

exact rates of absenteeism and cost of treating a widespread disease will depend on the virus or bacterium in question, the availability of vaccination or treatment, and the severity of symptoms. The CDC estimates that infections of *Salmonella* alone create \$365 million in direct medical costs annually, some of which would certainly be experienced in Pennsylvania.

4.3.21.9. State Facility Loss Estimation

The physical plant and facilities of the Commonwealth are not likely to be damaged by a mass food or animal feed contamination event. However, high rates of absenteeism associated with a pandemic or an infectious disease will likely lead to significant economic costs in lost productivity and increased medical costs in nearly all state agencies. Additionally, the 106 agricultural critical facilities would face lost revenues depending on the type and magnitude of the contamination event.

4.3.22. Nuclear Incident

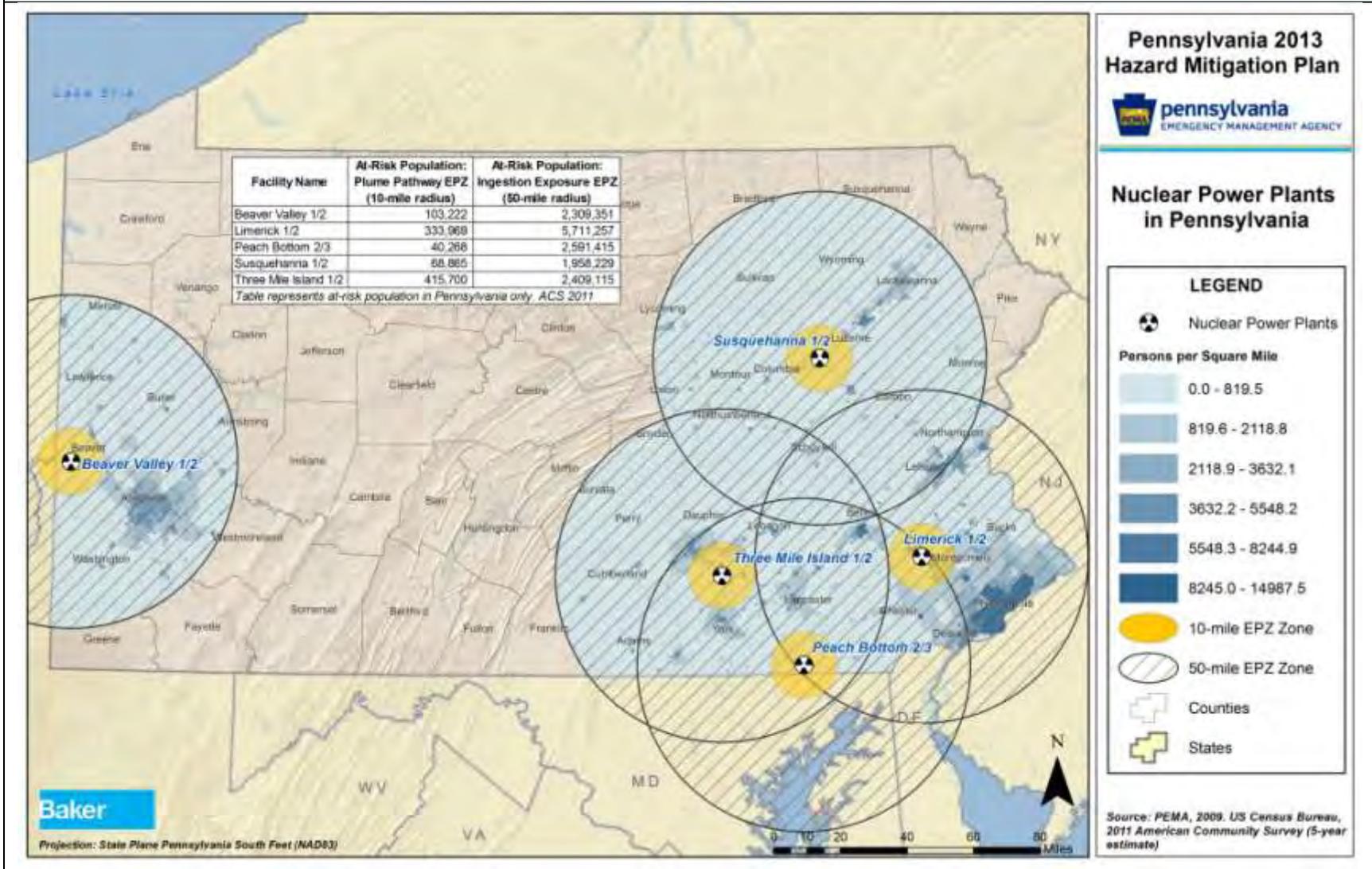
4.3.22.1. Location and Extent

Nuclear power is an important source of energy in the Commonwealth, and there are five nuclear power stations in Pennsylvania:

- Beaver Valley Power Station, Shippingport Borough, Beaver County;
- Limerick Generating Station, Limerick Township, Montgomery County;
- Peach Bottom Atomic Power Station, Peach Bottom Township, York County;
- Susquehanna Steam Electric Station, Salem Township, Luzerne County; and
- Three Mile Island Nuclear Generating Station, Londonderry Township, Dauphin County.

Most of these generating stations are concentrated in the eastern portion of the state, as seen in Figure 4.3.22-1. Four of the five nuclear power plants in the Commonwealth have two operating licensed units. Three Mile Island (TMI) has only one operating license with the second unit in a state of Post-Defueling Monitored Storage (PDMS).

Figure 4.3.22-1 Location of Pennsylvania nuclear power stations, their Emergency Planning Zones (EPZs), and the population density of affected municipalities (PEMA, 2009 and Census, 2011).



The Nuclear Regulatory Commission encourages the use of Probabilistic Risk Assessments (PRA) to estimate quantitatively the potential risk to public health and safety considering the design, operations and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. FEMA, PEMA and county governments have formulated Radiological Emergency Response Plans that include a *Plume Exposure Pathway Emergency Planning Zone (EPZ)* with a radius of about ten miles from each nuclear power facility and an *Ingestion Exposure Pathway EPZ* with a radius of about fifty miles from each facility. The exact size and configuration of the EPZ may vary in relation to local emergency response capabilities, topography, road networks, and political boundaries.

PEMA estimates the populations located in the Plume Exposure Pathway EPZ, showing that they range from 25,173 at Peach Bottom Atomic Power Station to 244,146 at Limerick Generating Station, as shown in Table 4.3.22-1 (Pennsylvania populations only). In all five Plume Exposure EPZs, approximately 640,000 Pennsylvanians are at risk. As indicated in Figure 4.3.22-1, the municipalities located within the 50-mile Ingestion Pathway EPZs of these nuclear power generating stations are some of the most densely populated in the state; approximately 11,654,347 Pennsylvanians live within the five Ingestion Pathway EPZs. This comprises about 95% of the total population of the Commonwealth. In addition to the Ingestion Pathway EPZs in Pennsylvania, populations in Erie, Crawford, and Mercer Counties fall within the Ingestion Pathway EPZ of the Perry Nuclear Power Plant in Northeast Ohio. Similarly, Pike County falls within the 50-mile radius of Indian Point Nuclear Generating Station in New York, and populations in Bucks, Chester, Delaware, Lancaster, Philadelphia, and Montgomery Counties fall within the Ingestion Pathway EPZs of Salem Nuclear Generating Station in Salem County, New Jersey.

Table 4.3.22-1 Population located in the Plume Exposure and Ingestion EPZs for PA nuclear power generating stations (PEMA, 2009).		
FACILITY	AT-RISK POPULATION: PLUME EXPOSURE EPZ (10-MILE RADIUS)	AT-RISK POPULATION: INGESTION EXPOSURE EPZ (50-MILE RADIUS)
Beaver Valley Power Station	89,132	2,451,000
Limerick Generating Station	244,146	5,814,000
Peach Bottom Atomic Power Station	36,405	2,452,000
Susquehanna Steam Electric Station	68,503	2,051,000
Three Mile Island Nuclear Generating Station	201,894	3,034,000

4.3.22.2. Range of Magnitude

The magnitude of a nuclear incident differs for those within the Plume Exposure Pathway EPZ and those within the Ingestion Exposure Pathway EPZ. The Plume Exposure Pathway refers to

whole-body external exposure to gamma radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation.

Nuclear accidents themselves are classified into three categories:

- **Criticality accidents:** Involves loss of control of nuclear assemblies or power reactors.
- **Loss-of-coolant accidents:** Occurs whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system.
- **Loss-of-containment accidents:** Involves the release of radioactivity from materials such as tritium, fission products, plutonium, and natural, depleted, or enriched uranium. Points of release have been containment vessels at fixed facilities or damaged packages during transportation accidents.

Nuclear facilities must notify the appropriate authorities in the event of an accident. The Nuclear Regulatory Commission uses four classification levels for nuclear incidents (Nuclear Regulatory Commission, 2008):

- **Unusual Event:** Under this category, events are in process or have occurred which indicate potential degradation in the level of safety of the plant. No release of radioactive material requiring offsite response or monitoring is expected unless further degradation occurs.
- **Alert:** If an alert is declared, events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the EPA Protective Action Guides (PAGs).
- **Site Area Emergency:** A site area emergency involves events in process or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the EPA PAGs except near the site boundary.
- **General Emergency:** A general emergency involves actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed the EPA PAGs for more than the immediate site area.

The accident at the Three Mile Island Generating Station in March 1979 remains the nation's only nuclear incident at the *General Emergency level* and remains the worst nuclear incident on record in the Commonwealth and the nation. During this incident, equipment malfunctions, design-related problems, and worker errors led to a partial meltdown of the TMI Unit 2 reactor core at TMI.

The nuclear industry has adopted pre-determined, site-specific Emergency Action Levels (EALs). The EALs provide the framework and guidance to observe, address, and classify the

severity of site-specific events and conditions that are communicated to off-site emergency response organizations (Nuclear Regulatory Commission, 2008). There are additional EALs that specifically deal with issues of security, such as threats of airborne attack, hostile action within the facility, or facility attack. These EALs ensure that appropriate notifications for the security threat are made in a timely manner. Each facility is also equipped with a public alerting system, which includes a number of sirens to alert the public located in the Plume Ingestion Pathway EPZ. This alerting system is activated by the counties of each specific EPZ. Emergency notifications and instructions are communicated to the public via the Emergency Alert System as activated by the Commonwealth of Pennsylvania Emergency Operations Center. State officials also have the capability to send emergency messages as text messages to mobile devices.

4.3.22.3. *Past Occurrence*

Nuclear incidents rarely occur, but the incident at Three Mile Island is the worst fixed-nuclear facility accident in U.S. history. The resulting contamination and state of the reactor core led to the development of a fourteen-year cleanup and scientific effort. Additionally, the *President's Commission on the Accident at Three Mile Island* examined the costs of the accident, concluding, "The accident at Three Mile Island on March 28, 1979, generated considerable economic disturbance. Some of the impacts were short term, occurring during the first days of the accident. Many of the impacts were experienced by the local community; others will be felt at the regional and national levels." The report concluded: "It appears clear that the major costs of the TMI Unit 2 accident are associated with the emergency management replacement power and the plant refurbishment or replacement. The minimum cost estimate of nearly \$1 billion supports the argument that considerable additional resources can be cost effective if spent to guard against future accidents."

Despite the severity of the damage, no injuries due to radiation exposure occurred. However, numerous studies were conducted to determine the measurable health effects related to radiation and/or stress. More than a dozen epidemiological and stress related studies conducted to date have found no discernible direct health effects to the population in the vicinity of the plant. However, one study conducted by the DOH's Three Mile Island Health Research Program did find evidence of psychological stress, "lasting in some cases for five to six years." According to the program chief, "the people suffering from stress perceived their health as being poorer than it actually was when the Health Department checked the medical records."

The issue of radiation effects resulting from the accident at TMI will continue to be debated. Radiation science does accept thresholds of expected mortality and morbidity resulting from the exposure to radiation. Administrative standards have been incorporated into plans used by public health officials and emergency planners for the purpose of making protective actions decisions pertaining to sheltering and evacuation.

The accident at Three Mile Island had a profound effect on the residents, emergency management community, government officials and nuclear industry, not only in Pennsylvania, but nationwide. There were minimal requirements for off-site emergency planning for nuclear power stations prior to this accident. Afterwards, comprehensive, coordinated, and exercised

plans were developed for the state, counties, school districts, special facilities (hospitals, nursing homes and detention facilities) and municipalities to assure the safety of the population. Costs associated with an event at one of the Commonwealth's nuclear facilities, be it real or perceived, are significant. The mitigation efforts put in place immediately following the 1979 continue until today. The Commonwealth Nuclear/Radiological plan which is a successor of the original "Annex E" is a result of the Commonwealth's efforts to address the many components of mitigation planning. The comprehensive planning involved with the five nuclear facilities is an ongoing effort. Plans are reviewed and amended on an annual basis. Recent amendments to various planning documents and station procedures include the efforts to enhance station security measures and the means to bolster communications and response in the event of terrorist activities.

There have been no significant nuclear incidents in the Commonwealth since the 2007 Plan. However, the most recent nuclear incident to occur worldwide was that which involved the Fukushima Daiichi nuclear reactor in Okuma, Fukushima, Japan. This incident occurred on March 11, 2011. An earthquake in the area resulted in a series of equipment failures, nuclear meltdowns and releases of radioactive materials. These failures and releases were largely attributed to the water that penetrated the structures following the tsunami that was generated by the earthquake. The flooding caused the failure of multiple generators meant to keep the systems operating safely after the automatic shutdown. No deaths have been directly attributed to the incidents at the reactor at this time. The World Health Organization completed a report that indicated there were only small proportional increases in the occurrence of certain cancers following the radiation exposure from the plant.

Following this incident, the United States Nuclear Regulatory Commission developed a set of recommendations based on the lessons learned from the Fukushima incident. These recommendations are meant to enhance reactor safety for US-based nuclear reactors against a variety of factors. Recommendations included the categories of regulatory framework, ensuring protection (of the facilities and equipment), enhancing mitigation, strengthening emergency preparedness and improving the efficiency of NRC programs. One of the specific recommendations involves the re-evaluation and upgrade of seismic and flooding protection of structures, systems and components for each reactor. As more information comes out, and more lessons learned are developed, it should only serve to reinforce the protections in place against any type of incident involving nuclear power stations.

4.3.22.4. Future Occurrence

Pennsylvania is home to the only nuclear power plant *General Emergency* in the nation. Since the Three Mile Island incident, nuclear power has become significantly safer and is one of the most heavily regulated industries in the nation. Despite the knowledge gained since then, there is still the potential for a similar accident to occur again at one of the five nuclear generating facilities in the Commonwealth. The Nuclear Energy Agency of the Organization for Economic Co-Operation and Development notes that studies estimate the chance of protective barriers in a modern nuclear facility at less than one in 100,000 per year (Nuclear Energy Agency 2005). Nuclear incident occurrences may also occur as a result of intentional actions; these acts are addressed under Section 4.3.22: Terrorism.

Across the United States, a number of *Unusual Event* and *Alert* classification level events occur each year at the 100+ nuclear facilities that warrant notification of local emergency managers. Of these, *Alert* emergencies occur less frequently. For example, in 1997, there were forty notifications of *Unusual Events* and three *Alert* events nationwide. Based on historical events, *Site Area Emergency* and *General Emergency* incidents are very rare.

4.3.22.5. Environmental Impacts

Potential environmental impacts include the long-term effects of radioactive contamination in the environment and, particularly in Pennsylvania, in agricultural products. Spills and releases of radiologically active materials from accidents can result in the contamination of soil and water. Areas underlain by limestone and some types of glacial sediments are particularly susceptible to contamination.

After a nuclear incident, another significant impact is the effect of radiation on the health of the population near the incident. The duration of primary exposure could range in length from hours to months depending on the proximity to the point of radioactive release. External radiation and inhalation and ingestion of radioactive isotopes can cause acute health effects (e.g. death, severe health impairment), chronic health effects (e.g. cancers) and psychological effects.

4.3.22.6. Jurisdictional Vulnerability Assessment

In Pennsylvania, 145 municipalities and 61 school districts in eleven counties are located in the 10-mile Plume Exposure Pathway EPZs of the five Pennsylvania nuclear power generating stations. The breakdown of jurisdictional vulnerability is shown in Table 4.3.22-2. A further fourteen counties provide support services related to monitoring and the mass care of evacuees from at-risk jurisdictions. In total, approximately 1,553 municipalities and 38 counties (of 67) are located within the 50-mile Ingestion Pathway Exposure EPZ (PEMA, 2010a). This does not include the communities vulnerable to nuclear incidents in neighboring states.

Table 4.3.22-2 Counties and municipalities located within each the 10-mile Plume Exposure Pathway EPZ (DEP Bureau of Radiation Protection, 2009)			
BEAVER VALLEY POWER STATION			
Risk County	Risk Municipalities		
Beaver County	City of Aliquippa	Glasgow Borough	Ohioville Borough
	Beaver Borough	Greene Township	Patterson Township
	Bridgewater Borough	Hanover Township	Patterson Heights Borough
	Brighton Township	Hookstown Borough	Potter Township
	Center Township	Hopewell Township	Raccoon Township
	Chippewa Township	Independence Township	Shippingport Borough
	Fallston Borough	Industry Borough	South Beaver Township
	Frankfort Springs Borough	Midland Borough	South Heights Borough
	Georgetown Borough	Monaca Borough	Vanport Township

Table 4.3.22-2 Counties and municipalities located within each the 10-mile Plume Exposure Pathway EPZ (DEP Bureau of Radiation Protection, 2009)			
LIMERICK GENERATING STATION			
Risk County	Risk Municipalities		
Berks County	Amity Township	Douglass Township	Washington Township
	Boyertown Borough	Earl Township	
	Colebrookdale Twp.	Union Township	
Risk County	Risk Municipalities		
Montgomery County	Collegetown Borough	Lower Salford Twp.	Skippack Township
	Douglass Township	Marlborough Twp.	Trappe Borough
	Green Lane Borough	New Hanover Twp.	Upper Frederick Twp.
	Limerick Township	Perkiomen Township	Upper Pottsgrove Twp.
	Lower Frederick Twp.	Pottstown Borough	Upper Providence Twp.
	Lower Pottsgrove Twp.	Royersford Borough	Upper Salford Twp.
	Lower Providence Twp.	Schwenksville Borough	West Pottsgrove Twp.
Risk County	Risk Municipalities		
Chester County	Charlestown Township	North Coventry Twp.	Upper Uwchlan Twp.
	East Coventry Twp.	Phoenixville Borough	Uwchlan Township
	East Nantmeal Twp.	Schuylkill Township	Warwick Township
	East Pikeland Twp.	South Coventry Twp.	West Pikeland Twp.
	East Vincent Twp.	Spring City Borough	West Vincent Twp.
PEACH BOTTOM ATOMIC POWER STATION			
Risk County	Risk Municipalities		
York County	Delta Borough	Fawn Township	Lower Chanceford Township
	Peach Bottom Township	Fawn Grove Borough	
SUSQUEHANNA STEAM ELECTRIC STATION			
Risk County	Risk Municipality		
Columbia County	Beaver Township	Briar Creek Twp.	North Centre Twp.
	Berwick Borough	Fishing Creek Twp.	South Centre Twp.
	Briar Creek Borough	Mifflin Township	
Risk County	Risk Municipality		
Luzerne County	Black Creek Township	Huntington Township	Salem Township
	Butler Township	Nanticoke City	Shickshinny Borough
	Conyngam Borough	Nescopeck Borough	Slocum Township
	Conyngam Township	Nescopeck Township	Sugarloaf Township
	Dorrance Township	New Columbus Borough	Union Township
	Hollenback Township	Newport Township	
	Hunlock Township	Nuangola Borough	
THREE MILE ISLAND NUCLEAR GENERATING STATION			
Risk County	Risk Municipalities		
Cumberland County	Lower Allen Township	New Cumberland Borough	

Table 4.3.22-2 Counties and municipalities located within each the 10-mile Plume Exposure Pathway EPZ (DEP Bureau of Radiation Protection, 2009)			
Risk County	Risk Municipalities		
Dauphin County	Conewago Township	Londonderry Township	Royalton Borough
	Derry Township	Lower Paxton Township	South Hanover Township
	Harrisburg City	Lower Swatara Township	Steelton Borough
	Highspire Borough	Middletown Borough	Swatara Township
	Hummelstown Borough	Paxtang Borough	
Risk County	Risk Municipalities		
Lancaster County	Conoy Township	Elizabethtown Borough	West Donegal Township
	East Donegal Township	Mount Joy Township	
Risk County	Risk Municipalities		
Lebanon County	South Londonderry Township		
Risk County	Risk Municipalities		
York County	Conewago Township	Hellam Township	Newberry Township
	Dover Township	Lewisberry Borough	Springettsbury Township
	East Manchester Township	Manchester Borough	Warrington Township
	Fairview Township	Manchester Township	York Haven Borough
	Goldsboro Borough	Mount Wolf Borough	

Beyond the identified risk municipalities, Table 4.3.22-3 lists which counties did and did not profile nuclear incidents, along with any ranking provided. As stated in Section 4.1, the decision by a county to profile a hazard is one indicator of the presence of risk from that hazard. This indicator should be viewed complementary to other analysis in this section. Together this analysis from reputable sources addresses different aspects of risk for a full risk profile.

Of the 19 counties which currently have calculated risk factor values for nuclear incidents, the average value is 2.3; this average does not include Lebanon, Montour, Perry, and Philadelphia, who use an alternate Risk Factor/Ranking system. The State Risk Factor for Nuclear Incident is 2.4, while the Pennsylvania THIRA scored Nuclear Incidents as a 7 out of 10. For more details on the State Risk Factor and THIRA rankings, please see Section 4.1.

Table 4.3.22-3 Counties profiling nuclear incidents with hazard ranking and risk factor (if available).				
COUNTY	PROFILED HAZARD	DID NOT PROFILE HAZARD	RANKING (IF AVAILABLE)	RISK FACTOR (IF AVAILABLE)
Adams	X		High	3.1
Allegheny	X		High	2.6
Armstrong		X		
Beaver	X		High	2.7

Table 4.3.22-3 Counties profiling nuclear incidents with hazard ranking and risk factor (if available).

COUNTY	PROFILED HAZARD	DID NOT PROFILE HAZARD	RANKING (IF AVAILABLE)	RISK FACTOR (IF AVAILABLE)
Bedford		X		
Berks		X		
Blair		X		
Bradford	X		Not Ranked	No RF
Bucks		X		
Butler	X		High	2.5
Cambria		X		
Cameron		X		
Carbon	X		Medium	2.4
Centre	X		Low	1.6
Chester		X		
Clarion		X		
Clearfield		X		
Clinton		X		
Columbia	X		Medium	2.3
Crawford		X		
Cumberland	X		Medium	2.1
Dauphin		X		
Delaware		X		
Elk		X		
Erie	X		Medium	2.1
Fayette		X		
Forest	X		Not Ranked	No RF
Franklin		X		
Fulton		X		
Greene		X		
Huntingdon	X		Not Ranked	No RF
Indiana		X		
Jefferson	X		Low	1.6
Juniata		X		
Lackawanna	X		Not Ranked	No RF
Lancaster	X		Low	1.7
Lawrence	X		High	3.1

Table 4.3.22-3 Counties profiling nuclear incidents with hazard ranking and risk factor (if available).

COUNTY	PROFILED HAZARD	DID NOT PROFILE HAZARD	RANKING (IF AVAILABLE)	RISK FACTOR (IF AVAILABLE)
Lebanon*	X		Not Ranked	2.9
Lehigh	X		Low	1.4
Luzerne	X		Not Ranked	No RF
Lycoming	X		High	2.6
McKean	X		Medium	2.3
Mercer	X		High	2.6
Mifflin	X		Not Ranked	No RF
Monroe	X		Medium	2.3
Montgomery		X		
Montour*	X		Not Ranked	2.9
Northampton	X		Low	1.4
Northumberland		X		
Perry*	X		Not Ranked	2.9
Philadelphia**		X		
Pike	X		Low	1.9
Potter		X		
Schuylkill		X		
Snyder		X		
Somerset		X		
Sullivan		X		
Susquehanna		X		
Tioga		X		
Union	X		Not Ranked	No RF
Venango		X		
Warren		X		
Washington		X		
Wayne	X		Not Ranked	No RF
Westmoreland	X		Not Ranked	No RF
Wyoming		X		
York	X		High	2.7

* Lebanon, Montour, and Perry use an alternate weighted ranking where Risk Factor = Frequency x [(0.25 x Critical facilities) + (0.40 x Social) + (0.25 x Economic) + (0.10 x Environmental)]. While this risk factor was used to comparatively rank hazards, the number does not correspond to a high-medium-low rating.

**Philadelphia uses an A, B, C rating system where A is high, B is medium, and C is low.

As stated in Section 4.2.2, jurisdictional and state critical facility vulnerability assessments were completed by spatially overlaying hazards with census tracts and state critical facility layers in GIS. When spatial analysis determined that the hazard would impact a census tracts within a county or the location of state critical facilities these locations were deemed vulnerable to the hazard. Loss estimates were prepared based on the value of the facilities impacted by census tract and by state critical facility. Each hazard uses a methodology that is specific to the type of risk it may cause; Table 4.2.2-2 includes a complete methodology description for vulnerability assessments and loss estimates for each hazard.

As shown in Table 4.3.22-4, 299 state critical facilities are located within the 10-mile EPZ of Pennsylvania's 5 nuclear facilities. Dauphin and Beaver Counties have the most vulnerable state facilities in their jurisdictions, followed by Montgomery County, which hosts 36 facilities.

Table 4.3.22-4 Number of State Critical Facilities impacted by the 10-mile EPZ in each county

COUNTY	NUMBER OF CRITICAL FACILITIES	COUNTY	NUMBER OF CRITICAL FACILITIES
Beaver	84	Lancaster	13
Berks	11	Luzerne	30
Chester	18	Montgomery	36
Columbia	18	Northampton	1
Cumberland	7	York	11
Dauphin	70		

Nuclear incidents create secondary hazard zones in the form of the 50-mile EPZ, or plume ingestion pathway. Because the primary danger in this zone is the ingestion of nuclear radiation, Pennsylvania's food and agriculture-related critical facilities are primarily vulnerable. Table 4.3.22-5 displays the number of food and agriculture-related critical facilities per county that fall within the 50-mile ingestion pathway.

Table 4.3.22-5 Number of food and agriculture State Critical Facilities impacted by the 50-mile EPZ in affected counties

COUNTY	NUMBER OF CRITICAL FACILITIES	COUNTY	NUMBER OF CRITICAL FACILITIES
Adams	5	Lebanon	3
Allegheny	4	Lehigh	1
Berks	8	Luzerne	1
Bradford	1	Lycoming	2
Bucks	1	Mercer	1
Chester	3	Montgomery	3
Columbia	2	Northampton	2
Cumberland	4	Northumberland	5
Dauphin	12	Philadelphia	4

Table 4.3.22-5 Number of food and agriculture State Critical Facilities impacted by the 50-mile EPZ in affected counties			
COUNTY	NUMBER OF CRITICAL FACILITIES	COUNTY	NUMBER OF CRITICAL FACILITIES
Delaware	1	Schuylkill	4
Juniata	1	Snyder	2
Lackawanna	1	Susquehanna	1
Lancaster	18	TOTAL	94

4.3.22.7. State Facility Vulnerability Assessment

The state facilities vulnerable to nuclear incidents are overwhelmingly fire departments, police stations, and schools; there are fewer than ten facilities in each of the other categories. Interestingly, even with its proximity to Three Mile Island, only two government facilities is vulnerable to nuclear incidents, as seen in Table 4.3.21-6.

Table 4.3.22-6 State Critical Facilities vulnerable to nuclear incidents by critical facility type	
STATE CRITICAL FACILITY TYPE	NUMBER OF IMPACTED FACILITIES
Agriculture	6
Banking	1
Chemical	3
Commercial Facilities	1
Dams	1
Education	8
Emergency Services	2
Energy	2
Fire Departments (Non-HSIP)	117
Government Facilities	2
Healthcare & Public Health	1
Hospital (Non-HSIP)	7
Nuclear Reactors, Materials & Waste	5
Police (Non-HSIP)	68
School (Non-HSIP)	73
Transportation	1
Water	1
Grand Total	299

As stated in section 4.3.21.6, the 94 food and agriculture critical facilities located in the 50-mi EPZ are vulnerable in the case of a nuclear incident. These facilities encompass farms and growers, food manufacturers, seed producers, and dairies.

4.3.22.8. Jurisdictional Loss Estimation

The loss experienced by each jurisdiction in the case of a nuclear incident will depend on the magnitude of the event. The example of the Three Mile Island incident gives an indication of local and regional economic losses, though. The President’s Commission on the Three Mile Island Incident calculated the economic impact of the accident, looking at direct and indirect losses and other potential growth impacts. Direct impacts to the manufacturing sector were estimated at \$6.3 million. These losses occurred within a few days after the accident and quickly subsided thereafter with no evidence of permanent layoffs resulting. Food processors incurred extraordinary expenses of \$250,000 with some firms purchasing equipment to detect radiation levels and converting dairy production to powdered milk.

The utility itself incurred significant costs in the areas of emergency management and plant refurbishment and replacement power. Emergency management costs ran into the hundreds of millions of dollars and replacement power for both units at a cost of \$24 million a month. The unaffected unit TMI Unit 1 was shut down for 6.5 years. During this time, more than \$100 million in plant upgrades and refurbishment took place. Replacement power costs today are estimated at nearly twice the 1979 dollars. Cost of the accident cleanup and placing the facility in monitored storage cost approximately \$1 billion.

The impact to tourism was estimated at approximately \$6.5 million with lost wages in this sector estimated from \$2.8 million to \$3.8 million. Losses to the agricultural sector appeared to be minimal due to off-growing season. The Pennsylvania Department of Agriculture indicated that losses were significantly less than \$1 million.

If there were to be some kind of catastrophic event at the nuclear facilities in the Commonwealth, combined jurisdictional losses could surpass \$114.5 billion (Table 4.3.22-7). Montgomery County is the one jurisdiction most threatened by nuclear incidents, with over 85,000 buildings worth \$28.8 billion.

Table 4.3.22-7 Estimated jurisdictional losses due to nuclear incidents.		
COUNTY	NUMBER OF IMPACTED BUILDINGS	DOLLAR VALUE OF EXPOSURE, BUILDING AND CONTENTS (THOUSANDS \$)
Beaver	46,031	\$11,063,057.00
Berks	17,719	\$5,352,463.00
Chester	58,168	\$19,180,745.00
Columbia	15,478	\$2,956,233.00
Cumberland	8,814	\$2,364,177.00
Dauphin	63,271	\$15,664,555.00
Lancaster	35,081	\$8,588,222.00
Lebanon	5,499	\$1,315,053.00
Luzerne	28,009	\$6,025,056.00
Montgomery	87,393	\$28,845,999.00
Washington	1,744	\$381,588.00

Table 4.3.22-7 Estimated jurisdictional losses due to nuclear incidents.

COUNTY	NUMBER OF IMPACTED BUILDINGS	DOLLAR VALUE OF EXPOSURE, BUILDING AND CONTENTS (THOUSANDS \$)
York	50,567	\$12,804,997.00
Grand Total	417,774	\$114,542,145.00

Potential jurisdictional losses in the 50-mile EPZ will solely originate from losses in farm products and contamination of farmland in counties within the 50-mile ingestion exposure pathway. Table 4.3.22-8 illustrates possible agricultural losses resulting from a nuclear incident, enumerating farmland acreage and the associated market value of products for counties where more than half the land area falls under the 50-mile EPZ.

Table 4.3.22-8 Estimated 50-mile EPZ jurisdictional losses relating to agricultural production.

COUNTY	IMPACTED FARMLAND ACREAGE	MARKET VALUE OF ALL AGRICULTURAL PRODUCTS
Adams	174,595	\$216,994,000
Allegheny	38,023	\$9,514,000
Beaver	67,075	\$15,187,000
Berks	222,119	\$367,840,000
Bucks	75,883	\$70,573,000
Butler	129,850	\$38,664,000
Carbon	20,035	\$8,944,000
Chester	166,891	\$553,290,000
Columbia	122,621	\$45,874,000
Cumberland	157,388	\$132,803,000
Dauphin	89,533	\$82,887,000
Delaware	4,361	\$9,455,000
Juniata	97,681	\$91,658,000
Lackawanna	39,756	\$16,216,000
Lancaster	425,336	\$1,072,151,000
Lawrence	92,391	\$35,639,000
Lebanon	113,486	\$257,097,000
Lehigh	84,643	\$72,059,000
Luzerne	66,577	\$18,151,000
Mercer	171,860	\$60,655,000
Monroe	29,165	\$7,819,000
Montgomery	41,908	\$30,028,000
Montour	50,252	\$36,193,000
Northampton	68,252	\$31,762,000
Northumberland	147,660	\$110,978,000

Perry	144,375	\$105,052,000
Philadelphia	262	\$487,000
Schuylkill	118,501	\$124,752,000
Snyder	100,179	\$109,041,000
Sullivan	27,821	\$7,240,000
Union	63,795	\$90,497,000
Washington	211,053	\$28,649,000
Wyoming	77,957	\$13,496,000
York	292,507	\$212,634,000
TOTAL	3,733,791	\$4,084,279,000

4.3.22.9. State Facility Loss Estimation

The estimated replacement cost of all State Critical Facilities located within the 10-mile plume exposure pathway EPZ is \$1,819,008,224. Because most of the food and agriculture-related critical facilities are privately held, the replacement value of these facilities is unknown.

4.3.23. Terrorism

4.3.23.1. Location and Extent

Terrorism is a threat everywhere, but there are a number of important considerations in evaluating terrorism hazards, such as the existence of facilities, landmarks, or other buildings of international, national, or regional importance. High-risk targets for acts of terrorism include military and civilian government facilities, international airports, large cities, and high-profile landmarks. Terrorists might also target large public gatherings, water and food supplies, utilities, and corporate centers. Furthermore, terrorists are capable of spreading fear by sending explosives or chemical and biological agents through the mail (FEMA, April 2009).

Nonetheless, terrorism can take many forms and terrorists have a wide range of personal, political, or cultural agendas. Therefore, there is no location that is not a potential terrorist target.

Of particular concern to Pennsylvania are the many critical facilities in the Commonwealth. Police stations, hospitals, military installations, fire stations, schools, wastewater treatment plants, and nuclear power generation stations along with critical infrastructure such as bridges, tunnels, electric generation and distribution facilities, public water supplies, and government buildings may be potential terrorist targets. Damage to these facilities and infrastructure could cripple transportation routes and commerce. Additionally, there are over 3,300 SARA Title III facilities as well as many transportation routes vital to the entire nation traversing the Commonwealth, making intentional hazard material releases a potential threat to citizens and the environment. This hazard is addressed in full in Section 4.3.19.

4.3.23.2. Range of Magnitude

The term “terrorism” refers to intentional, criminal, malicious acts, but the functional definition of terrorism can be interpreted in many ways. Officially, terrorism is defined in the CFR as “...the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social