D. Community Risk Assessment and Risk Levels

Risk Assessment

Risk is defined as the likelihood (i.e., probability) of a damaging or injury-inflicting event in combination with the consequences of that event. Risk can also be examined and compared subjectively in terms of categories such as low, moderate, and high, or variations of these qualitative measures. In general, as incident mitigation increases in complexity the risk moves from low to special. Low risk level incidents can be managed through sequential tasking by one or two responding units. As risk increase and additional resources are required to mitigate the incident, tasking becomes concurrent and collaborative, and may ultimately involve multiple agencies.

Montgomery County Fire and Rescue Service (MCFRS) provides fire, rescue and emergency medical service to a population of 1,004,709 citizens. The geographical service area is approximately 495 square miles (507 sq mi including bodies of water) and covers metropolitan, urban, suburban and rural areas. Montgomery County also provides mutual aid services to bordering jurisdictions including Washington, D.C., Fairfax County, Virginia and Prince George's, Fredrick, Howard, and Carroll Counties in Maryland.

Within proximity of the Nation's Capital, Montgomery County is at risk of potential terrorist attacks in terms of buildings and transportation networks. Local airports in surrounding jurisdictions include Washington DC Reagan National, Dulles International and Baltimore Washington International Airports. Many commercial and private aircraft travel over the County to approach and depart from the region's three major and two minor airports. In addition, a high volume of railway routes travel through Montgomery County carrying both commuter passengers and hazardous materials. The Potomac River and Chesapeake and Ohio Canal border the southwest side of the County and are highly occupied recreational waterways during the spring, summer and fall.

The fire, rescue and emergency medical services in Montgomery County are provided by a combination of career and volunteer personnel from 36 fire and rescue stations. There are more

than 1200 career personnel and 800 active volunteers who provide service. The MCFRS responds to almost 110,000 incidents annually, including mutual aid assistance each year. MCFRS is responsible for providing staff to the following units on a 24 hour/7 day a week basis: 34 Engines, 14 Trucks/Aerials, 6 Rescue Squads, 25 BLS Units, 17 ALS units, 9 Tankers, 10 Brush trucks, and various specialty units. MCFRS maintains the following specialty teams: Hazardous Materials Team, Urban Search and Rescue Team, Technical Rescue Team, Swift Water Rescue Team, and Bomb Squad. The special operations teams are staffed to an operational level on a daily basis by personnel having specialty team duties as collateral duties. They are supplemented by additional personnel for long term incidents through a callback system consisting of both career and volunteer members.

Community Risk Input factors

According to CFAI the factors used as inputs in the risk assessment process are both physical and theoretical.

Physical Risk Factors

According to CFAI, The review of physical risk factors requires an understanding of those features which may increase demand, adversely affect the capability of the agency to respond, increase the probability of an emergency, or increase the consequences of life safety and economic impact upon the community served.

Geospatial Characteristics of the Service Area

- **Political Boundaries –** Areas served or underserved due to different level of government or laws
- **Growth Boundaries** – Areas where new services will be required due to rapid growth
- **Construction Limitations** – Limitations or lack there of, due to the height, size, or complexity of the new development
- **Infrastructure Limitations –** The ability of water, power, sewer, streets, and other infrastructure to support the service area currently and with new development. Of particular note are areas where development will over take the infrastructure either temporarily or permanently

Topography

- **Response Barriers** – Areas not easily accessed due to level of connectivity.
- **Elevation Changes** – Areas where grade differential requires steep roads, multi-tired structures, extreme changes in water pressure, or narrow/windy roadways.
- **Open/Surface Interface** – Undeveloped areas without circulation or infrastructure that produce large open space areas which act as impediments to response or inhibit access.

Transportation Networks

- **Roads** – roads and vehicles are sources of incidents within the service area. These service demands come in the form of accidents, medical calls and fires. As a general rule, the more traffic in the area, the larger the number of incidents generated
- **Rail Lines** - Virtually every commodity used in life today is carried on rail lines. The locations, usage, and nature of the rail lines will dictate the level of risk. Side spurs into industrial areas will generally have loading and unloading issues but lower volumes. Main lines and passenger routes will have higher frequencies of usage and higher speeds, which can generate major incidents.
- **Airports –** Most aircraft accidents occur during the take off and landing phase of air travel. Thus, the areas surrounding airports will have increased risk of hazard. As with rail lines, the activity levels at airports will have a significant impact on the level of risk. Airports of significant operation levels can create the need for specialized response resources.
- **Waterways –** Like other transportation features, waterways will increase exposure to incidents. Like rail lines, water ways can also have access issues and may require specialized equipment.

Climactic Impact

Montgomery County is classified by the National Weather Service as part of the Baltimore/Washington region which has experienced several significant snow, wind, and rain events between 2008 and 2010[1]. Montgomery County defines weather events in accordance with the National Weather Service[2] guidelines. The Baltimore/Washington Region is not prone to severe droughts, earthquakes, hurricanes, or incidents with heavy wildland interface.

In 2008, Montgomery County experienced 3 snow and ice events that produced school closures and response delays in January and February. There were also 5 heavy rainfall events between March and June with accompanying wind gusts up to 70 mph and short-duration tornados in the region. In 2009, there was a significant snow event in March and another in December that each produced over 7 inches. In 2010, there was snow event in January that produced over 7 inches and a blizzard in February that produced up to 50 inches of snow in Montgomery County. There were also 4 heavy rainfall events between July and November with accompanying wind gusts up to 90 mph and short-duration tornados in the region. Each heavy rain event produces some level of flooding in Montgomery County and snow events are consistently accompanied by school closures. Heavy winds and tornados that often accompany rain events increase calls for wires and trees down and place significant demands on emergency response.

Disaster Exposure

Potential Risks:

- Earthquakes
- Floods
- Wildland Interface
- Wind Events (tornado, hurricane, and high wind events)
- Key Assets

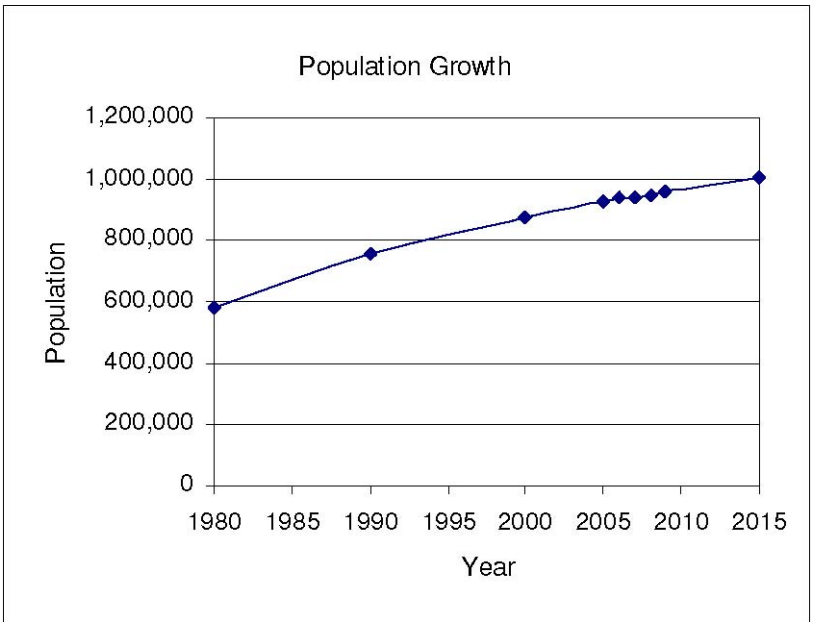
History of Major Events:

- Jan 08 snowfall up to 6 inches
- Feb 08 ice up to 0.3 in
- Feb 08 snowfall up to 1.5 in
- March 08 rain up to 2 in
- March 08 wind up to 66 mph
- April 08 tornados local/rainfall
- May 08 rainfall up to 3.4 in/local tornados
- June 08 local tornados/winds up to 59 mph
- March 09 snow up to 7.7 in
- Dec 09 snow up to 7.3 in/rain up to 1.6 in, ice up to 0.1 in
- Jan 10 2.4 in and 7.2 in snow events
- Feb 10 blizzard July 10 rain/wind gusts up to 70 mph
- Aug 10 80-90 mph wind gusts thunderstorms
- Sept 10 rainfall up to 5.4 in/local tornados
- Nov 10 local tornados/thunderstorms.

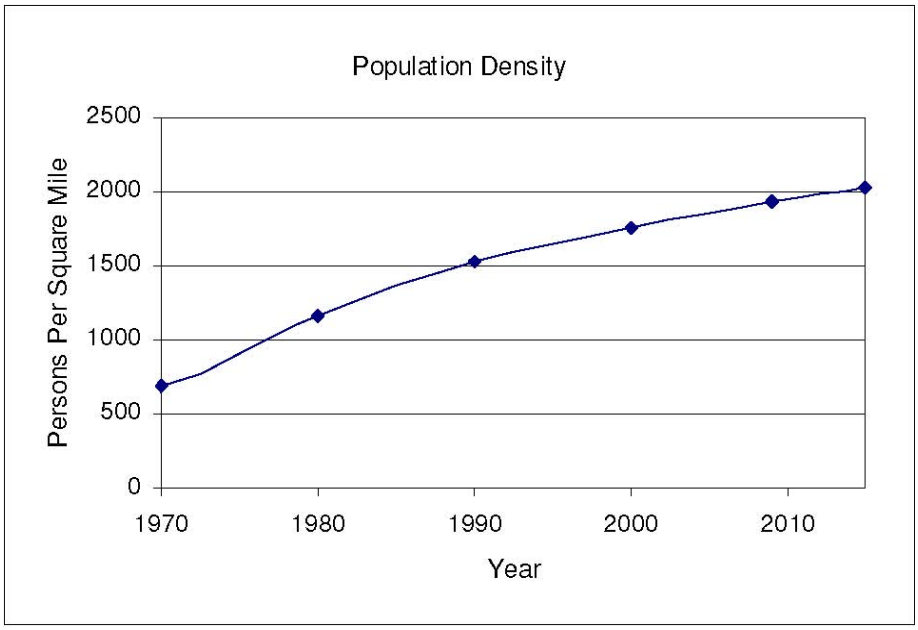
Development and Population Growth

According to CFAI, the current population levels and locations should be detailed to include: density of development areas and average age of concentrations at risk. Also, the impact of transient populations on service demands should be noted.

- **Population:** Montgomery County's population grew 51% between 1980 and 2000, a 2.5% average yearly growth rate. The population grew at the rate of 1% or less from 2005 through 2009. It can be expected that the county population will continue to grow at a 1% or less annual rate. Population projections by the Maryland National Capital Park and Planning Commission (MNCPPC) indicate that the total population in Montgomery County should reach 1,002,800 by 2015.



- **Population Density:** Population density is measured in persons per square mile. There are 495 square miles of land in Montgomery County, and population has increased steadily since 1970. Between 1970 and 2000, overall population density increased from 688 to 1755 persons per square mile, indicating a 5.2% average annual rate of increase. It is projected that population density will reach 2024 persons per square mile by 2015, an expected annual increase of approximately 1%.



- **Age Groups:** According to a 2005 Census Update Survey by MNCPPC, 62.9% of Montgomery County's population is between the ages of 18 and 64, 25.9% are under the age of 18, and 11.2% are 65 years of age or older. The median age is 36.9 years. In the year 1987, 25.9% of the population were less than 18 years of age, 63.7% were between the ages of 18 and 64, and 10.5% were 65 or older. While the percentage of 65+ persons in the County has not increased dramatically, the percentage of 45-64 year old residents has increased from 21.4% in 1987 to 27.5% in 2005. This is significant given the 36.6% overall population increase (all ages combined) during that time.
- **Households:** There were 350,000 estimated households in Montgomery County in 2005, up 35.9 % from 257,558 in 1987. The number of family households went from 166,876 in 1987 to 259,609 in 2005, a 34.6% increase. In 2005, family households made up 74.2% of all households, compared to 74.9% in 1987. Married couples occupied the majority (80.1%) of single-family detached households in 1987 as well as in 2005 (78.8%). Single parent households made up 10.2% of family households in 2005, compared to 7.9% in 1987. Single persons made up 21.0% of the total households in 1987 and occupied 58.9% of the high-rise households. In 2005, 23.5% of all the county households were single persons who occupied 60.0% of the high-rise households. In 1987, 70.1% of households owned their home while 29.9% rented. In 2005, 74.3% of households owned and 25.7% rented. The median age of heads of household were 44 in 1987 and were 51 in 2005.

- **Employment:** There were approximately 518,000 jobs in Montgomery County as of January, 2007. Unemployment averaged 2.9% in 2007 (through July). The largest employment sector is professional and business services. Many of these jobs are concentrated in high-paying scientific, technical, legal and other advanced service fields. Technology jobs account for 23% of the professional and business services employment sector. Technology industry employers include Biotech, Information Technology, Communications and Aerospace companies. Lockheed Martin is the largest technology Company in the County, employing nearly 3,700 people.

  Montgomery County's job base increased by 50,000 between 2000 and 2006. Job growth in 2006 was approximately 1.4%. The County is projected to add nearly 100,000 new jobs by 2020 and more than 150,000 new jobs by 2030. Professional and business services were also the fastest growing employment sector, with a 5.4 percent job growth rate in 2006. Tech sector job growth was 3.4 percent and biotech employment increased 3.8 percent. The construction industry, which employs approximately 30,000 people, expanded 4.3 percent in 2006.

  In 2006, jobs in Montgomery County paid an average annual salary of approximately $54,000. Professional & technical services paid an average annual salary of approximately $75,000. In 2005, 526,830 Montgomery County residents over age 16 were employed. Approximately 60% work in the County. Approximately 68% of working-age women are employed. Sixty percent of Montgomery County's resident labor workforce was in private industry, 22% worked for federal, state, or local governments, 11% worked for non-profits, and 7% were self-employed or worked as unpaid family workers.

  Approximately 260,000 Montgomery County residents (54%) are employed in business and professional occupations, primarily in information technology, life sciences, education, finance, medicine, law, business management, the arts, law and architecture. Twenty two percent of employed residents, 107,000 people, work in sales jobs (including retail). Thirteen percent, 60,000 employed residents, work in service occupations such as healthcare support, public protection services, food preparation and landscaping. Six percent, 30,000 people, work in construction. Four percent, 20,000 people, work in production and transportation occupations.

- **Education:** Nearly 80% of Montgomery County adult residents age 25 and older have some level of higher education. Thirty percent of adults (180,000 residents) have earned a masters, professional, or doctorate degree. Nearly 56% of adults (350,000 residents) have earned a bachelor's degree or higher. Approximately 78% of the County's adult population (475,000 residents) has at least some post-secondary education and 91% of adults in Montgomery County have completed high school.
- **Language:** Thirty six percent of adult residents in Montgomery County are foreign-born. English is the primary language of 65% of Montgomery County adults in the workforce, followed by Spanish (13%), other Indo-European (10%), Asian (9%) and other languages (4%). More than two-thirds of English speakers have a bachelor's degree or higher (67 percent), and an additional 20 percent have an associate's degree or some other college education. Only 2 percent of English-speakers have less than a high school education. Among Spanish-speakers, 22% have a bachelor's degree or higher, and 23% have an associate's degree or some other college education. Thirty three percent have not completed high school.

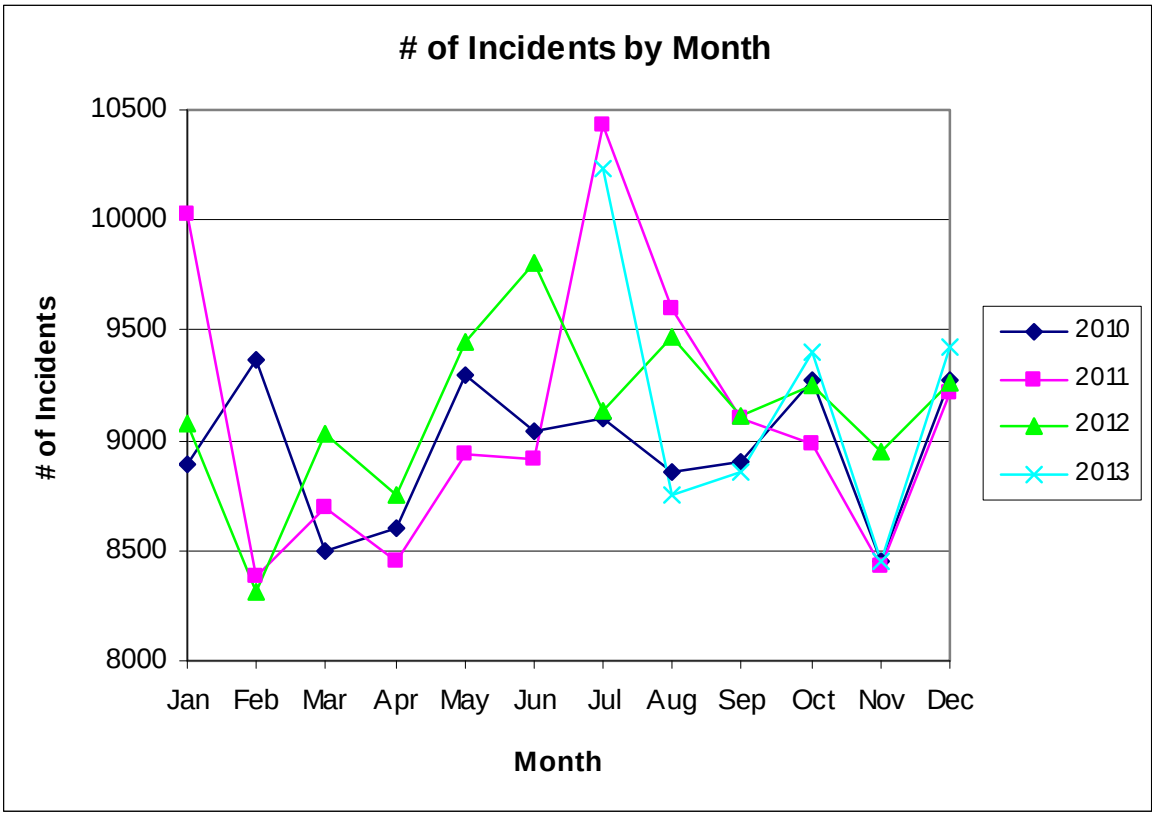
Service Demand/Work Load

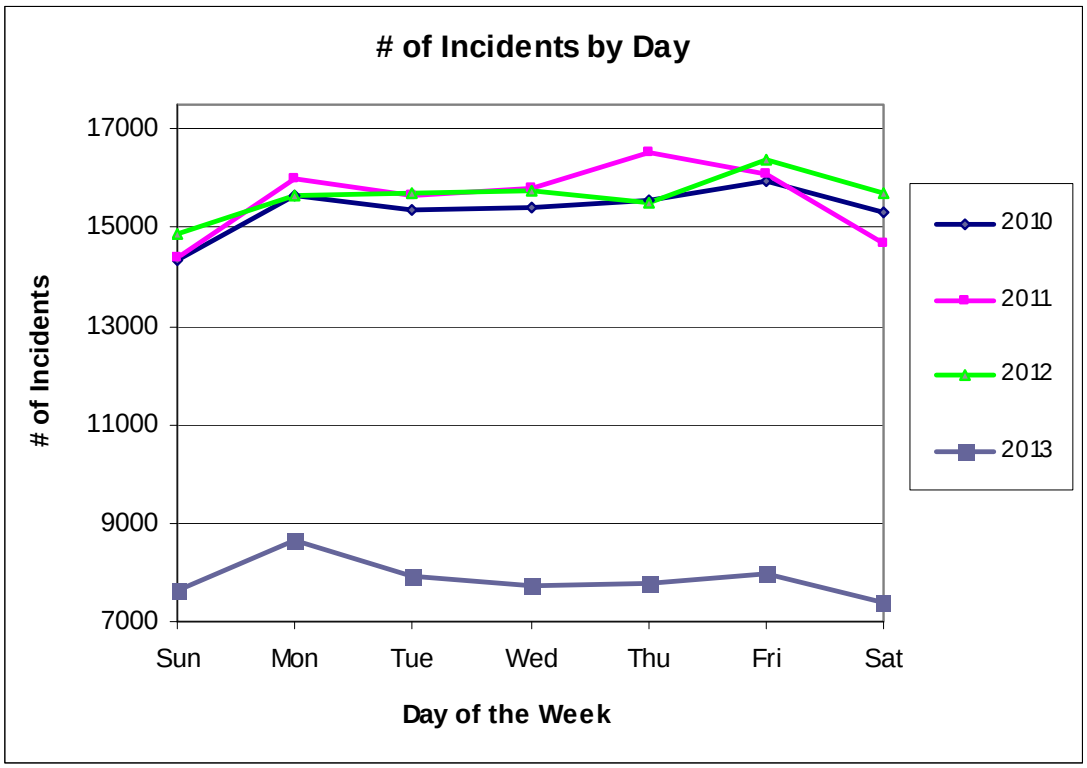
A work load study can be defined as historical data driven analysis which includes: call types, location of calls, and frequency of calls.

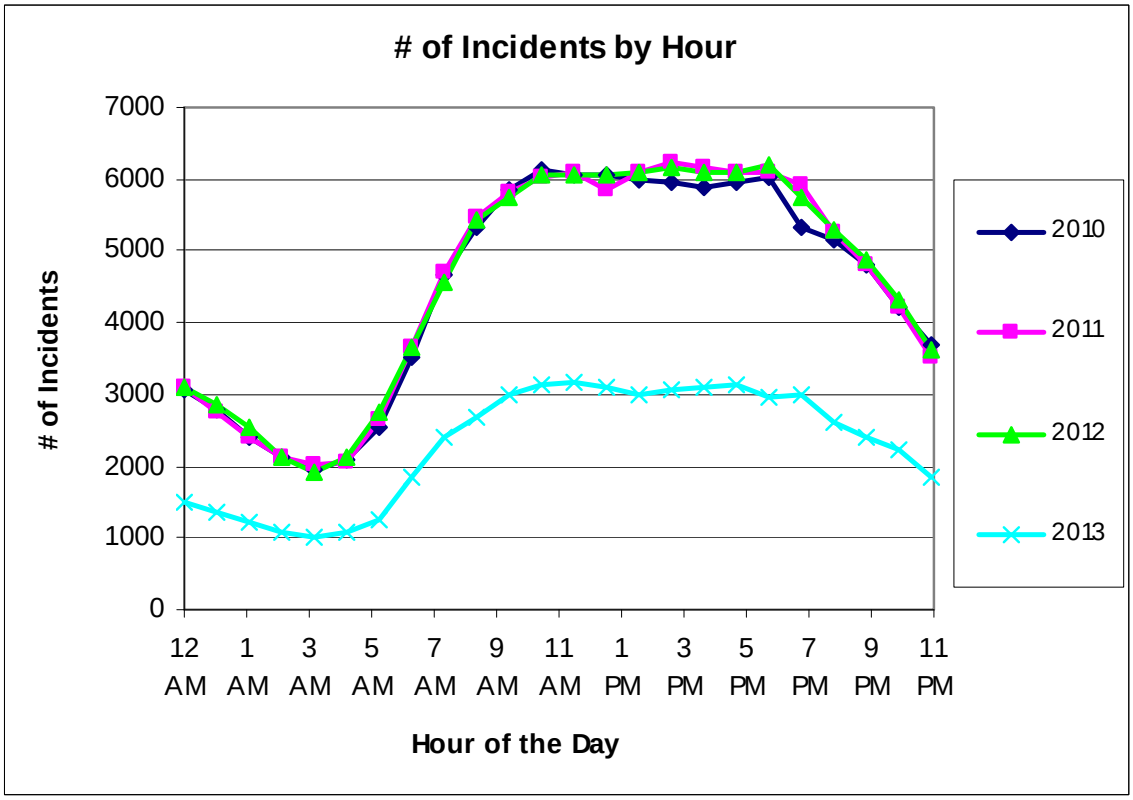
County-Wide Total Emergency Workload By Fiscal Year	
FY	**Total # of Incidents**
2010	107525
2011	109153
2012	109597
2013	55111 *2013 only reports the first two quarters of the fiscal year

County-Wide Emergency Workload Separated by Program and by Fiscal Year										
FY	Adaptive	ALS1	ALS2	Aviation	BLS	Explosive	Firefull	Hazmat	Technical	Water
2010	14916	27181	3681	1	45764	240	958	672	795	29
2011	15850	27344	3509	2	46364	340	963	1272	1009	10
2012	14535	27933	3523	1	46833	328	1008	1356	992	26
2013	7851	14739	1865	1	23301	156	528	646	525	11

*** 2013 only reports the first two quarters of the fiscal year**




# of Incidents by Day
17000
15000
13000
11000
9000
7000
# of Incidents
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Day of the Week
2010
2011
2012
2013


# of Incidents by Hour
7000
6000
5000
4000
3000
2000
1000
0
# of Incidents
12 AM
1 AM
3 AM
5 AM
7 AM
9 AM
11 AM
1 PM
3 PM
5 PM
7 PM
9 PM
11 PM
Hour of the Day
2010
2011
2012
2013

Personnel Resources

According to CFAI, as input to the risk assessment process, the level of staffing and capabilities of this staffing is essential to the assessment. Therefore, the availability of human resources will be examined.

Fire Suppression Services

Fire is a risk that residents and other property owners face on a daily basis throughout Montgomery County. Fires can be categorized as structure fires, vehicle fires, rubbish fires, utility pole fires, and fires involving natural resources such as brush, grasslands, croplands, and forests. All fires present some degree of risk to people and/or wildlife, sometimes resulting in injuries and deaths. With the exception of rubbish fires, all fires cause property damage ranging from minor to catastrophic. While automatic suppression systems are present in some buildings to control or extinguish fires while they are in their early stages of development, the fire department is expected to suppress all fires that have not been controlled or extinguished by suppression systems.

Residential Fire Risk

A rapidly growing fire that seriously threatens the structure and its occupants occurs frequently in Montgomery County. Nationally, the ratio of residential structure fires to all structure fires is approximately 3 to 1. . More importantly, approximately 85% of all civilian fire deaths and 75% of all civilian fire injuries occur in residential occupancies. The vast majority, about two-thirds of all fire deaths and about 50% of all fire injuries occur in one-and two-family dwellings. These ratios have held nearly constant in spite of increased use of smoke detectors, and advances in public education programs. Montgomery County has many large single-family homes (in excess of 4,000 square feet) found in all areas of the County and presents challenges not normally encountered by large municipal fire departments in other areas of the country. The threats posed to the occupants of

these homes, and the opportunity for a rapidly spreading fire to consume the structure before suppression resources can assemble for large fire flows, are great. Many times, first arriving units are faced with rapidly advancing, post-flashover fires that must be aggressively attacked to prevent the fire from totally destroying a given structure. Newer construction that takes advantage of lightweight trussed construction epitomizes this problem.

Commercial and Industrial Fire Risk

With a few exceptions, Montgomery County is not an area where large industrial parks or other highly protected risks exist to the extent that fire service capabilities are unusually challenged. By and large, the commercial and industrial occupancies are arranged and organized such that existing response guidelines are adequate to protect these structures.

Strip shopping centers and several regional shopping malls provide challenges, particularly in established areas of the County. Many of these occupancies were built before sprinkler protection and other code-mandated safeguards were enacted. The potential for a large dollar loss fire is significant in these structures. In nearly all cases, adequate fire fighting water is available to extinguish a large fire and protect adjacent exposures.

Montgomery County Fire Flow Requirements

The amount of water in gallons per minute (GPM) required to suppress a fire in a given structure is most often referred to as needed fire flow, or required fire flow. Water requirements for fire fighting include the rate of flow, the residual pressure required at that flow rate and the total quantity required.

Several different methods may be used to calculate needed fire flow for non-sprinklered structures. The Iowa State University Method is the easiest to apply and is most frequently used by Command Officers for a convenient method to estimate fire flow needs. This simple formula is: GPM Required = Length x Width x Height of Structure / 100. The most widely recognized and utilized formula is contained in the Insurance Services Office Fire Suppression Rating Schedule. The fire flow calculated using this method is considered a good estimate. The ISO Method considers building construction, occupancy, adjacent exposed buildings and communication paths for fire spread

between buildings. Calculations are typically rounded to the nearest 250 GPM for flows under 2500 GPM and the nearest 500 GPM for larger flows. Additional adjustments are made for buildings with wood shingle roofs. As a general rule both the American Water Works Association (AWWA) and the ISO recommend 3500 GPM as the upper limit for needed fire flow for normal public protection. These organizations have further established 500 GPM as the minimum needed fire flow. Calculated fire flows up to 12,000 GPM are not unusual for many buildings in older cities. Data provided to the MCFRS by the ISO, however, shows that most non-sprinklered residential high-rise buildings within Montgomery County have a calculated required fire flow of between 5,000 and 8,000 GPM. The needed fire flow should be available simultaneously with domestic consumption at the maximum daily rate. Needed fire flow should be available for up to 10 hours. Many municipal water authorities place an upper limit of 2 to 4 hours on fire fighting water supply duration due to the economics of pumping and storing large quantities of water. Due to the large number of garden apartments, townhouses, and clusters of homes, the MCFRS provides a minimum quantity of fire fighting water in the 3000-3500 GPM range for townhouses, garden apartments, and other groups of dwellings. This is routinely accomplished in areas with municipal fire hydrants utilizing the resources currently deployed on a structure fire response, provided that sufficient supply lines are deployed above ground. Water supply requirements for structures equipped with automatic sprinklers are required by code to meet the anticipated flow (design flow) of the sprinklers, plus an allowance for hose streams for manual fire fighting. Structures protected by automatic sprinklers, therefore, are excluded from needed fire flow calculations. The long-standing success of automatic sprinklers is well documented in the fire protection community. Montgomery County passed various legislation over the past 24 years requiring automatic sprinklers in new residential construction including: both single and multi-family homes, apartments and town homes.

NFPA 1142 -Standard for Water Supplies for Suburban and Rural Fire Fighting identifies minimum requirements for fire fighting water supplies in rural and suburban areas where reliable water supply systems do not exist. NFPA guidelines are used to calculate a minimum water supply in gallons. The basic formula for minimum water supply is:

$$\text{Minimum Water Supply} = \frac{\text{Total Volume of Structure}}{\text{Occupancy Class Number}}$$

(Construction Classification #)

Where:

Occupancy Classification Number =

3 for Severe Hazard Occupancies

4 for High Hazard Occupancies

5 for Moderate Hazard Occupancies

6 for Low Hazard Occupancies

7 for Low Hazard Occupancies

and:

Construction Classification Number =

0.5 for Type I Fire Resistive Construction

0.8 for Type II and IV Noncombustible and Heavy Timber Construction

1.0 for Type III Ordinary Construction

1.5 for Type V Wood Frame Construction

Assignment of the various occupancies is pre-determined in NFPA 1142, although the Authority Having Jurisdiction (AHJ) can exercise professional judgment when applying the requirements of the standard based on other factors.

Calculation of the total water supply required in gallons is then used in the following table to determine the minimum rate of delivery by the fire department:

Total Water Supply Required (GALS)	Rate of Delivery (GPM)
Up to 2499	250 gpm
2500 – 9999	500 gpm
10,000 – 19,999	750gpm
20,000 or more	1000 gpm

Source: Table 5-9(b), NFPA 1142

The NFPA standard referenced here focuses on rural and suburban areas where water may not be as

readily available. In either case, the standard operating procedures adopted by the MCFRS for structural fire fighting and needed fire flow are supported by either of these methods.

Montgomery County is served by three independent municipal water systems: the Washington Suburban Sanitary Commission (WSSC), the City of Rockville, and the Town of Poolesville. Of the three, WSSC has the largest network and serves the largest number of County customers. All three public systems serve a dual purpose: (1) to supply water for normal domestic demand and (2) to provide water to fire hydrants for fire fighting use and or to supply fixed fire protection systems such as automatic sprinklers, standpipe and other fire suppression systems. The various components of these systems determine the quantity and quality of fire fighting water available to units suppressing fires in Montgomery County. Other in-place procedures, or lack of procedures, determine the reliability of this available water. The WSSC water distribution system is adequate for supplying both domestic and fire suppression needs under normal conditions. Much of the system is looped; ensuring that water supply is not cut off to a large area should a main break or otherwise need to be shut down for a short period. About 20,000 fire hydrants are located throughout the WSSC water supply system and are owned and maintained by WSSC. In residential areas containing single family homes, hydrants are spaced not more than 600-800 feet apart, as measured along an improved roadway. In addition, hydrants must be within 600 feet of the most distant corner of any single family dwelling, as measured along an improved roadway. For areas containing townhouses and garden apartments, hydrants are spaced not more than 300 feet apart, and hydrants must be within 300 feet of the most distant corner of any townhouse or garden apartment, as measured along an improved roadway. In areas containing high-rises, commercial, and/or industrial occupancies, hydrants are spaced not more than 300 feet apart, and specific flow rates are determined per occupancy. The minimum flow rate for hydrants in single family dwelling neighborhoods is 1000 gallons per minute (GPM) at 20 PSI, and 1500 GPM at 20 PSI for multi-family dwellings.

The City of Rockville water system, operated by the City's Public Works Department, serves properties within the city limits with the exception of a few areas which are served by WSSC. The Rockville system serves about 11,650 residential, business and institutional customers. Fire hydrants are located throughout the City of Rockville water supply system and are owned and maintained by the city. In residential areas containing single family homes and/or townhouses, hydrants are spaced not more than 500 feet apart. In areas containing commercial and/or industrial occupancies, hydrants are spaced not more than 300 feet apart.

The Town of Poolesville water system, operated by the Town's Public Works Department, serves properties within the town limits. About 300 fire hydrants are located throughout the Town of Poolesville and are owned and maintained by the town. The system-wide minimum flow rate for hydrants is 1200 GPM at a residual pressure of 20 PSI; normal static pressure is 60 PSI. In residential areas containing single family homes, hydrants are spaced not more than 600-800 feet apart. In areas containing townhouses or commercial occupancies, hydrants are spaced not more than 300 feet apart. For areas containing townhouses and garden apartments, hydrants are spaced not more than 300 feet apart.

A significant portion of Montgomery County is not served by municipal water service and therefore considered rural in nature for fire fighting purposes. There are two major reasons why rural areas do not have municipal water service – cost of laying water mains to distant, sparsely populated areas; and land-use, zoning, and growth policies that restrict development and extension of water and sewer lines. The latter issue is heavily impacted by the County's desire to maintain agricultural and rural open space in an effort to preserve the County's agricultural heritage and to maintain undeveloped areas that contribute to the overall quality of life for all County residents. The legal mechanism for preserving agricultural and open spaces is based in the document titled "*Functional Master Plan for the Preservation of Agriculture and Rural Open Space in Montgomery County*," adopted in 1980. The plan created an Agricultural Reserve of approximately 91,000 acres. Through the application of preservation techniques (e.g., Rural Density Transfer Zone, Transfer Development Rights, etc.), this land has remained largely undeveloped, although limited types of low-density residential development is allowed in specific areas. Most dwellings and businesses within the "Reserve" are served by wells and septic fields; thus fire hydrants are non-existent throughout the vast majority of the Reserve. Because of this preservation policy, high-density development in Montgomery County is taking place only in areas where water and sewer lines have been approved. Non-hydranted areas must be served by some combination of fire department tankers, underground storage tanks, dry hydrants, cisterns, etc.

The MCFRS has identified small pockets of non-hydrated areas throughout much of the hydranted portion of the County. Station areas 10, 30, 33 and 40 are primary examples of areas having pockets

of non-hydranted streets adjacent to larger areas that are fully served by hydrants. Some of these areas are part of designated park and recreation lands that will not be developed in the future. Other areas are a result of inadequate planning as water and sewer was extended into expanding areas of the County over the years. A smaller number of areas exists where groups of homeowners have chosen not to connect to public utilities for a variety of reasons. As growth and development expands further into the rural areas of the County, the MCFRS has taken positive actions to assure that a well-planned water delivery system is in place throughout the County to efficiently provide fire fighting water to our suppression forces in rural, suburban and urban areas. The Standard Operating Procedure for "Safe Structural Fire-Fighting" provides for efficient water delivery in all areas of the County. These procedures have been tested and continue to be practiced to guarantee minimum required fire flows using municipal fire hydrants, tanker shuttle, or engine relays. The MCFRS has deployed tanker resources in the County to ensure first arriving suppression units can initiate an attack with 5,000 gallons of water for ten minutes. The MCFRS sees a number of important advantages to this concept. Delivering a minimum of 5,000 gallons of water to the fire ground will guarantee that units will be able to utilize effective streams and sustained fire flows for a short duration of time, well beyond the reach of fire hydrants and other water supplies. In all cases, the MCFRS has adopted a strategy that strives to provide a fire fighting water supply that is rapid, efficient, expandable and uninterrupted.

Limited-Access Highways

In addition to large structure fires, the MCFRS has considered the threats posed by limited-access highways and the net affects of fires similar to those that have occurred either in Montgomery County or in other nearby jurisdictions. Serious incidents involving a large volume of fire are always challenging since water is not directly available on most limited-access highways[1]. The MCFRS includes other major commuter routes in our consideration of limited-access highways that may or may not have available fire fighting water. Route 29, River Road, Clara Barton Parkway, Mid-County Highway, Great Seneca Highway and Route 27 serve as prime examples. Nonetheless, the MCFRS believes the County's greatest water supply risk to be on the interstate highways. Fires that occur on limited-access highways are usually of little threat to our citizens, other than those directly involved in the incident. For example, a serious fire that threatens the bridges at the points where I-495, Rt-355, and the Metro Rail overpass meet would disrupt the transportation network in the metro

area. Clearly, the most efficient and cost-effective method for water delivery on the various highways is to bring it on-board initial arriving units. Most often, this is accomplished using the booster tanks on fire department engines, and, in many instances, tankers. The MCFRS does not believe that an adequate, uninterrupted water supply can be provided in the event of a hazardous materials transportation emergency using hauled water alone. The new Inter-County Connector (MD200) is the first and only limited-access highway in Montgomery County equipped with fire hydrants.

Target Hazards

Fire department target hazards and their subsequent risks are selected based upon known history and the threat to human life rather than the potential to tax a fire department's water supply delivery system. These risks are well known and are considered the basis for the fundamental and occupancy chapters of NFPA-101, The Life Safety Code. The MCFRS provides aggressive Life Safety and Structures programs focused on preventing incidents based upon pre-defined laws, codes and recommended best practices. In the final analysis, the MCFRS was able to confirm that their strategy regarding needed fire flow as related to occupancy risk was adequate and prudent with few exceptions. Those exceptions were primarily limited to occupancies without adequate fire department access, unregulated Federal installations, and unique target hazards like the Mirant Power Plant in Dickerson.

Evaluation of Probability

Risk is defined as the probability (i.e., likelihood) of a damaging or injury-inflicting event in combination with the consequences (i.e., severity) of that event. Stated mathematically: Risk = Probability of Occurrence X Consequences where probability and consequences can be stated numerically to derive a numerical level of risk that can be compared with other types of risks in order to rank them. Risk can also be examined and compared subjectively in terms of categories such as low, moderate, and high, or variations of these qualitative measures. The highest risk posed to the citizens of Montgomery County on any given day, week, month, or year is the result of a hazard posing both a high probability of occurrence and severe consequences. The lowest risk is one having a low probability of occurrence and minor consequences. A moderate level of risk might be the result of a hazard posing a high probability of occurrence but with minor consequences, or a hazard posing a low probability of occurrence but having severe consequences. Probability is defined as the likelihood that a particular event will occur within a given period of time. In the context of describing risk, probability is the likelihood that a damaging or injury-inflicting event will occur, without regard to who or what may be harmed. The probability of a given event occurring within a given time frame may range from very low to very high depending upon the presence of a number of casual factors including, but not limited to, hazards present, condition of people who are present, actions/activities/processes underway, environmental factors, weather conditions, season of the year, day of week, time of day, or some combination of these or other factors. A table showing the probability of occurrence of several types of fire-rescue incidents on a daily basis can be found in Appendix 1. Probabilities are based upon past frequency of incidents within Montgomery County over the past ten years. The most probable incident to occur on a daily basis is a BLS incident involving one patient (e.g., “sick person”). A hazmat incident at a fixed facility is an example of an incident having a medium probability of occurrence on any given day. The least probable incident (of those shown in the table) on a daily basis is a terrorism incident.

INCIDENT PROBABILITIES AND FREQUENCY OF OCCURANCE

Incident Type	Very High	High	Medium	Low	Very Low	Impact Area
BLS, one patient, non-PIC	X					L
ALS, one patient, non-PIC	X					L
PIC, one patient	X					L
PIC, multiple patients	X					L
Structure fire		X				L
Vehicle fire		X				L
Brush/woods/mulch fire		X	X			L
		Summer	Winter			
Rubbish/debris fire		X				L
Hazardous condition[3]		X				L
Destructive device			X			L
Suspicious package			X			L
HazMat, fixed facility			X			L
HazMat, in transport			X			L
Water rescue			X		X	L
			Summer		Winter	
PIC, bus, w/ mass casualties			X			L
Thunderstorm, w/o tornado			X		X	L-C
			Summer		Winter	
Snow/ice storm, w/o blizzard			X			C
Extended temperature extreme			X			C
Extended drought			X			C
Pipeline leak/fire				X		L
Incident Type	**Very High**	**High**	**Medium**	**Low**	**Very Low**	**Impact Area**
Hurricane				X		C
Tornado				X		L
Blizzard				X		C
Flooding				X		L-C
Rescue, structural collapse				X		L
Rescue, confined space				X		L

Rescue, high angle		X		L
Metro Rail incident		X		L
Passenger train incident		X		L
Passenger airline incident		X		L
Terrorism, WMD		X		L-C
Terrorism, other (i.e., non-WMD such as shootings)		X		L-C
Utility disruption, water		X		L
Utility disruption, power		X		L
Utility disruption, gas		X		L
Utility disruption, phone		X		L-C
Pollution emergency	X Summer	X Winter		C
Disease/health epidemic		X		L-C
Civil disturbance		X		L-C
Commodity shortage		X		C
Dam failure			X	L
Earthquake			X	C
Sinkhole			X	L
Mudslide			X	L
Conflagration			X	L
Act of war			X	C

****** Note: All incident types are <u>non-terrorism related</u> unless stated specifically as terrorism**

Incidents include downed/arcing wires, downed trees, natural gas leaks, electrical shorts, odor of smoke, unknown odor, lockout with food on stove, etc.

L-Locally C-County-wide

Risk Assessment Methodology

The risk assessment contains the quantitative outputs pertaining to the determined risk input factors. Each item contains a probability/consequences matrix which represents the considerations of risk assessment in each community.

Fire Risk Assessment

Primary Fire Risks Categories

MCFRS concluded that our primary occupancy risks were based in the following broad categories listed below:

Low Fire Risk:

These incidents include those requiring a single engine response. This type of incident is minor in nature having relatively low personal safety risk and low property loss rate of less than $40,000 are:

- Passenger style vehicle fires
- Dumpster fires detached from buildings
- Grass or woodland fires less than one acre in area

Moderate Fire Risk

These incidents are those requiring a one or two Engine Company and special service unit (Truck, Tower or Rescue Squad**)** adaptive response. This type of incident is moderate in nature an increased potential for civilian or fire service injuries and/or an increase in direct property loss rate of $40,000 to $ 100,000 are:

- Truck or bus fire
- Dumpster fires attached to buildings
- Grass or woodland fires greater than one acre in area without the potential for structural involvement

- Contained fires within a dwelling i.e. oven fires

High Fire Risk

This includes incidents requiring a Fire-Full Assignment dispatch of five Engines, two Trucks or Towers, a Rescue Squad and two command officers. This type of incident has a high potential for civilian and fire service injuries and an increase in direct property loss rate greater than $100,000 but less than $ 1,000,000 are:

- Single-family dwelling fires
- Commercial building fires on one floor only and involving less than 52,000 square feet.
- Transportation related fires and/or explosions i.e. Metro, rail

Special Fire Risk

These incidents require greater than five Engines, greater than two Trucks or Towers, greater than one Rescue Squad, and multiple command officers as in a box alarm with greater alarm response, a high-rise fire, or a fire in a non-hydranted area. This type of incident has a high potential for civilian and fire service injuries and an increase in direct property loss rate greater than $1,000,000 are:

- Multi-family dwelling fires
- Commercial building fires on multiple floors or involving more than 52,000 square feet
- Fires involving CBRNE materials
- Fires interrupting critical infrastructure, commercial or governmental
- Incidents involving high-rise structures
- Fire incidents requiring rural water supply

Fire Risk Assessment Methodology

Fire Risk was determined by combining incident data history with zoning data.

Incident Data

Incident data is from fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. The data is categorized into two groups: Fire Full Assignment and Fire Non Full Assignment. Fire Full Assignment call types include:

Call Type	Call_Type_Description

FIR/HOUS	HOUSE FIRE
BOX	BOX ALARM
BARN	BARN FIRE
GARAGE	GARAGE FIRE
TRN/FIRE	TRAIN FIRE
FIR/BLDG	BUILDING FIRE
FIR/GARG	GARAGE FIRE DET
METRO-BX	METRO BOX ALARM
TRAN/PAS	PASS TRAIN DERAIL OR FIRE
BOX/HM	BLDG FIRE W/HAZMAT
HOUSE	HOUSE FIRE
FIR/APT	APT FIRE
MET/CRSH	METRO CRASH
FR/GARG	GARAGE FIRE DET

Fire Non Full Assignment call types include:

Call_Type	Call_Type_Description
ACT/CO	ACTIVATED CARBON DIOXIDE DETECTOR
ACT/SD	ACTIVATED SMOKE DET
ADAPTIVE	ADAPTIVE RESPONSE
AFA	AUTOMATIC FIRE ALARM
AHFA	AUTO HOME FIRE ALARM
ALA/AFA	ALARM FROM ALARM CO
ALA/AHFA	HOME ALARM FROM ALARM CO
ALA/BELS	LOCAL ALARM - NO SMK/FIRE
ALA/CO	ALA/CO
AUTO	AUTOMOBILE(CAR) FIRE
BBQ	ILLEGAL BBQ
BELLS	AUDIBLE ALARM BELLS
BOGS	BROKEN OUTSIDE SERV
BRUSH	BRUSH, GRASS, WOODS
BUS	BUS FIRE
DUMPSTER	DUMPSTER FIRE
ELEC/SHT	ELECTRICAL SHORT
EQUIP	CONSTRUCTION EQUIP
FIR/APPL	CONF APPLIANCE FIRE
FIR/BRSH	VEGETATION FIRE
FIR/DUMP	DUMPSTER FIRE
FIR/LGVH	FIRE - LARGE VEH, BX TRK, RV, BUS
FIR/OUT	FO IN STRUCT, NO SMK/FIRE
FIR/SEWR	FIRE IN SEWER
FIR/SHED	SHED FIRE
FIR/TRSH	TRASH FIRE
FIR/TXFM	TRANSFORMER FIRE
FIR/UNK	FIRE UNKNOWN
FIR/VEH	AUTO FIRE
FIRE/OTH	FIRE OTHER
FIREOUT	FIRE REPORTED OUT
FO/SMOKE	FIREOUT W/SMOKE COND
FOOD	FOOD ON THE STOVE

FRWATCH	FIREWATCH
FURNACE	CONFINED HVAC FIRE
GAS/LEAK	INSIDE ODOR OF GAS
ILLEGAL	ILLEGAL FIRE
INVEST	INVESTIGATION
LO/FOOD	LOCKOUT/FOOD ON STOVE
MET/OTH	METRO OTHER EVENT
ODOR	ODOR OF SMOKE
OVEN	CONFINED OVEN FIRE
PEPCO	NON-DISPATCH WIRES
PICK-UP	SMALL TRUCK FIRE
POLE	POLE FIRE
SEWER	FIRE IN SEWER
SHED	SHED FIRE
SHORT	ELECTRICAL SHORT
SMOKE	SMOKE IN THE AREA
TRASH	TRASH FIRE OUTSIDE
TRUCK	TRUCK FIRE
TXFORMER	TRANSFORMER FIRE
UN/EMER	UNKNOWN EMERGENCY
UN/FIRE	UNDETERMINED FIRE
VEH/OTH	OTHER VEHICLE
W/F	WATERFLOW ALARM
WIRES	WIRES DOWN

The numbers of incidents in each Risk Management Zone were counted. The Fire Full assignment incidents were assigned 2 points per incident and the Fire Non Full Assignment were assigned 1 point per incident.

For example – Risk Management Zone 0203:
20 Full Assignment Incidents: 20 x 2 points = 40 points
160 Non Full Assignment Incidents: 160 x 1 point = 160 point

200 total incident points

The incident point scores were then grouped into 5 separate categories:

Scores assigned:

- 0 Incident points = 0 points
- 1-50 Incidents = 1 point
- 51-200 Incidents = 2.5 points
- 201-400 = 5 points
- 401 – 800 = 7.5 points

- 801 – 1257 = 10 points

Therefore, Risk Management Zone 0203 with 200 total incident points receives a score of 2.5.

Zoning Data

The zoning data for the county is the best method we have to capture general building characteristics on a County-wide level. The zoning data gives a general overview of each risk management zone and is a good indicator of whether an area is primarily residential, commercial, industrial or agricultural. Each zoning category carries inherent risk based on building type. Each zoning category was examined individually and predominate building size, height, and use was determined to give the zoning category a level of risk.

Building size
Small = 1 point
Medium= 2 points
Large= 3 points
Very large= 4 points

Building height
Access with Ground Ladder = 1 point
Access with Aerial Ladder = 2 points
Areas with no ladder access = 3 points

The use of structure (occupancy type)
Low hazard occupancy = 1 point
Moderate hazard occupancy = 2 points
High hazard occupancy = 3 points

The 3 largest zoning categories were used in the risk analysis since there can be over 20 categories per risk management zone. This gives us the predominant building characteristics. An average score of the three largest zoning categories was used as the final score for zoning.

For example – Risk Management Zone 0203 has the following zoning categories:

ZONE_	Sq Footage
R-60	4859429.16270246
R-10	464336.618971379
R-40	427612.52844544
R-30	330667.216770291
RT-8	171770.474176
C-1	113369.06861541
C-O	68551.5756323
O-M	38396.4778358

R-60, R-10 and R-40 are used in this risk analysis since they are the largest in square footage.

R-60, Residential One-Family, Minimum lot area of 6,000 square feet for each dwelling.

R-10, Multiple-Family High Density Residential, Minimum net lot area of 1,000 square feet for each dwelling.

R-40, Residential One-Family, Minimum lot area of 4,000 square feet for each dwelling.

FireZoning							
Zone	Size	Size_score	Height	Height_nu	Use	Use_nu	Zone_TotPoints
R60	Medium	2	Low	1	Low	1	4
R10	Medium	2	Medium	2	Low	1	5
R40	Medium	2	Low	1	Low	1	4

Zoning Score Assigned for each Risk Management Zone. Range is 3.3 -9.

For example – Risk Management Zone 0203's Average Zoning Score is 4.3

Totals

All of the points were added together to create the total Fire Risk.

Total point score grouped for each Risk Management Zone:

Fire Risk	Total Points
Low	0-6
Moderate	6-8
High	8-10
Special	10-15.3

For example – Risk Management Zone 0203:

Incident Data – 2.5
Population Density - 4.3 points

6.8 points = Moderate Risk

Emergency Medical Services

Emergency medical services (EMS)-related risk is one of the most significant risks facing Montgomery County's residents, business owners, and visitors on a daily basis. The consequences of EMS incidents can impact one individual (e.g., person suffering a heart attack) up to potentially hundreds or even thousands of people depending upon the scope of the incident (e.g., mass casualty incident).

The MCFRS categorizes EMS incidents into advanced life support (ALS) and basic life support (BLS) incidents. ALS incidents include life-threatening incident types such as cardiac arrest, chest pains, heart attack, unconscious person, asthma, choking, diabetic, shooting, stabbing, electrocution, pedestrian struck, allergic reactions, severe bleeding, poisoning, and anaphylactic shock. BLS incidents include non-life threatening incident types such as injured persons, sick persons, hemorrhages, patients with mental disorders, child deliveries, and similar incidents of a basic life support nature. While EMS incidents are distributed throughout Montgomery County, these incidents are heavily concentrated in certain areas within the south and central portions of the County. EMS incident density is highest in areas having the following characteristics:

- High population density Nursing homes, assisted living facilities, and group homes
- Residential communities or individual mid-rise/high-rise residences for seniors
- Large concentrations of mid-and high-rise occupancies, particularly residential
- Major highways Shopping malls or other large concentrations of commercial/retail occupancies

For the most part, larger nursing homes average about one to two ALS incidents per day. The large "Leisure World" community for seniors, located north of Station 25 in the Aspen Hill area, experiences a very high volume of ALS incidents. Another heavy user of ALS (and BLS) services is the large Asbury Methodist complex located south of Station 8 in Gaithersburg. A third complex consisting of a large residential occupancy for seniors (Revitz House), two nursing homes (Smith-Kogod and Wasserman Buildings), and a community center, located on Montrose Road near East Jefferson Street in Rockville, also experiences an especially high volume of ALS (and BLS)

incidents annually. The heaviest concentrations of ALS incidents are located in Rockville, Aspen Hill, Gaithersburg, Germantown, Silver Spring, Four Corners, Burtonsville, Wheaton, Chevy Chase, Bethesda, and Friendship Heights. This density of ALS incidents is expected to continue, and the volume of ALS incidents is expected to increase as the County's senior population and overall population increases in Silver Spring, Wheaton, Chevy Chase, Bethesda, and Friendship Heights.

Areas of moderate density of BLS incidents include Hillandale, Burtonsville, Kensington, and Germantown. Much like ALS incidents, a high volume of BLS incidents occurs at nursing homes, assisted living facilities, group homes and senior communities/complexes. Roadways, shopping malls, schools, and recreational facilities also generate a large volume of BLS incidents. This density of BLS incidents is expected to continue for at least the next ten years, and the volume of BLS incidents is expected to increase as the senior population and overall population increases.

EMS Risk Assessment Methodology

EMS Risk was determined by combining incident data history with population density.

Incident Data

Incident data is from fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. The data is categorized into four groups. The number of incidents in each Risk Management Zone were counted and assigned a point based on severity of incident type.

BLS Incidents = 1 points
ALS1 Incidents = 3 points
ALS2 Incidents = 5 points

For example – Risk Management Zone 0203:
BLS Incidents: 548 x 1 points = 548 points
ALS1 Incidents: 314 x 3 points = 942 points
ALS2 Incidents: 48 x 5 points = 240 points

1730 total incident points

The incident point scores were then grouped into 5 separate categories with the following scores assigned:

- 0 Incidents = 0 points
- 1-250 Incidents = 1 point
- 251-500 Incidents = 2.5 points
- 501-1000 = 5 points

- 1001 – 5000 = 7.5 points
- 5001 – 12436 = 10 points

Therefore, Risk Management Zone 0203 with 1730 total incident points receives a score of 7.5.

Population Density

Census 2010 block data was partitioned to create box area population density. The ranges that were used are from the CFAI definitions.

Population Density (people/Sq Mi)	Points
Rural - less than 1,000 people/sq mi	0
Suburban - 1,000 - 2,000 people/sq mi	1
Urban - 2,000 + people/sq mi	2
Metropolitan - 3,000 + people/sq mi	3

For example – Risk Management Zone 0203 is Metropolitan population density, and thus receives 3 Population Density points.

Totals

All of the points were added together to create the total EMS Risk.

Total point score grouped for each Risk Management Zone:

EMS Risk	Total Points
Low	0-3.25
Moderate	3.25-6.5
High	6.5-9.75
Special	9.75-13

For example – Risk Management Zone 0203:

Incident Data – 7.5
Population Density - 3 points

10.5 points

Primary Medical Risks Categories

MCFRS concluded that our primary medical risks were based in the following broad categories listed below:

Low Medical Risk

Incidents requiring a single ambulance response staffed with two EMTs able to provide basic life support. This type of incident is minor in nature, presenting a relatively low personal safety risk for the EMTs, and the response provides basic first aid and transportation for those suffering from non-life threatening injuries or illnesses. Examples include:

- Injured person from a fall without a loss of conscious
- Automotive collisions on roads with speeds less than 40 MPH
- Sick person complaining of flu like symptoms
- EMS support at fire scenes or at special events

Moderate Medical Risk

These are incidents requiring a single medic unit response staffed by one EMT and one Paramedic capable of providing advanced life support. This type of incident presents a relatively low personal safety risk for the responders, and it provides basic to advanced life support and transportation for a stable patient who is suffering from life threatening or life altering injuries or illnesses. Examples include:

- Injured person from a fall with a loss of conscious
- Automotive collisions on roads with speeds greater than 40 MPH
- Hypertensive patient complaining of chest pain
- Asthma or patient complaining of trouble breathing

High Medical Risk

Incidents requiring a single medic unit response staffed by one EMT and one Paramedic plus a second Paramedic responding on the nearest available Fire-Rescue unit capable of providing advanced life support (e.g., ALS engine). This type of incident presents a moderate personal safety risk for responders, and it provides advanced life support and transportation for an unstable patient suffering from life threatening or life altering injuries or illnesses. Examples include:

- Patients with traumatic injuries
- Patients in respiratory or cardiac arrest
- Incidents having more than one Priority-2 patient
- Patients suffering from infectious disease

Hazardous Materials Services

Hazardous materials generally present a moderate risk within Montgomery County on a daily basis. Hazardous materials are classified as flammable/combustible liquids, compressed gases, corrosives, poisons/toxic materials, oxidizers, flammable solids, etiologic agents, cryogenics and radioactive materials. Many hazardous materials pose multiple hazards such as flammable gases (e.g. acetylene) and poisonous corrosives (e.g., drain cleaner). Substantial quantities of hazardous materials are present in Montgomery County every day, whether in storage, in use, or transported within or through the County. Hazardous materials are stored and used in numerous businesses, offices, research centers, laboratories, and other facilities throughout the County.

Hazardous materials are transported through the County by means of vehicles, trains, and underground pipelines, and over the County by aircraft. No portion of the County is risk free from hazardous materials, although the urbanized areas are considerably more at risk than suburban and rural areas. Hazardous materials can be released from their containers into the surrounding environment in the form of leaks, spills, explosions, and/or fires. The release may occur all at once in a catastrophic container failure, or gradually through small breaches in containers. Upon entry to the environment, released hazardous materials can cause immediate harm to nearby people, wildlife, property, and the natural environment. Spills will flow downhill and can harm anyone or anything in their path. Leaks produce vapors, sometimes large vapor clouds, which will be carried downwind to impact anything in its path.

Hazardous materials are constantly on the move across, beneath and above Montgomery County. Hazardous materials are transported across the County by a variety of highway vehicles and train cars on a daily basis. At the same time, aircraft are transporting hazardous materials above the County around the clock. Aside from any hazardous cargo, commercial aircraft carry thousands of gallons of fuel which presents a life safety and environmental risk in and of itself should the aircraft crash. Some hazardous materials are being delivered within the County for sale or for use while

others are simply passing through en route to other destinations.

Primary roadways used by vehicles transporting Hazardous materials include Interstates 495, 270 and 370; U.S. Route 29, and Maryland Routes 200-Intercounty Connector, 355-Rockville Pike, 97-Georgia Avenue, 650New Hampshire Avenue, 193-University Boulevard, 185-Connecticut Avenue, 108Olney-Sandy Spring Road, 28-Darnestown Road, 190-River Road, 410-East West Highway, 124-Woodfield Road, 27-Ridge Road, 119-Great Seneca Highway, 109Beallsville Road, and 586-Veirs Mill Road**.** I-495 carries the highest number of hazmat vehicles in the County on a daily basis. County-owned and -maintained roadways with heavy hazmat traffic include Shady Grove Road, Montrose Road, Randolph Road, Montrose Parkway, and Bel Pre Road.

Commonly transported hazardous materials in Montgomery County include gasoline, diesel fuel, heating oil, propane, hot tar, muriatic acid, pesticides, compressed gases (e.g., oxygen, acetylene), sodium hydroxide, potassium hydroxide, chlorosulphonic acid, and hydrogen peroxide. A wide variety of flammable, combustible, corrosive, and compressed gas products are also transported in tractor-trailers and smaller delivery trucks/vans. Large quantities of hazardous materials are also transported by rail along the CSX Railroad tracks running between Silver Spring (to the south) and Dickerson (to the northwest) and through Kensington, Rockville, Gaithersburg, Germantown, Boyds and Barnesville along the way.

Commonly transported hazardous materials by rail include: propane, liquid petroleum gas, chlorine, anhydrous ammonia, hydrochloric acid, sulfuric acid, caustic soda, nitric acid, phosphoric acid, acetic acid, acetone, alcohols, molten sulfur, acrylonitrile, ethylene oxide, and methyl mercaptan. Passenger train locomotives carry about 3,000 gallons of diesel fuel in each fuel tank that can spill and catch fire during derailments, endangering passengers, crew, and emergency responders, and damaging the environment. High pressure petroleum product pipelines that traverse the County are considered Montgomery County’s top conventional hazmat risk. The Colonial Pipeline transports gasoline and diesel fuel, and the Columbia, Williams (Transcontinental), and Dominion pipelines transport natural gas. All four pipelines transport products at extremely high pressure, adding to the risk of the flammable fuels being transported.

There are over 2500 businesses, facilities, and occupancies that store, use, or process hazardous materials in Montgomery County. Types and quantities of hazardous materials vary considerably

from location to location, posing varying degrees of risk. Types of occupancies that store, use, and/or process hazardous materials on the premises include the following:

- Laboratories Multiple/all categories of Hazardous materials
- Research & development firms Multiple/all categories of Hazardous materials Bio-technology firms Multiple/all categories of Hazardous materials
- Manufacturers Multiple categories of Hazardous materials
- Hospitals Comp. gases, cryogenics, etiologic agents
- Garden centers Pesticides, fertilizers
- Nurseries Pesticides, fertilizers, flammable fuels
- Lawn care storage/filling facilities Pesticides, fertilizers
- Farms Pesticides, fertilizers, flammable fuels
- Golf courses Pesticides, fertilizers, flammable fuels
- Pest control storage facilities Poisons
- Chemical suppliers Multiple categories of Hazardous materials
- Vehicle repair and painting shops Flammables, corrosives, compressed gases
- Automobile dealerships Flammables, corrosives, compressed gases
- Auto parts stores Flammables, corrosives, compressed gases
- Gasoline/service stations Flammables, corrosives, compressed gases
- Propane storage/filling facilities Flammable liquids, compressed gases
- Compressed gas storage/filling facilities Compressed gases–flammable and non-flam.
- Refinishing shops Flammables, corrosives, compressed gases
- Home improvement centers Multiple categories of Hazardous materials
- Hardware stores Multiple categories of Hazardous materials
- Grocery stores Multiple categories of Hazardous materials
- Pharmacies Multiple categories of Hazardous materials
- Sporting goods stores Flammables, compressed gases
- Camping goods stores Flammables, compressed gases
- Paint stores Flammables, comp gases, poisons, corrosive
- Department stores Multiple categories of Hazardous materials
- Warehouses Multiple categories of Hazardous materials
- Quarries and construction sites Explosives, flammable fuels Water filtration plants

Chlorine, other Hazardous materials for water treatment

- Power plant Flammables, compressed gases Natural gas
- Pressure reduction facilities Flammable compressed gas Cell/microwave towers Corrosives (batteries)
- Schools/colleges (chemistry labs) Multiple categories of Hazardous materials
- Pools Chlorine, corrosive acids.

Hazmat Risk Assessment Methodology

Hazmat Risk was determined by combining incident data history with hazmat risk facility locations.

Incident Data

Incident data is from fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. Call Type Group 3 = Hazmat and HM/Full call type. Excludes BOMBP and BOMBT call types.

The number of Hazmat incidents in each Risk Management Zone were counted and assigned a point based on the total number of incidents.

Total point score grouped for each Risk Management Zone:

Number of Incidents	Points
0	0
1-10	1
11-20	2
21-104	3

Hazmat Risk Facilities

The number of SARA Title III Sites in each Risk Management Zone were counted and assigned a point based on the total number of facilities.

Total point score grouped for each Risk Management Zone:

# Sara Title III Facilities	Points
0	0
1-3	1
4-8	3

Incident Data and Hazmat Risk Facilities were added together to calculate total Hazmat Risk for each Risk Management Zone

Hazmat Risk	Total Points
Low	0-1
Moderate	2
High	3-4
Special	5-6

Primary Hazardous Materials Risk Categories

Levels of Risk

Low Risk:

This category, Hazmat Investigation, is used for small scale spills and incidents were a unit on-scene requests the hazardous material officer consultation. The minimum response force for these events is four (4) personnel.

This category is dispatched to the following call types:

Call Type	Definition
HM/WATER	A spill into or reported substance in a creek or other body of water with no vapor, fumes, flames or injured people
SC/FIRE	An event to assist a unit already on-scene

Moderate Risk:

This category, Hazmat Local Alarm, is for responses to hazardous material incident that do not involve fire, five or more sick people, a transportation of dangerous goods vehicle or a natural gas or propane leak. The minimum response force for these events is 19 personnel.

This category is dispatched to the following call types:

Call Type	Definition
HM/SPILL	An emergency involving the spilling or leaking of a hydrocarbon or other fuel product when there are no vapor, fumes, or flames visible and four or less sick persons involved

HM/PWDR	An emergency involving an powder spill or leak when there are no vapor, fumes, or flames visible and four or less sick persons involved regardless of the container the package is or is not in
HM/MERC	An emergency involving a spill of mercury with no active fire conditions.

High Risk:

The category, Hazmat Street Alarm, is for responses to hazardous material incidents that do not involve fire, a natural gas or propane leak but do involve five or more sick people. The minimum response force for these events is 28 personnel.

This category is dispatched to the following call types:

Call Type	Definition
HM/CHEM	An emergency involving an chemical spill or leak when there are no vapor, fumes, or flames visible and four or less sick persons involved
HM/UNK	An emergency involving the spill, leak or escape of a suspected hazardous material when there are no vapor, fumes, or flames visible and four or less sick persons involved and the caller cannot provide more detailed information
EMD CO Call Types	An emergency involving signs and symptoms of multiple sick people with possible indications of carbon monoxide exposure.

Special Risk:

The category, Gas Box Alarm, is for responses to hazardous material incidents that involve fire. The minimum response force for these events is 48 personnel.

This category is dispatched to the following call types:

Call Type	Definition
Gas/BOX	An emergency that is primarily a hazardous materials incident but involves fire or smoke inside a structure.

Water/Ice Risk Assessment Methodology

Water/Ice Risk was determined by incident data history.

Incident Data

Incident data is from fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. Call types are: FERRY, ICE. LAKERIV/STIL, RIV/SWFT, RIVER, SWIFT2, SWIFT3 and WATER.

The number of Water/Ice incidents in each Risk Management Zone were counted and assigned a point based on the total number of incidents.

Total point score grouped for each Risk Management Zone:

0-2 incidents = Low
3-4 incidents = Moderate
5-9 incidents = High
10+ incidents and Potomac River RMZs = Special

*Potomac River RMZs received an automatic score of Special.

Aviation Risk Assessment Methodology

Aviation Risk is based on facilities in the County. Risk Management Zones with Airports are Special Risk and RMZs with helipads are moderate risk.

Risk Management Zone	Risk	Facility
0201	Moderate	Helipad
0321	Moderate	Helipad
0419	Moderate	Helipad
2008	Moderate	Helipad
2901	Moderate	Helipad
5001	Moderate	Helipad
5401	Moderate	Helipad
1718	Special	Airport
2801	Special	Airport

* There were only five aviation incidents in fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. All incidents were located at the airports.

Technical Rescue Risk Assessment Methodology

Technical Rescue Risk was determined by incident data history.

Incident Data

Incident data is from fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. Data includes the following call types: 22-D-1, 22-D-1A, COLLAPS2, CONFINE2, ELEVATOR, FCRASH, RES/CLPS, RES/CONF, RES/HIGH, RES/LOW, RES/OTH RES/TRNC, ROCK/WAT, and TRAN/OTH.

The number of Technical Rescue incidents in each Risk Management Zone were counted and assigned a point based on the total number of incidents.

Total point score grouped for each Risk Management Zone:

0-9 incidents = Low
10-48 incidents = Moderate
49-99 incidents = High
100-327 incidents = Special

Bomb/Explosive Risk Assessment Methodology

Bomb/Explosive Risk was determined by incident data history.

Incident Data

Incident data is from fiscal years 2010, 2011, 2012, and the 1st and 2nd quarters of 2013. Data includes the following call types: BOMBP and BOMBT

The number of Bomb/Explosive incidents in each Risk Management Zone were counted and assigned a point based on the total number of incidents.

Total point score grouped for each Risk Management Zone:

0-9 incidents = Low
10-49 incidents = Moderate
50-98 incidents = High
99 incidents = Special