1954 and 2021, the State of New York was not included in any CBRN-related FEMA disaster declarations.

For this HMP, known CBRN events that have impacted New York State and Westchester County between 2015 and 2021 are identified in Table 5.4.7-1. Many sources were researched for historical information regarding CBRN events in Westchester County; therefore, Table 5.4.7-1 may not include all CBRN events that have impacted the County.

Table 5.4.7-1. CBRN Events Impacting Westchester County, 2015 to 2021

Dates of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
April 2, 2015	Magnesium Hydroxide Spill	Town of Ossining	N/A	N/A	Approximately 1,400 gallons magnesium hydroxide was spilled onto Water Street and Snowden Avenue in Ossining
April 17, 2015	Chlorine Spill	City of Peekskill	N/A	N/A	A chlorine spill at Peekskill Middle School Friday led to the early dismissal of students.
October 5, 2015	Oil Spill	City of Yonkers	N/A	N/A	A runaway oil tanker crashed into the side of an apartment building, tipped on its side and spilled 100 gallons of oil in Yonkers.
July 7, 2016	Chlorine and Hydrochloric Acid Spill	Town of Greenburgh	N/A	N/A	A four car collision resulted in the spill of swimming pool chemicals chlorine and hydrochloric acid.
February 27, 2016	Oil Spill	City of Yonkers	N/A	N/A	A leaking truck spilled as much as 600 gallons of oil into the Bronx River today as hazmat crews scrambled to clean up a large oil spill.
December 11, 2016	Gas Spill	Town of Cortlandt	N/A	N/A	a tractor trailer driver on an icy Route 6 drove head-on into a car traveling in the opposite direction, leading to a gas spill of 20 gallons of diesel fuel.
December 16, 2016	Oil Spill	City of New Rochelle	N/A	N/A	Officials say an oil truck carrying 2,500 gallons of home heating oil was backing up to make a delivery to a college-owned house on Pryer Terrace when the oil started spewing out
December 24, 2016	Gas Leak	Town of Mamaroneck	N/A	N/A	A faulty boiler caused a gas leak at a nursing home, trapping hundreds of residents in their rooms.
January 4, 2017	Gas Leak	Town of Mamaroneck	N/A	N/A	Rye Neck High School was evacuated after a gas leak on a valve was found in the science department and ConEdison was called to repair the problem.
January 5, 2017	Gas Leak	City of Yonkers	N/A	N/A	A resident drilling a hole in a wall for a flat screen TV hit a gas line, leading to an evacuation of residents.
March 6, 2017	Fuel Spill	Village of Mount Kisco	N/A	N/A	Workers responded to clean up 100 gallons of spilled fuel.
September 25, 2017	Fuel Spill	City of Yonkers	N/A	N/A	A tractor-trailer leaking fuel caused one lane of I-87 in Yonkers to shut down during the morning commute.
October 4, 5, 2017	Suspicious Powder	City of Yonkers	N/A	N/A	On October 4, police investigated a suspicious white powder found at a Westchester business. On October 5, Yonkers police responded to 77 Lee Ave., the address for St Paul the Apostle School, to investigate a white powder found in a plastic bag. Both events were found to be false alarms.
December 7, 2017	Gas Leak	Village of Tarrytown	N/A	N/A	A gas leak resulted in the evacuation of Tarrytown Music Hall.

Dates of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Event Details*
August 6, 2018	Oil Spill	Town of Somers	N/A	N/A	An oil spill of at least 200 gallons threatened the Somers Reservoir.
February 19, 2019	Gasoline Spill	Town of North Salem	N/A	N/A	An overturned tractor-trailer on Route 116 spilled a small amount of fuel into the Titicus Reservoir. The Reservoir was lowered by a foot or two to prevent water from passing through the spillway and allow for containment.

Source: NOAA NCEI 2021, FEMA 2021, North American Hazmat Situations and Deployments Map 2021.

Climate Change Projections

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). Westchester County is located in ClimAID Region 5, which includes the East Hudson and Mohawk River Valleys. Table 5.4.7-2 provides the projected seasonal precipitation changes for Region 5 (NYSERDA 2014).

Table 5.4.7-2. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	-5 to +10	-5 to +5	-5 to +10

Source: NYSERDA 2011

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The distribution of precipitation is expected to become less even with climate change. Increased precipitation will likely be experienced in the winter months as rain, with potentially less precipitation in the summer and fall. Downpours will likely increase in intensity and frequency. This may impact drinking water through flooding contaminating wells; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2011, 2014). Less frequent rainfall during the summer months may hamper water supply provision during these months. Furthermore, increased water temperatures in rivers and streams will have impacts upon aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants and industrial discharges (NYSERDA 2011).

As temperatures change, excessive heat on containers that contain CBRN materials may alter the material properties. In addition, materials and facilities located in the floodplain may experience an increase in flood events due to the project changes in increased precipitation events, magnitude, and frequency.

Probability of Future Events

As a whole, CBRN incidents are highly likely to occur in the County. Releases of chemicals, notably gasoline and diesel fuel related to traffic accidents and spills at fueling stations, occur on a daily basis, but are usually so minor that they do not require an emergency response. While the County’s proximity to New York City may make it more likely to be affected by a major, intentional CBRN incident from a terrorist attack, a large-scale CBRN incident occurring in Westchester County is unlikely.

Based on the history of occurrence and input from the Planning Partnership, the probability of future occurrences are considered occasional (between 10 and 100% annual probability event may occur).

5.4.7.2 Vulnerability Assessment

A qualitative assessment was conducted for CBRN incidents in Westchester County. The following discusses the County’s vulnerability to this hazard. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess CBRN risk.

Impact on Life, Health, and Safety

CBRN release or incident has the potential to compromise the health and safety of those living and working in the area of the incident. Specific impacts vary according to the type of material released, the area affected, and the population within the affected area.

A chemical incident may also include an explosion, with additional injuries and deaths being caused by the pressure wave from the explosion. Biological incidents effects on the population depend on the nature of the agent involved, transmissibility, at-risk populations, incubation period, time before detection, and other factors. Biological agents may cause disease from which some individuals will recover while others will not. Radioactive materials can cause significant health effects in individuals, especially if the materials are taken into the body. Radiological incidents that result in the release of radioactive materials from a nuclear power plant can contaminate sources of potable water, livestock, and crops, leading to a dramatically reduced local food supply. Large chemical incidents, and radiological incidents that result in the release of radioactive materials can contaminate sources of potable water, crops, and livestock, leading to a reduced local food supply.

Impact on General Building Stock, Critical Facilities, and Lifelines

Chemical, radiological, and nuclear incidents could cause significant damages to homes and businesses. Structures could be damaged from an explosion linked to a chemical release or could become contaminated by chemicals that may degrade the structures themselves. Radioactive contamination from a radiological incident would result in the need to decontaminate any affected structures; those that could not be decontaminated may have to be demolished. Nuclear incidents could completely destroy or seriously damage thousands of structures, depending on where the blast occurred and the strength of the detonation. Biological incidents would not affect the structures themselves but could still result in damages to buildings and critical infrastructure. If a structure required regular maintenance, and a biological incident rendered the maintenance staff unavailable for a prolonged period of time, the structure could suffer damages. Likewise, if the operators at a critical piece of infrastructure, such as a power plant, were unavailable, there could be physical damages to the infrastructure itself.

Impact on Economy

CBRN incidents could impact the local economy in a number of ways. Chemical, radiological, and nuclear incidents could result in significant physical damages to businesses and infrastructure, which would require repair and perhaps remediation to address. Many businesses would never recover from a prolonged closure. Businesses would also suffer from a decreased workforce and lower productivity from any type of CBRN incident. Contamination of the local food and water supply due to radioactive contamination may lead to herd culling and crop destruction that dramatically reduce the economic value of the County's and region's farmlands.

Impact on Environment

CBRN releases can contaminate soil, water systems, plants, insects, and animals. Certain chemicals and hazardous materials can be toxic to plants and animals, damaging their habitats and food sources. Radioactive materials released into the environment could enter the food chain and ultimately contaminate the human food supply. Nuclear impacts on the environment are similar to that of radioactive materials; however, the extent of impacts can be larger due to the amount of miles it can impact (NYC 2019).

Cascading Impacts on Other Hazards

CBRN incidents can cause utility failure. If an explosion or contamination occurred, water quality and supply could stop or drastically decrease.

Future Changes That May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County 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 climate change

Projected Development

Understanding future changes that impact vulnerability in the Westchester County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. An increase in development and population can increase the likelihood of a CBRN incident. Future migration to larger jurisdictions may also increase the likelihood of an incident. The tables and hazard maps included in the jurisdictional annexes contain additional information regarding the specific areas of development that would increase county vulnerability to the CBRN hazard.

Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Increased population trends throughout the County can the overall risk to CBRN incidents. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As temperatures change, excessive heat on containers that contain CBRN materials may alter the material properties. In addition, materials and facilities located in the floodplain may experience an increase in flood events due to the project changes in increased precipitation events, magnitude, and frequency.

Change of Vulnerability Since the 2015 HMP

This vulnerability assessment uses updated data where applicable to provide a better understanding of the potential impacts caused by CBRN.