

4.3.25. Urban Fire and Explosion

4.3.25.1. Location and Extent

Urban fire and explosion hazards incorporate vehicle and building/structure fires as well as overpressure rupture, overheating, or other explosions that do not ignite. This hazard occurs in denser, more urbanized areas statewide and most often occurs in residential structures (US Fire Administration, 2009). Urban fires can more easily spread from building to building in these denser areas. Furthermore, urban fires are a more significant threat in the many areas of the Commonwealth with a significant proportion of buildings over 50 years of age. Figure 4.3.25-1 illustrates the concentration of residential structures over 50 years old in Pennsylvania.

Urban fires and explosions often begin as a result of other hazards, particularly storms, lightning strikes, drought, transportation accidents, hazardous materials releases, criminal activity (arson), and terrorism.

4.3.25.2. *Range of Magnitude*

In general, the current extensive networks of roads and streets coupled with the number of local fire departments should provide swift access to fire events. It is anticipated that blockage by damage, debris, and operations will be localized and temporary. However, urban fires have the potential to cause extensive damage to residential, commercial, or public property. Damage ranges from minor smoke and/or water damage to the destruction of buildings. People are often displaced for several months to years depending on the magnitude of the event. Urban fires and explosions can also cause injuries and death; in Pennsylvania, the fire mortality rate is approximately 1.35 deaths per million residents, or about 172 fire-related deaths per year. This is the 21th highest fire mortality rate in the nation and is higher than the national average of 11.1 deaths per million residents (US Fire Administration, 2010).

In the most serious urban fire events, the extreme heat of a fire event can damage the underlying infrastructure. For example, in 1996, an eight-alarm tire fire ignited in Philadelphia under Interstate 95. The extreme heat of the fire caused the bridge to buckle and forced two months of repairs to the bridge. The governor declared this event a disaster shortly after it occurred.

The worst-case urban fire or explosion event in Pennsylvania occurred in February 1991, when a fire broke out in the One Meridian Plaza skyscraper in Philadelphia. The fire started on the 22nd floor and burned for 18 hours, gutting eight floors and causing an estimated \$100 million in property loss. This event also caused the windows in the building to break, granite to crack, and other structural weakening.

4.3.25.3. *Past Occurrence*

Urban fire events occur daily in communities across Pennsylvania. According to the Office of the State Fire Commissioner, there were 51,743 building fires, 10,560 vehicle fires, and 1,925 explosions reported to the Pennsylvania Fire Information Reporting System (PennFIRS) in Pennsylvania from 2010-2012. This represents a reduction from the previous reporting period from 2005-2009.

In addition, PEIRS collects information from local emergency managers on structure fires and explosions. Note that this data source is not as comprehensive as PennFIRS reports. Table 4.3.25-1 enumerates PEIRS urban fire and explosion events from 2001-2009.

Table 4.3.25-1 Urban fire and explosion events reported to PEIRS, 2001-2009 (PEIRS)									
	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Structure Fires	395	398	452	535	521	642	1058	1081	605
Vehicle Fires	8	6	18	25	35	42	66	58	28
Explosions	3	0	0	0	0	0	0	0	9
Urban Fire and Explosion Hazards - totals	406	404	470	560	556	684	1124	1139	642
<i>*Events totaled through June 2009</i>									

WebEOC, PEMA's incident reporting system from 2010-2012, does not have categories related to urban fires and explosions. While it is expected that these events have occurred in similar numbers to previous years, there is no formal accounting of these events.

PEMA's State Disaster History lists a number of significant fire events resulting in disaster declarations. An April 1978 fire in East Stroudsburg resulted in a President's Declaration of Major Disaster. A tire fire in March 1997 in Washington County triggered a Gubernatorial Proclamation of Disaster Emergency, as did a fire in McKeesport, Allegheny County in 1976 and a refuse bank fire in August 1972 in Plymouth, Luzerne County. Additionally, many fire events warranted Small Business Administration disaster Declarations. For more details, see Section 4.2.1.

4.3.25.4. Future Occurrence

Many factors contribute to the cause of urban fires and explosions. Due to the various factors, urban areas in Pennsylvania are considered at risk to one degree or another. Minor urban fires can be expected every day in Pennsylvania. Major fires will continue to occur several times a year, particularly in dense, urban areas with aging building stock. However, the probability of future occurrences may decrease with the construction of new buildings to building codes that address fire prevention, detection, and extinguishments. Also, continued efforts to increase public awareness of the dangers of urban fires will help to mitigate injury, death, and property loss. The probability of future occurrence may increase in communities whose populations are growing and where new areas are developed.

4.3.25.5. Environmental Impacts

The impact of urban fire and explosion events vary based on the size of the incident and the population and structure density where it occurs. There may be environmental impacts related to hazardous materials when a fire event or explosion releases dangerous materials.

There are additional economic consequences related to this hazard. Urban fires and explosions may result in lost wages due to temporarily or permanently closed businesses, destruction and damage involving business and personal assets, loss of tax base, recovery costs, and lost investments in destroyed property.

The secondary effects of urban fire and explosion events relate to the ability of public, private, and non-profit entities to provide post-incident relief. Human services agencies (community support programs, health and medical services, public assistance programs and social services) can be affected by urban fire and explosion events as well. Effects may consist of physical damage to facilities and equipment, disruption of emergency communications, loss of health and medical facilities and supplies, and an overwhelming load of victims who are suffering from the effects of the urban fire, including loss of their home or place of business.

4.3.25.6. Jurisdictional Vulnerability Assessment

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.

Jurisdictional vulnerability to urban fires and explosions is defined as areas that have the highest population densities coupled with the oldest residential buildings. GIS analysis indicated that the vulnerability thresholds for Pennsylvania jurisdictions are those counties with 60 percent or more of residential structures older than 50 years. In the Commonwealth, areas that meet this criterion are concentrated in nine counties: Allegheny, Cambria, Delaware, Lackawanna, Luzerne, McKean, Northumberland, Philadelphia, and Schuylkill Counties.

Table 4.3.25-2 lists which counties did and did not profile urban fire and explosion, 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 21 counties which currently have calculated risk factor values for urban fire and explosion, the average value is 2.2; this average does not include Lebanon, Montour, Perry, and Philadelphia, who use an alternate Risk Factor/Ranking system. The State Risk Factor for urban fire and explosion is 1.9, while the Pennsylvania THIRA scored urban fire and explosion as a 6 out of 10. For more details on the State Risk Factor and THIRA rankings, please see Section 4.1.

COUNTY	PROFILED HAZARD	DID NOT PROFILE HAZARD	RANKING (IF AVAILABLE)	RISK FACTOR (IF AVAILABLE)
Adams	X		High	3.4
Allegheny	X		Medium	2.2
Armstrong		X		
Beaver	X		Low	1.8
Bedford		X		
Berks		X		
Blair		X		
Bradford	X		Not Ranked	No RF
Bucks	X		Medium	2.3
Butler	X		Low	1.9
Cambria		X		
Cameron	X		Low	1.9
Carbon		X		

Table 4.3.25-2 Counties profiling urban fire and explosion hazards with hazard ranking and risk factor (if available).				
COUNTY	PROFILED HAZARD	DID NOT PROFILE HAZARD	RANKING (IF AVAILABLE)	RISK FACTOR (IF AVAILABLE)
Centre	X		Low	1.7
Chester		X		
Clarion		X		
Clearfield		X		
Clinton		X		
Columbia		X		
Crawford		X		
Cumberland	X		Low	1.9
Dauphin		X		
Delaware	X		Medium	2.2
Elk	X		Medium	2.1
Erie	X		Medium	2.2
Fayette	X		Medium	2.3
Forest		X		
Franklin		X		
Fulton		X		
Greene		X		
Huntingdon		X		
Indiana		X		
Jefferson	X		Low	1.9
Juniata		X		
Lackawanna		X		
Lancaster		X		
Lawrence	X		High	3.4
Lebanon*		X		
Lehigh	X		High	2.6
Luzerne		X		
Lycoming		X		
McKean	X		Low	1.9
Mercer	X		Low	1.9
Mifflin		X		
Monroe		X		
Montgomery	X		High	2.6

Table 4.3.25-2 Counties profiling urban fire and explosion hazards with hazard ranking and risk factor (if available).				
COUNTY	PROFILED HAZARD	DID NOT PROFILE HAZARD	RANKING (IF AVAILABLE)	RISK FACTOR (IF AVAILABLE)
Montour*	X		Not Ranked	7.5
Northampton	X		Medium	2.2
Northumberland		X		
Perry*	X		Not Ranked	15
Philadelphia**		X		
Pike	X		High	13.3
Potter		X		
Schuylkill		X		
Snyder		X		
Somerset		X		
Sullivan	X		Not Ranked	No RF
Susquehanna		X		
Tioga	X		Medium	2.2
Union		X		
Venango		X		
Warren		X		
Washington		X		
Wayne	X		Not Ranked	No RF
Westmoreland	X		Not Ranked	No RF
Wyoming	X		Not Ranked	No RF
York	X		Medium	2.3

* 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.

The jurisdictions most vulnerable to urban fire and explosion hazards host 1,685 critical facilities, the majority of which are located in Allegheny County, as illustrated in Table 4.3.24-3.

Table 4.3.25-3 Number of State Critical Facilities impacted by urban fire and explosion in identified vulnerable jurisdictions			
COUNTY	NUMBER OF CRITICAL FACILITIES	COUNTY	NUMBER OF CRITICAL FACILITIES
Allegheny	706	McKean	50
Cambria	144	Northumberland	96
Delaware	140	Philadelphia	122
Lackawanna	162	Schuylkill	208
Luzerne	251	TOTAL	1,879

4.3.25.7. State Facility Vulnerability Assessment

The vulnerability of state facilities is similar to that of buildings across the Commonwealth; older buildings located in dense urban and suburban communities are more vulnerable urban fires and explosions. Because building age data for state facilities is not available, state facility vulnerability can be more generally defined as facilities that are located in the most vulnerable jurisdictions in the Commonwealth, as urban fire hazards can quickly spread to surrounding structures. Table 4.3.25-4 illustrates the vulnerable state facilities by facility type. Notably, fire departments, schools, and police facilities rank highly among vulnerable facilities. Additionally, the three vulnerable chemical companies could present an additional fire risk if flammable chemicals are stored or used at those facilities.

Table 4.3.25-4 State Critical Facilities vulnerable to urban fires and explosions by Critical Facility Type	
STATE CRITICAL FACILITY TYPE	NUMBER OF IMPACTED FACILITIES
Agriculture	21
Banking	12
Chemical	5
Commercial Facilities	29
Dams	6
Defense Industrial Base	12
Education	44
Emergency Services	13
Energy	10
Fire Departments (Non-HSIP)	675
Government Facilities	14
Healthcare & Public Health	14
Hospital (Non-HSIP)	84
National Monuments & Icons	3
Nuclear Reactors, Materials & Waste	1
Police (Non-HSIP)	356
Postal & Shipping	5
School (Non-HSIP)	520

Table 4.3.25-4 State Critical Facilities vulnerable to urban fires and explosions by Critical Facility Type

STATE CRITICAL FACILITY TYPE	NUMBER OF IMPACTED FACILITIES
Transportation	34
Water	21
TOTAL VULNERABLE CRITICAL FACILITIES	1,879

4.3.25.8. Jurisdictional Loss Estimation

In the nine jurisdictions most vulnerable to urban fire and explosion events there are over two million potentially impacted buildings. These buildings have a combined replacement cost of \$620 billion (Table 4.3.25-5). As the densest jurisdiction in the Commonwealth with the highest proportion of old housing stock, Philadelphia is the jurisdiction that is the most threatened by urban fire events. Philadelphia has over \$200 billion of exposure and 778,715 impacted buildings.

Table 4.3.25-5 Estimated jurisdictional losses due to urban fires and explosions.

COUNTY	NUMBER OF IMPACTED BUILDINGS	DOLLAR VALUE OF EXPOSURE, BUILDING AND CONTENTS
Allegheny	706,960	\$180,606,811,000.00
Cambria	102,381	\$21,746,588,000.00
Delaware	281,319	\$86,856,472,000.00
Lackawanna	147,658	\$33,533,470,000.00
Luzerne	217,160	\$47,952,052,000.00
Northumberland	42,505	\$8,092,723,000.00
Philadelphia	73,299	\$15,599,858,000.00
Schuylkill	778,715	\$201,276,171,000.00
TOTAL	2,464,194	\$620,706,349,000.00

4.3.25.9. State Facility Loss Estimation

State facility losses will range in magnitude from small-scale damages resulting from smoke or water to complete destruction or collapse by fire or explosion. If the identified state facilities were to be destroyed in an urban fire or explosion incident, the replacement value of all facilities would be approximately \$14,260,359,516.

4.3.26. Utility Interruption

4.3.26.1. Location and Extent

Utility interruption includes any impairment of the functioning of telecommunication, gas, electric, water, or waste networks. These interruptions or outages occur because of geomagnetic storms, fuel or resources shortage, electromagnetic pulses, information technology failures, transmission facility or linear utility accident, and major energy, power, or utility failure. The focus of utility interruptions as a hazard lies in fuel, energy, or utility failure; this hazard is often secondary to other natural hazard event, particularly transportation accidents, lightning strikes, extreme heat or cold events, and coastal and winter storms.