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

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 (FEMA 2013). 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 (National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats 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 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 Putnam 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.

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.

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 Putnam County through the central and northern suburbs and provides a connection to I-84 (Westchester County Databook 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 Local Emergency Planning Committee (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

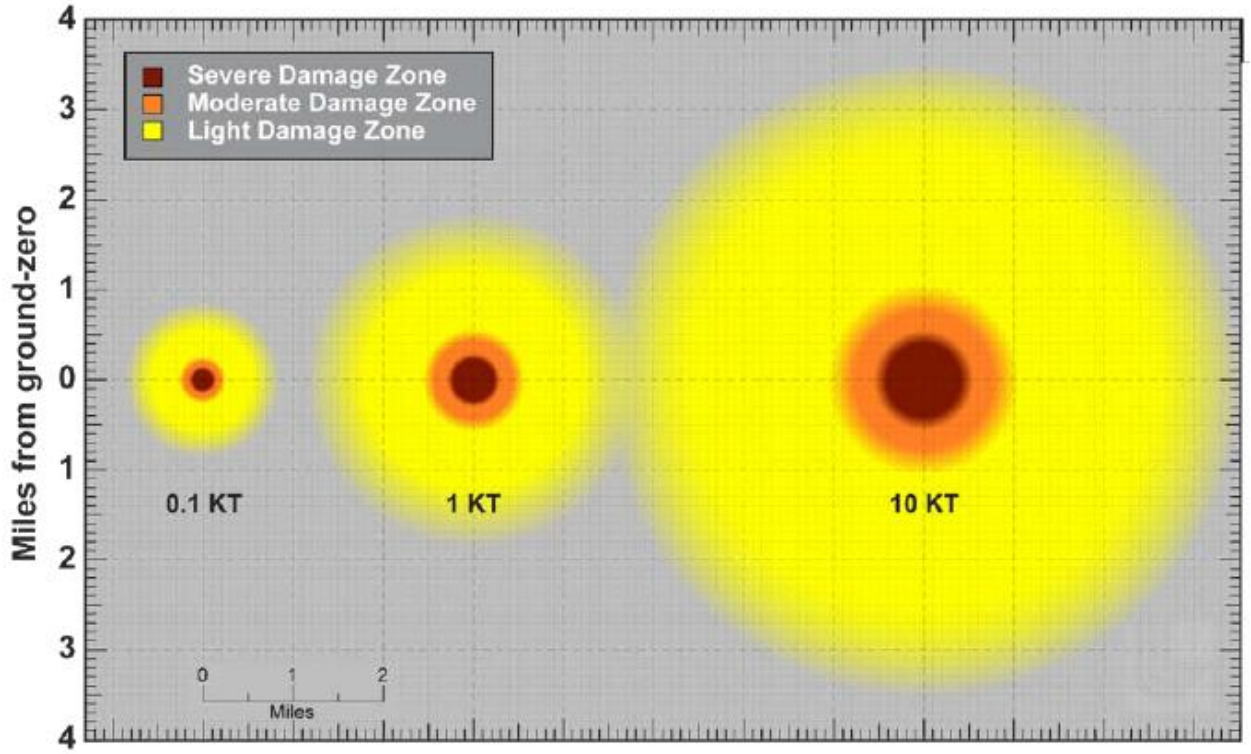
Radiological incidents may occur from radioactive materials in or being transported to or from medical facilities with radiology departments, or from industry utilizing equipment and facilities with radiological sources.

Westchester County is home to the Indian Point Energy Center, a nuclear power plant just south of Peekskill. 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.

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. Figure 5.4.7-1 shows the diameter of damage zones associated with different nuclear yields.

Figure 5.4.7-1. Representative damage zones for 0.1, 1, and 10 KT nuclear explosions



Notes: "There are no clear boundaries between the representative damage zones resulting from a nuclear explosion, but generally, the Light Damage (LD) zone is characterized by broken windows and easily managed injuries; the Moderate Damage (MD) zone by significant building damage, rubble, downed utility lines and some downed poles, overturned automobiles, fires, and serious injuries; and the Severe Damage (SD) zone by completely destroyed infrastructure and high radiation levels resulting in unlikely survival of victims."
Source: National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats 2010

Previous Occurrences and Losses

This section provides a brief overview of the CBRN incidents that Westchester County has experienced, followed by a table summarizing specific incidents.

Chemical

Most chemical incidents in the County are petroleum products released from vehicles involved in transportation accidents. These incidents are generally minor, and fluids are cleaned up by the responding fire department or clean-up contractor. Other incidents may result in the release of a chemical agent from a business or infrastructure.

Biological

There are no records of biological incidents occurring in Westchester County, but the County's population is constantly infected with and affected by a wide range of biological agents such as influenza, the cold virus, chicken pox, and other diseases that are normally found in communities in the United States. Two of the most notable events in recent years is the Ebola outbreak of 2014, in which one individual was treated in nearby New York City. In 2009, individuals were diagnosed and treated for the Novel Influenza A (H1N1) during the pandemic.

Radiological

Since February of 2000, there were two reportable events at the Indian Point Energy Center that had the potential to impact offsite facilities and personnel. Neither event had an actual impact on offsite facilities or personnel. Both events required limited Westchester County Emergency Operations Center (EOC) activation for the purposes of monitoring and support. No County support was required by onsite authorities for either event.

Nuclear

There is no history of nuclear incidents in Westchester County or anywhere else in the United States.

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. The County's population faces seasonal diseases that occur every year, such as influenza and the common cold. 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.

5.4.7.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable within the identified hazard area. The following factors are addressed in subsequent text that evaluates and estimates potential impacts of the CBRN incident hazard on Westchester County:

- 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 2005 Westchester County Hazard Mitigation Plan
- Further data acquisitions that will increase understanding of this hazard over time

Overview of Vulnerability

The entire County is exposed to CBRN incidents. Because it is difficult to predict the location and time of these events, assessing vulnerability to the hazard is difficult.

Data and Methodology

At the time of this Plan, insufficient data is available to model the long-term potential impacts of CBRN incident events on Westchester 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

All CBRN incidents have the potential to injure or kill people. The specific chemicals involved in a chemical incident may be dangerous to individuals. 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 and Critical Facilities

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.

Future Growth and Development

As discussed in Sections 4 and 9, areas targeted for future growth and development have been identified across Westchester County. Any areas of growth could be potentially impacted by the CBRN incident hazard because the entire County is exposed and vulnerable. Please refer to the specific areas of development 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

Because CBRN incident events are human-caused, no climate change impacts are associated with the hazard.

Change of Vulnerability

This is a new hazard for Westchester County; therefore, there is no change in vulnerability.

Additional Next Steps

For the Plan Update, any additional information regarding localized concerns and past impacts will be collected and analyzed. This data will be developed to support future revisions to the plan. Mitigation efforts could include building on existing New York State, Westchester County, and local efforts.