CITY OF MARYVILLE RISK ANALYSIS

Developing a Risk Analysis for the City of Maryville

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Certification Statement

I hereby certify that this paper constitutes my own product, that where language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used that language, ideas, expressions, or writings of another.

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Abstract

The problem is that the City of Maryville does not have an up to date risk analysis. The purpose of this project is to identify risks that would affect the City of Maryville and its fire department. Descriptive methodology was used to guide this study. The research questions were (a) what natural and/or man-made risks exist or have the potential to develop in the City of Maryville? (b) what risks will have the greatest impact upon Maryville's citizens and businesses? (c) what history is available to address risks within the City of Maryville? (d) is the City of Maryville Fire Department prepared to respond to the identified risk and if not, what steps need to be implemented to do so? The procedures that were involved in this research started in January 2009 at the National Fire Academy's Learning Resource Center. Results indicated that Maryville was most vulnerable to an incident involving hazardous materials in transportation and at fixed locations. The downtown district was another risk because of density, changing occupancy, and age. Tornados and earthquakes were also identified as potential risk. The recommendations were that the downtown district needs to have a thorough pre-fire plan on every structure. Fire department personnel need to know the layout and construction of each building in the downtown area. Emergency Operations Plans should be kept current with annual table top exercises to prepare fire department officers to operate more efficiently. Special training should be required to respond to some of these risks. In conjunction with the training, hands-on exercises should be used to increase the understanding of the potential incidents to the responders. The public should be educated and prepared for such events. The use of automatic aid to identified target hazards should be established.

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Developing a Risk Analysis for the City of Maryville

In the past few years, the issue of disasters has been brought to the forefront because of such incidents occurring throughout the country; i.e. hurricanes, tornados, earthquakes, epidemics, and terrorist events just to name a few. These incidents have brought harm to all of the communities they have reached. Bouwsema (2006) believes that the process of disaster planning needs to follow an established procedure to ensure preparedness (¶ 1). Without proper planning and identification, the City of Maryville would not be prepared in the event of a disaster. The problem that the City of Maryville was facing is that it does not have an up-to-date risk analysis that identifies risks that would involve the city. The City of Maryville is a growing city that has both residential and industrial components that will have to be considered in assessing risks. For an effective response, the fire department has to be familiar with these risks.

The purpose of this project was to identify possible risks that would affect the City of Maryville and its fire department. The research questions used to guide this study were (a) what natural and/or man-made risks exist or have the potential to develop in the City of Maryville? (b) what risks will have the greatest impact upon Maryville's citizens and businesses? (c) what history is available to address risks within the City of Maryville? (d) is the City of Maryville Fire Department prepared to respond to the identified risk and if not, what steps need to be implemented to do so? Descriptive research methodology was used in preparing this paper.

Background and Significance

The City of Maryville is located in the Eastern portion of Tennessee. Maryville is centrally located between the Great Smoky Mountain National Park, and Knoxville, which is the third largest city in the state. Maryville is located approximately 14 miles south of Knoxville. Maryville has available to it all the modern conveniences a large city has to offer yet possessing

small town appeal. Maryville's downtown district serves as a snapshot of times past with historic landmarks dotting the landscape. Great care has been taken to ensure the city does not lose its small town appeal. This is evident by looking at new construction as building design closely resembles the construction of the surrounding area. In 1999, A&E, the Arts and Entertainment cable television network, named Maryville one of America's *Top 10 Cities to Have It All* (Butler, 1999). According to Butler, the selection was based on climate, economic prosperity, friendliness of the people, access to recreational activities, public safety, comfort, and affordability in retirement years (p. 2).

At present, Maryville has a population of over 25,000 residents that encompasses 14.9 square miles (City of Maryville, 2009). According to Blount Industry (2009) while Maryville is primarily residential and small business oriented, the city is home to the headquarters of Ruby Tuesday, a national restaurant chain and to DENSO, an automotive industry supplier. DENSO has nearly a one billion dollar investment in the area and employees 3,500 people.

The City of Maryville is governed by a council/manager form of government. The council consists of five seats that are elected to a four year term. The terms are alternating with elections held every two years. By virtue of the council/manager form of government, the city manager is responsible for the day-to-day administrative functions of city government and is responsible for carrying out council policies through a professionally trained and experienced staff (City of Maryville, 2009).

The fire department consists of three shifts of 12 personnel per shift, each shift works 24 hours on duty followed by 48 hours off. Administratively, there is one chief, one deputy chief, one administrative captain/training officer, one fire marshal, one fire inspector and one administrative assistant. The fire line personnel operate out of three stations, with Station One

serving as headquarters. MFD's headquarters is centrally located within the downtown business district. The agency provides a full range of services including, fire suppression, code enforcement, advanced life support (ALS), basic life support (BLS), vehicle extrication, hazardous materials response, and technical rescue which includes high angle and confined space. The agency has an ISO Class three rating and responded to 2,981 calls for service during the 2008 calendar year (Maryville Fire Department, 2008).

MFD was exceedingly fortunate in the fact there were no fire related deaths within a structure for 14 years. Unfortunately that changed in 2002, Maryville Fire Department recorded two fire deaths in separate structures within the City of Maryville. This record held until November 2007, when MFD had another structure fire death within the city limits of Maryville (Maryville Fire Department, 2007). According to the Tennessee Public Fire and Life Safety Educators' Association, the State of Tennessee is ranked fifth in the nation for civilian fire related deaths (¶ 1). The department believes in a proactive role in public fire education and code enforcement which has been successful because of the civilian fire death rate within Marvyille compared to other cities in Tennessee.

On February 26, 2008, the City of Maryville Fire Department received accreditation status from the Center for Public Safety Excellence. By virtue of the accreditation process, MFD was able to assess itself as to what is actually happening within the department. According to the Center for Public Safety Excellence (2006), the accreditation process will reveal a fire department's ability of meeting goals (p. 42). Through the process MFD has become more adapt in planning, setting, and meeting goals. Achieving accreditation status was a major accomplishment for the department and a positive step in improving the department's services.

For MFD to prepare for incidents involving the fire department, the potential risks must be identified. This is something that the fire department and the city have neglected. When responding to an incident with a current pre-fire plan, the results are usually better and the scene is always made safer via these plans. Without knowing what to pre-plan for, MFD is facing an unknown. This is why the department has to know what incident may materialize within the City of Maryville.

To address the United States Fire Administration's operational objectives (2003), a risk analysis for the City of Maryville will be the initial step in developing a comprehensive multi-hazard risk reduction plan. This analysis will also benefit the life safety of the entire community both young and old. Also, by having an up-to-date risk analysis will aid MFD to appropriately respond in a timely manner to emergency issues.

This study is significant to the City of Maryville because of the risks that are known and those risk that are unknown. The National Fire Academy's Executive Analysis of Fire Service Operations in Emergency Management (2007a) states that by addressing the known risks and identifying the unknown risks, the department will be able to set priorities, develop strategies, and have information that will enhance the emergency planning process (SM 4 – 3).

Literature Review

To research risks within the City of Maryville, several methods were explored. National standards were explored along with books, periodicals, internet articles, and video sources. The National Fire Academy's Learning Resource Center (LRC) was also used for research data.

Question one asked, what natural and/or man-made risks exist or have the potential to develop in the City of Maryville? To have an effective response, a fire department must understand the extent and size of a risk that may face its community and its department. The

Federal Emergency Management Agency (1996) states, “Identifying risk exposures is the foundation of an integrated process for managing risk,” (p. 34).

A definition of a risk and a hazard should be attained before answering this question. Ross (1999) defines a risk as anything that could bring loss by damage, injury, or death (p. 8). Klein (1996) states that a hazard “is an object or situation with the potential to do harm” (page 8). A hazard either exists or it does not exist. Risks are the probability, chance, or likelihood that a particular hazard will cause harm. When evaluating these risks, the common risks of a winter storm, earthquake, tornado, flood, wildfire, hazardous materials in fixed and transportation incidents, and civil disturbances should be evaluated. In researching this topic, the author interviewed Bart Stinnett, Emergency Management Director for Blount County, Tennessee. Director Stinnett stated that “the county had developed a multi-jurisdictional all-hazards risk mitigation plan” (Personal Communication, May 9, 2009). After reviewing this plan, the following natural hazards were identified for Blount County: earthquakes, flooding/flash floods, landslides, land subsidence, severe weather, and wild fires. The manmade hazards that were identified in Blount County’s plan were dam/levee failure, hazardous materials incident, illegal methamphetamine labs, and pandemic/vectors. By having an all-hazard risk analysis of Blount County avialable, the hazards in Maryville were easier to identify.

Bouwsema (2006) believes that risk analysis begins by identifying all possible hazards that either exist or have the potiential to exist. When identifying these hazards, the probability of secondary hazards that can evolve from the initial hazard or incident should be considered (¶ 4). Some of these secondary hazards are loss of electrical power, wide spread fires following a tornado, natural gas leaks, etc., in a summary, any disaster that could occur in the City of Maryville should be included in the risk analysis.

The National Fire Academy's Leading Community Risk Reduction (2007b) class teaches risk should be divided into two components: "exposures and effects" (SM 2 – 9). The exposures components are all the hazards found in a community. The effects are the actual effects of the exposure or the incident itself. Some of the hazards will be minor or even routine daily responses. Others will strain the fire department's response for an effective outcome. Some hazards can even be triggering events for disasters that have a crippling effect on the community. Whenever the fire department's resources are overwhelmed, a major disaster is possible (NFA, 2007b).

The Center for Public Safety Excellence's Emergency Self-Assessment Manual (2006) describes the elements of a risk analysis as "(a) fire flow, (b) probability, (c) consequence, (d) occupancy risk, (e) fire management zones, and (f) community risk" (p. 48). According to the Center for Public Safety Excellence, fire flows are defined as necessary fire flow for specific occupancies including the occupancy type and location (p. 48). These flows are now being compiled within MFD's pre-fire plans. Probability is the likelihood that an event will occur within a given period of time. Consequences can be defined as life safety, economic impact, and environmental impact. Occupancy risk is the actual risk that may be present in an incident to life and property. Fire management or demand zones are used in defining the management of risk. These zones can be one building or a group of buildings and are usually defined in geographical areas. MFD has identified demand zones within its Standards of Response Coverage (SOC) document. According to the Center for Public Safety Excellence (2006), "community risk is the overall profile of the community and is based upon demographics, socioeconomic factors, occupancy risk, fire management zones, and the level of services currently provided" (p. 49).

Another factor to consider in any emergency is proper insurance. The Federal Emergency Management Agency (2009) "strongly encourages property owners and renters to fully explore their insurance needs and obtain adequate coverage before a disaster strikes" (¶ 2).

Research question two asked, what risks will have the greatest impact upon Maryville's citizens and businesses? Like all communities, every citizen and business within the City of Maryville faces risks. Risks are inevitable and have to be planned for prior to occurrence. By participating in a risk analysis process, citizens and businesses can limit the probability that an undesirable event will occur and help reduce the magnitude of that event when it does occur (Federal Emergency Management Agency, 1996).

Mike Wisko with the Galveston, TX Fire Department gave some lessons learned during Hurricane Ike in September 2008. Chief Wisko listed the following as lessons learned: (a) preparation, (b) incident management, (c) public education, (d) safety, (e) critical incident stress management, (f) mutual aid and other outside assistance, (g) take care of your apparatus and equipment, and (h) training. Chief Wisko (2009) also stated:

> We must be prepared for worst-case scenarios, and we must realize that even we, as emergency responders, cannot prevent the devastation brought about by Mother Nature. Planning, practice, and good judgment will enable us to serve our communities regardless of the situation. Take a look at your plans. Make sure you are prepared for the disaster that could affect you someday. It will be worth the time and effort. (p. 86)

In identifying risks, the National Fire Academy's class Leading Community Risk Reduction (2007b) divides risks into four categories, low frequency/low risk, low frequency/high risk, high frequency/low risk, and high frequency/high risk (SM 1-79 – 80). While identifying risks, citizens and business owners should be attentive to risks that have a low-frequency and

high-risk hazards. Low frequency/high risk events have the greatest potential for major disaster within a community because of their infrequency; response agencies can be unprepared and even complacent to these responses. A high frequency/low risk is a risk that usually has low impacts on life, property, and/or the community. A high frequency/high risk can become routine because of the frequent nature of the event and because of the frequent occurrences such events are dealt with effectively. A low frequency/low risk usually has low impact on life, property, and/or the community. Fire departments when faced with situations that have a frequency of occurring quite often will plan and be prepared for these types of events (National Fire Academy, 2007b).

For risk analysis to be a success, leaders of the community must be involved. McKay (2006) states, “Successful leaders are those elected leaders who have made preparing for disasters a priority” (p. 16). If plans do not have the support from local officials, the outcomes are most likely to fail. McKay also states “that when a disaster strikes leaders will be noted for their preparedness or lack of preparedness to address these issues” (p. 17).

Public education on major emergency incidents is vitally important. The public should be educated on evacuation procedures. The public needs to be aware that responders sometimes cannot respond due to adverse conditions. Wisko (2009) stated, when an evacuation is declared, the public will need to understand that emergency responders will not be responding to their needs when weather conditions make it unsafe for the responders (p. 83).

Once the risk analysis has been completed, plans have to be implemented and maintained. This will bring about an operational change of day-to-day activities, and these plans will have to be a priority if success is to be achieved. Kotter (2007) says that the change process goes through several phases and requires a considerable length of time. Kotter recommends these eight steps of transforming your organization to change:

> (a) establishing a sense of urgency, (b) forming a powerful guiding coalition, (c) creating a vision, (d) communicating the vision, (e) empowering others to act on the vision, (f) planning for and creating short-term wins, (g) consolidating improvements and producing still more change, and (h) institutionalizing new approaches. He advises that skipping any of these steps will impede satisfactory results (¶ 6).

What history is available to address risks within the City of Maryville? When identifying risk, it is important to ask what has gone wrong. In answering this question, the risks that have actually occurred in Maryville are explored because if it has happen once it can happen again. Kipp and Loflin (1995) stated "the first, and possibly the most effective data, is the agency's own loss history. From there, use input and ideas from the agency's personnel, trade journals, professional associations, and other service providers" (p. 13).

Information on weather related incidents were found on National Oceanic and Atmospheric Administration, National Weather Bureau, and the National Lightning Safety Institute. Data from these websites were helpful in identifying this history. These websites contained information on weather history plus information in general about the weather.

According to the National Weather Bureau (2009), two tornados have occurred in Maryville since 1950. These tornados occurred in the early 1970s and involved a few injuries but no deaths, (see Appendix A).

Earthquakes are another risk that has to be considered when conducting a risk analysis. Earthquakes have not been a major problem in Maryville but the possibility does exist. Although in 1973, an earthquake which measured 4.6 occurred in the East Tennessee Valley. This earthquake was south of Knoxville which would be in the Maryville area. This quake generated 30 after shocks, but the main shock distributed the damage. There were minor damage to walls,

windows, chimneys, and a temporary loss of power in Maryville due to this earthquake, (U.S. Geological Survey, 2009). According to Council of the National Seismic System (2009), Maryville is prone to a major earthquake due to it geographical location to the New Madrid Earthquake Fault (see Appendix B).

Electrical storms have occurred in Maryville and throughout Tennessee with a reported 597,751 cloud-to-ground flashes from 1996 through 2008 statewide (National Oceanic and Atmospheric Administration, 2009). According to the National Lightning Safety Institute (2009), Tennessee ranks 17 throughout the nation for lightning fatalities, injuries, and damage. According to the National Lightning Safety Institute damages reported from 1989 – 1993 there were an estimated $127,000,000 in structure fires due to lighting with a reported 20,000 lightning caused residential structure fires nationwide (¶ 1).

According to the Weather Underground (2009), Maryville has experienced extreme cold temperatures and large amounts of snow fall. On January 21, 1985, Maryville experienced a record cold temperature of -23 degrees Fahrenheit (¶ 1). During this time, there were six inches of snow and a wind that ranged from 6 – 15 MPH. According to the Weather Underground (2009) on March 13, 1993, Maryville received 15 inches of snow and an additional accumulation of 13 inches on March 14, 1993 (¶ 1). This snow storm crippled the Maryville area and led to many rescues and opening of shelters in the town.

On January 17, 2009, MFD responded to Maryville's downtown district to a building collapse. An exterior brick veneer wall collapsed on top of a passing car entrapping two passengers. The City of Maryville's downtown district has buildings that date back 100 years which pose a significant threat to firefighters in a fire or collapse situation.

Technological events are risks that need to be addressed as well. On July 25, 2005, city government moved into its new city municipal building that houses fire, police, IT department, human resource office, and finance department (City of Maryville, 2009). This center houses many of Maryville's departments and is the hub for managing the city's operations. The Information Technology (IT) Department controls the city's computer system. This computer system includes all city departments and the city school system's computers. The main computer room for the city's computer system is located in the Maryville Municipal building. According to Terry McCoy, IT Director, this room is temperature controlled with sensors that sounds alarms and notifies Director McCoy in the event the temperature starts to elevate (Personal Communications on May 27, 2009). Loosing this system would be a tragic incident that would disrupt the city government's operations both on a daily routine as well as the possible loss of valuable data. Director McCoy said that this system is vital to the city's daily operations and precautions have to be made to ensure its success. The computer room became operative on July 2005, and there was a near disaster at that time involving this room. The computer system is linked via fiber connections which feed into the computer room from the front and the rear of the building. The front feed went into a manhole which was higher in elevation than the computer room. Director McCoy and his staff soon realized this problem and mitigated it by properly sealing the piping for the fiber cable which had already accumulated water. This would have likely led to flooding of the city's mainframe computers and having a major impact on daily business.

Research question four asked, is the City of Maryville Fire Department prepared to respond to the identified risk and if not, what steps need to be implemented to do so? By planning and preparation, MFD will have a better opportunity to respond effectively to the

identified risks within the City of Maryville. Risdon (1989) believes that in an ideal world, there should be a balance between the risk and the available capability of the fire department. If this was so, this would indicate that the fire department's forces are adequately staffed, trained, equipped, and capable of dealing with the predictable demands within its community (p. 34).

Thompson (2009) believes that by having a timely and properly staffed emergency response, the incident damage can be mitigated and the incident could be held within control. Proper training, practice, and planning can help achieve this goal. The fire department is expected to answer tough questions during tough times. Everyone has a responsibility when it comes to keeping the community safe. Citizens will look to elected officials and the fire department is often thrust into the incident for response and to answer questions (p. 20).

When risks are identified, MFD will need to use exercises to test the department's readiness to respond to these incidents. Collins (2009) states by utilizing exercises, many out of the ordinary objectives will be identified. Some of these are: mutual-aid systems, strategies to expedite obtaining resources including out of state resources, locate and rescue trapped victims, treat and remove the injured to definitive medical treatment, and confine hazardous material release (p. 61). Collins goes on to say;

> there is a need for public awareness of local hazards, need to improve public education to help improve personal readiness of the affected population, have a multi-tiered emergency response system, use of well-considered construction codes and ordinances to improve the performance of structures and lifelines, and the ability of all levels of government and military to respond quickly, effectively, and in unison during disasters. (p. 64)

When considering risk, the critical infrastructures have to be considered. The International Association of Fire Chiefs (2002) defines critical infrastructure as “people, things or systems that must be intact and operational in order to make daily living and working possible” (p. 5). MFD has to include critical infrastructures planning (CIP) to prevent degradation or loss of critical infrastructures that are needed for safety and survival (International Association of Fire Chiefs, 2002). Emergency preparedness and action plans have to be implemented by the fire department as well as adopted by the community.

MFD has to consider the cascade effects that a risk could start when the risk becomes an actual event. The Executive Analysis of Fire Service Operation in Emergency Management’s Student Manual (National Fire Academy, 2007) describes a cascade effect as a triggering event that will lead to other events. For example, an earthquake could cascade into building collapse, fire, hazardous-material release, power outages, blocked or impassable roads, etc (SM, 4-14).

When faced with a possible catastrophic incident, MFD will have to consider evacuation. To properly implement an evacuation the following guidelines should be followed: (a) who can order an evacuation, (b) vulnerable zones where evacuation could be necessary and a method for notifying persons in these places, (c) provisions for a precautionary evacuation, (d) methods for controlling traffic and providing alternate traffic routes, (e) shelter and alternative shelter locations, (f) agreements with nearby jurisdictions to receive evacuees, (g) agreements with hospitals outside the local jurisdictions, (h) protective shelter for relocated populations, (h) reception and care of evacuees, and (i) re-entry procedures (Blaich, 2004, ¶ 14).

After risks have been identified, MFD will have to develop a plan of action for risks that pose a threat to the community. Unique incidents will have to be considered in this plan. A unique incident could be a hazardous material incident where response of MFD’s haz-mat team

is required. The Tennessee Emergency Management Agency (2009) states that haz-mat incidents will take two forms fixed facility incidents and transportation incidents. The fixed facility hazardous materials can be identified before the incident occurs, but in a transportation incident the materials are unknown (¶ 2).

In summary, this literature review indicates responses to emergencies are the responsibilities of fire and emergency departments. Unfortunately, most do not prepare for the out of the ordinary events. MFD must identify, prepare, plan, and form coalitions to obtain the best outcome for the city and the fire department. By involving all the populace and responders, the coordination of the incident will be improved.

Procedures

Descriptive research was used in examining the risks in the City of Maryville. To answer the research questions and determine risks in the City of Maryville several procedures were used. These procedures are discussed in the following paragraphs.

Research question one posed the question, what natural and/or man-made risks exist or have the potential to develop in the City of Maryville? To assess these risks, the Federal Emergency Management Agency's comprehensive risk list was used. This list divided the risks into the following categories: (a) natural hazards, (b) technological, (c) national security hazard, and (d) target hazards. Appendix C has a copy of the assessed risks within the City of Maryville.

To properly assess the risks within Maryville the probability of these risks needed to be identified. Using Federal Emergency Management Agency's Matrix 1 – Hazard Identification, the probability of events was broken into three categories: unlikely, possible, and likely. Within each event, the possible number of the population was also identified as affected, (see Appendix D).

During this analysis, a vulnerability assessment was completed, (Appendix E). The vulnerability assessment was performed by Blount County Emergency Management personnel, Maryville Fire Department personnel and this author. The assessment was completed in approximately two weeks. In this assessment each identified risk was broken down into scores of one, two, and three. The scoring was as follows: one indicated a low risk, two represented a moderate risk, and three signified a high risk. Each risk was scored with its relationship to (a) danger/destruction, (b) economic, (c) environmental, (d) social, and (e) political planning level. After the scores were distributed to the specific risk, a total vulnerability rate was identified by adding up the total scores. Then a ranking of low, moderate, or high was given to each risk which provided a rating according to the city's vulnerability to the risk.

In Appendix F, the identified risks and the identified vulnerabilities were calculated by multiplying the possibility of occurrence and the vulnerability. This provided a rating to each risk with a nine being the highest and a one being the least. By using this table, a rating was assigned to each risk in relationship to the city's probability and vulnerability.

Question two asked, what risks will have the greatest impact upon Maryville's citizens and businesses? In this analysis, the risks that will have the greatest impact on Maryville's population would be those identified in Appendix F as a high risk. The risks were rated on possibility of occurrence and vulnerability with a score given for likely, possible, and unlikely. Then the possibility of occurrence and vulnerability scores were multiplied which provided a rating for each risk.

Blount County's Risk Analysis was reviewed during this research and comparisons were made between Maryville and Blount County. Blount County's Emergency Management Director Bart Stinnett assisted in this comparison and gave recommendations upon knowledge of the

region. Stinnett's expertise with risk analysis helped in identifying risks that will have the greatest impact on the City of Maryville and the fire department.

Question three addressed the history of risks that have occurred in the City of Maryville. By investigating Maryville's history of risk, a list of potential risks was developed. This history also aided in identifying the probability of a risk reaching the incident phase. This information was obtained via the local library, websites, newspapers, and personal interviews.

Three personal interviews were helpful in obtaining information as. Those interviewed are authorities within their field of expertise and were asked the following questions: (a) what natural and/or man-made risks exist or have the potential to develop within your jurisdiction? (b) of those risks, which risks will have the greatest impact on your jurisdiction? (c) does historic data help you in your identifications of these risks or on your response to the identified risks? (e) what other pertinent information do you have on this subject? Those interviewed were (a) Terry McCoy, Director of the Information Technology Department for the City of Maryville, (b) Bart Stinnett, Emergency Management Director for Blount County, Tennessee, and (c) Greg Miller, Chief of the Gatlinburg Fire Department.

Director Terry McCoy was interviewed on May 27, 2009 in his office with the interview lasting approximately one hour. Director McCoy answered questions and gave input about technological issues that could have a devastating effect on city operations. Bart Stinnett, Emergency Management Director for Blount County was interviewed on May 18, 2009 at the City of Maryville Fire Department with the interview lasting two hours. Director Stinnett gave valuable information about planning that had been completed in the county and how some of these plans would be of benefit to the city. Chief Greg Miller of the Gatlinburg Fire Department

was interviewed on May 20, 2009 at the Gatlinburg Fire Department Headquarters wtih the interview lasting for approximately three hours.

Question four asked, is the City of Maryville Fire Department prepared to respond to the identified risk and if not, what steps need to be implemented to do so?

The City of Maryville Fire Department is an accredited fire agency through the Center for Public Safety Excellence. With the accreditation status, MFD must maintain a Standards of Coverage. The Center for Public Safety Excellence's Fire and Emergency Self-Assessment Manual (2006) denotes the SOC document as written policies and procedures that establish the distribution and concentration of fixed and mobile resources of an organization (p. 47). By having a SOC, MFD is better prepared to respond to emergency incidents within its community.

Limitations that were discovered during this research were that many cities and other government agencies did not seem interested in obtaining data relating to risk. An updated risk analysis for a locality was not readily available in most neighboring communities. Also an effective emergency operations plan with available resources was unavailable as well. Unfortunately, a sense of complacency seems to be common in many Tennessee communities.

Results

For Maryville to properly assess the risks that might inflict this community the risks had to be accurately identified and vulnerability of the community evaluated. To properly identify risks and the community's vulnerability, a recognized evaluation process was needed. Using the Federal Emergency Management Agency's comprehensive risk list and vulnerability matrix provided direction in accessing the risks and vulnerability.

The first research question asked what natural and/or man-made risks exist or have the potential to develop in the City of Maryville. These findings were based on researched

documents, history, and personal interviews. Using these resources, the potential risks in the City of Maryville were identified via FEMA Comprehensive Hazard List (2009). FEMA Comprehensive Hazard List examined events relating to natural hazards, national security hazards, and target hazards, (Appendix C). Target hazards identified were Maryville College, Blount Memorial Hospital, National Guard Armory, and local nursing homes. These hazards ranged in ratings from two through nine. A rating of two would indicate the risk according to the probability and vulnerability rating was minute but still present. The higher rating of nine indicates the probability was more likely to occur and the vulnerability would be at the highest in this category.

A vulnerability assessment was completed during this analysis. In this assessment vulnerability ratings were attached to the risk hazards. Each hazard was evaluated on its effect to (a) danger/destruction to the community, (b) economic, (c) environmental, (d) social, and (e) political planning level. After these categories received a score by adding all categories together, the hazard was ranked as a low, moderate, or a high hazard to Maryville, Tennessee. Out of the 26 identified hazards ten were rated as low, six were moderate, and ten were rated as high. This assessment can be viewed in Appendix E.

Using FEMA's list of potential risks and the vulnerability matrix, it was determined that Maryville was likely to face an incident involving hazardous materials in transit or at a stationary location. The downtown district was also determined to be a potential risk due to density, building construction, and age. Tornados and earthquakes were next identified in the risk analysis as potential risks to Maryville.

In an interview with Terry McCoy, Director of the Information Technology (IT) Department for the City of Maryville gave some information on concerns with the IT

Department. This department has identified the greatest threat to its computer system is from within the City of Maryville via internal users. Anyone logged into the city's computer system could possibly "hack" into secure areas which would jeopardize secure documents and possibly provide an avenue for identity theft. Director McCoy's department is using several virus scanning systems and performing audits to ensure the system's integrity. One of these audits is the SAS 70 which the city receives from the Tennessee Valley Authority. According to McCoy, this audit was developed via the Enron fraud and scandal and is used at the City of Maryville to ensure the system's integrity. Another audit, Director McCoy mentioned was the Red Flag Act which was developed by the Federal Communications Commission. This audit concentrates on the identification of and prevention of identity theft.

The second research question asked: what risks will have the greatest impact upon Maryville's citizens and businesses? Bart Stinnett, Emergency Management Director for Blount County, Tennessee identified the top natural risks for Blount County as (a) flooding, (b) tornado, and (c) winter storms. The comparison between county and city are similar, but the county does have a greater threat due to flooding because of rural unmaintained areas. Severe weather could impact the county and the city in the same way. Manmade hazards in the county were (a) dams, (b) hazardous materials incidents stationary and transportation, and (c) wild land/urban fires. The City of Maryville does not have any dams to contend with, but the hazardous materials incidents are prevalent in the city.

While researching this topic, it was discovered the importance of proper insurance to aid in mitigation of damages that could be incurred during these incidents. When concluding a community risk analysis, the businesses and homeowners should be made aware of potential incidents that could affect the City of Maryville.

After identifying risks and frequency, events that occur with a low frequency and have a high risk will have the greatest impact on the City of Maryville. These types of events have the greatest potential for major disaster within a community. Overall, a risk with a low probability of occurrence with a high vulnerability rating would likely have the greatest impact on Maryville's populace.

In conducting this research the history of risks need to be addressed; therefore, the question was asked what history is available to address risks within the City of Maryville? The City of Maryville has been relatively tranquil to weather related events; however, there have been some events in years past that require attention. According to the Weather Underground (2009), there was a large snow storm that hit Maryville on March 14 and 15, 1993 with accumulations in excess of 27 inches (¶ 5).

Maryville has extremes in temperatures that will range from highs in the seventies during the summer and very cold during the winter with temperatures dipping into the thirties. July is usually the warmest month for Maryville with an average maximum temperature of 86 degrees Fahrenheit. According to Tennessee Weather (2009) January is usually the coldest month with an average minimum temperature of 28 degrees Fahrenheit; however, in 1985 Maryville saw January temperatures dip to a negative 23 degrees Fahrenheit and six inches of snow (¶ 1). Therefore, the city must be prepared for unexpected snow and extreme temperatures.

During this research, the downtown area was identified as a target hazard. This was due to the building construction, density, and age of the downtown area. A recent event in Maryville occurred on January 17, 2009 with the collapse of a brick veneer wall which injured two citizens and caused major disruption in downtown traffic for several months. This incident was an

indication of Maryville's downtown deterioration due to age, and a warning to firefighters in the event of an incident involving this section of town.

The fourth and final research question asked; is the City of Maryville Fire Department prepared to respond to the identified risk and if not, what steps need to be implemented to do so? Risdon (1989) believes that a fire department that will identify the potential risks within their jurisdiction will be better prepared to respond (p. 32). By knowing these risks, MFD will be better prepared through training, equipment, and staffing.

By identifying risks within this community, MFD will be able to develop plans of response, mitigation, communications, and identify available and needed resources. Using the information within this risk analysis, MFD will be better prepared to respond to these incidents. Mason (2009) believes that firefighters should know the response district their company protects. By being familiar with a response district, the fire department will be better prepared to handle major incidents that could affect the community (¶ 9). Being familiar with your response district goes beyond preplanning for a fire; MFD has to plan for disasters that could happen in Maryville in which the department will be called upon.

Chief Greg Miller with the Gatlinburg Fire Department was interviewed on May 20, 2009. Chief Miller shared some experience in downtown fires and what a fire department will need to do before and during an incident involving the downtown district. Chief Miller believes that to be prepared for a fire response downtown, the firefighters must know the area. The buildings in most downtowns, including Maryville, are old. Some of these change occupancies quite often which can increase occupancy load and have specific risk due to the business itself. The building density downtown was another factor Chief Miller mentioned during this interview. With the buildings being so close together, spotting apparatus becomes vital during a fire. It will

be difficult to use textbook tactics such as apparatus positioning and consideration of collapse zones when the fire-ground area is convoluted with narrow egress and additional structures. Unfortunately, there will be times when the fire-ground operations have to be performed within the collapse zone, but firefighters need to be aware of this and take proper precaution. Water supply was another factor Chief Miller mentioned. With the density and fire load, water supply will have to be able to support the needed fire flow. Chief Miller strongly urges a "very aggressive" pre-fire plan program for the downtown district.

Discussion

During the course of this research, many authors' opinions were evaluated. All were found credible and useful in defining this risk analysis. All research pointed to the need for communities to identify and prepare for such incidents. Federal Emergency Management Agency provided an instrument to assess what risks might face the City of Maryville along with identifying the vulnerability of the city. The probability and the consequences of the risks were explained and what could be expected from an incident causing or cascading to another incident. Education of the public was an item of importance mentioned by Chief Wisko of the Galveston Fire Department (2009). By educating the public to understand the roles they will need to play as well as the role of the responders will provide better coordination and helps to form a coalition (p. 82). The history research provided data on incidents that have occurred and will likely occur again.

Research question one asked, what natural and/or man-made risks exist or have the potential to develop in the City of Maryville? When determining the risks that have potential development within Maryville, the risks and the results of the risks must be considered. The National Fire Academy's Leading Community Risk Reduction (2007b) class teaches that risks

should be divided into two categories: exposures and effects with the exposures being the actual hazards and the effects being the consequences of the incident itself. This class also contends that when a fire department's resources are overwhelmed a major disaster has the potential to develop.

Bouwsema (2006) discussed the possibility of secondary events that will develop from the original event (¶ 4). This is something to keep in mind because these secondary events could be more severe than the original event. To properly respond, MFD must be aware of all possible risks within its jurisdiction including secondary events. The department has to train, educate firefighters and the community of these risks, and have the proper equipment and staffing or have the proper channels available to obtain the equipment and staffing to respond to these events.

Research question two asked, what risks will have the greatest impact upon Maryville's citizens and businesses? While researching this question, an important consideration became apparent. Mike Wisko (2009) gave some lessons learned in Galveston Texas during Hurricane Ike. Wisko stated that it was important to (a) prepare, (b) implement incident management, (c) educate the public, (d) safety, (e) critical incident stress management, (f) mutual aid and other outside assistance, (g) take care of you apparatus and equipment, and (h) training (p. 82 – 84). There are two important players in any emergency incident, the responders and the victims. Without the items Wisko spoke of, the safety and effectiveness of any incident will be impaired. Wisko also spoke of always preparing for the worst and having plans for such situations. Maryville's citizens and businesses will be better prepared to face an emergency involving the community if prepared and able to institute change into its culture.

Another aspect to consider in this question would correspond with research question four regarding MFD's ability to respond to the risks in Maryville. If the fire department is not trained, equipped, or staffed to respond with adequate resources and training, this would have an adverse affect on people in the Maryville area during an emergency incident.

Question three posed the question, what history is available to address risks within the City of Maryville? Maryville's history played an important role in defining the risks that the populace may face. Maryville has had a snow storm that produced approximately two feet of snow and has also faced extreme temperatures. According to Council of the National Seismic System (2009), Maryville is situated in the middle of the New Madrid Earthquake Fault which could pose a significant threat to the community (Appendix B). The City of Maryville's downtown was identified as a risk. In a personal interview with Chief Miller (May 19, 2009) of the Gatlinburg Fire Department some useful information was given to deal with a downtown response.

Question four asked, is the City of Maryville Fire Department prepared to respond to the identified risk and if not, what steps need to be implemented to do so? This research indicated that the City of Maryville Fire Department (MFD) is not adequately prepared to respond to some of the identified risks. Using MFD's Standards of Cover, MFD is better prepared than in years past but in a major incident the proper amount of staffing, equipment, and training will be lacking to address the incident. Using MFD's SOC and the risk analysis, MFD should be better prepared to respond. MFD like most fire departments cannot plan for the worst case scenario on every response. Scott and Windisch (2006) stated that fire departments must realize that on duty staffing cannot be designed for worst-case scenarios (p. 402). When responding to any incident that will strain staffing levels, the department should request outside aid for these incidents via

automatic and/or mutual aid systems. This will require the automatic and mutual aid systems to be in place prior to the incident with all area fire departments aware of the response role expected by the responding department. MFD needs to rely on neighboring fire departments for automatic and mutual aid in the event of a significant incident. MFD also has the authority to employ the state wide mutual aid plan in these types of incidents. Coalition building during this time will be important as well because of the pre-incident information and the incident procedures that can be shared with the public and the responders in a pre-event setting.

According to the Tennessee Emergency Management Agency (2009), with the exception of severe storms and flooding, hazardous materials incidents are perhaps the most likely to affect a community (¶ 1). Hazardous materials incidents were identified as a potential risk at Maryville. The Tennessee Emergency Management Agency (2009) feels that stationary hazardous material sites are relatively easy to identify what on-site materials a fire department will have to control. A transportation incident could involve many different types of hazardous materials (¶ 2). The City of Maryville Fire Department has a hazardous-materials team with technician and specialist levels of hazardous-materials certifications. Training in not only handling the materials is vital, but responders will need to know how to identify all materials and what the materials are capable of doing (¶ 4).

After the conclusion of assessing the risks within Maryville, Tennessee, the City of Maryville Fire Department is able to create a current emergency operations plan that will be based on likely circumstances. Appropriate training, education, planning, and response will be better served through this risk analysis.

Recommendations

With the risks identified that could affect Maryville, MFD and the city should institute several steps to assure an adequate response with trained personnel. These responders need to have an up to date Emergency Operations Plan (EOP) along with the risk analysis and resource lists. To obtain these results all city departments will need to be involved. Involving everyone from responders to business people and the public will aid in development of plans and the use of the plans when needed.

In order to effectively respond to out of the ordinary incidents, updated emergency operation plans (EOP) need to be completed that address each department's role. These EOPs need to be updated annually along with the resource lists. In conjunction with updating the EOP, all departments need to practice their department's role in a response. This can be accomplished by having an annual table top exercise that addresses a response to an identified risk within the City of Maryville. To obtain better feedback on the city's response capabilities, evaluators should be utilized that are both from within the city's departments as well as outside agencies. This will assist all city departments to gain insight in regard to their strengths and weaknesses.

One of the identified risks is the city's downtown district. The area consists of numerous four to five story buildings that were built in the early 1900s. The threat these buildings pose dictates that department personnel need a strong understanding of building construction in order to enhance firefighter safety. This education will require thorough pre-fire planning and building tours in order to familiarize all involved with these structures. Once complete, the information could result in some structures being labeled defensive actions only. No building is worth a firefighter injury or death.

In relation to the downtown district a personal interview was conducted on May 19, 2009 with Gatlinburg Fire Chief Greg Miller. Chief Miller has had hands-on experience with large fires in the downtown area of Gatlinburg. Using Chief Miller's information, MFD will need to develop a Standard Operational Guideline (SOG) for fighting fires in the downtown of Maryville. In this SOG, the importance of familiarization of the downtown buildings has to be stressed. These building are old and most do not have sprinkler systems. Occupancy will be another factor that will need to be addressed as well as the frequent change in occupancies. The density of the buildings is a major factor in firefighting in this old section of town with most joined together and some just a few feet apart. Limited space for placing fire apparatus will be a problem because of the possibility of setting up in a collapse zone. These buildings and the contents will produce a large amount of BTUs, thus water supply will need to be calculated for fire flow for each building and for groups of buildings that could be affected during a fire.

All of these risks pose a specific threat to the populace, structures, environment, economy, infrastructure, and responding personnel. Because of these threats, MFD personnel will need to train for these events. Some will require specialized training such as swift water, hazardous material response, rescue, confined space rescue, emergency medical services, ICS, and accountability of personnel. Each risk will need to be evaluated as to what level of training will be needed. In conjunction with the training, hands-on drills will be used to assure the proper training and correct amount of training is being accomplished. Drills will also provide items of importance that can be used to improve upon response.

Chief Wisko (2009) spoke about the importance of public education from lessons learned during Hurrican Ike. This will involved effort but will be worth it because a coalition will be built during the process. Several avenues could be used to reach the appropriate groups. These

types of opportunities could be accomplished by use of the media and through public forums. Others involved should include the Local Emergency Planning Committee (LEPC), the home builders association, the Red Cross, hospital, as well as any other entity with a duty to respond in the event of an incident.

In the event of one of these risks developing into an incident or any significant incident especially involving life safety, the City of Maryville Fire Department will need to have additional resources to properly respond. Like many fire departments, Maryville Fire Department does not have the resources in equipment and personnel to respond to such incidents. An automatic aid agreement with neighboring fire departments should be established. These agreements need to focus on target hazard areas where life safety concerns are evident.

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Appendices

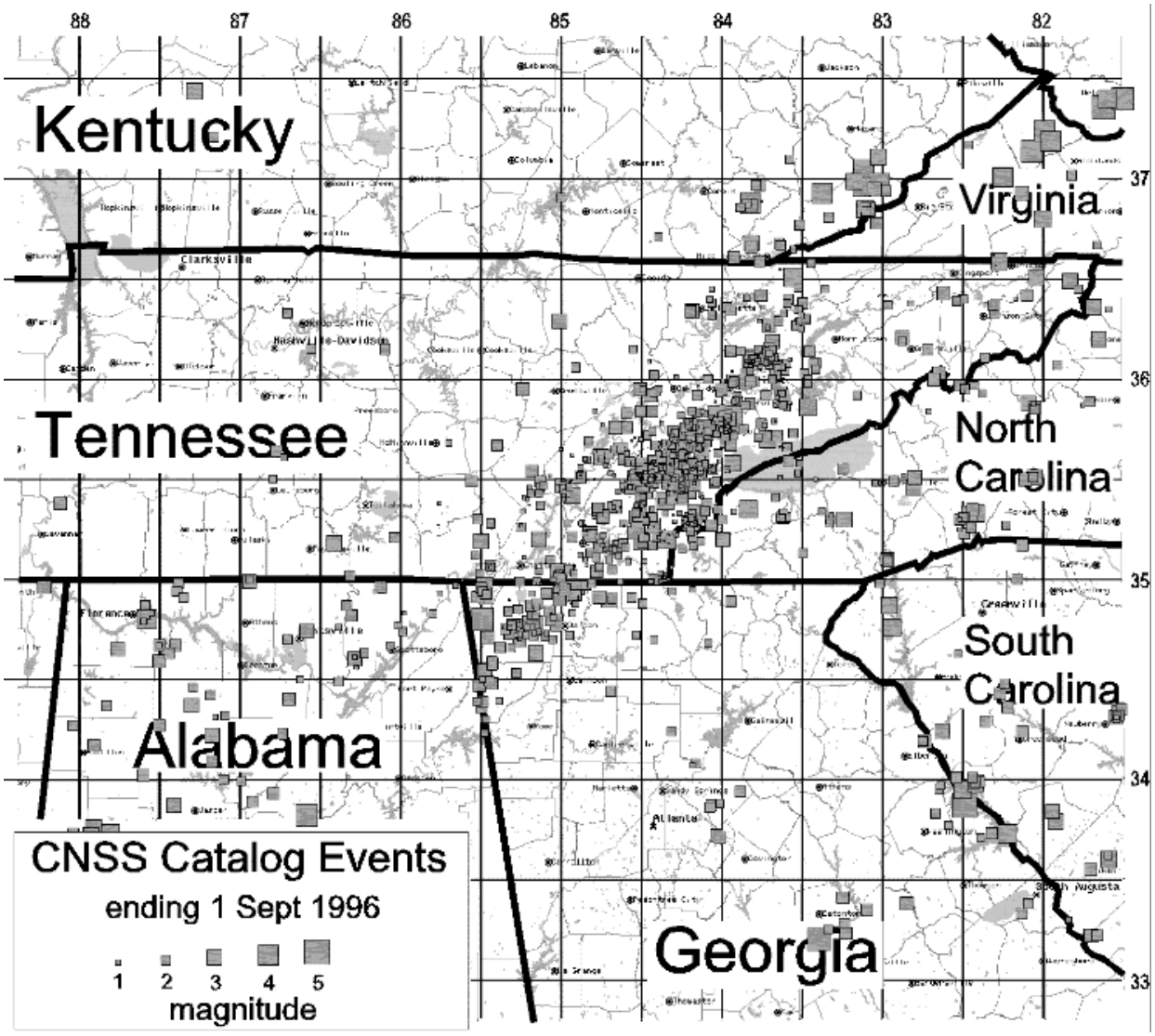
Appendix A

Tornados in the Maryville area

Date	Time (LST)	Dead	Injured	Path Length (miles)	Rating	Location
June 28, 1972	6:40 PM	0	3	0.5	F1	Maryville
April 3, 1974	3:00 PM	0	2	0.5	F2	Maryville
March 7, 1975	1:40 PM	0	0	0.5	F1	Cades Cove
March 7, 1980	6:30 PM	0	0	0.1	F1	Townsend
February 21, 1993	5:20 PM	0	0	10.0	F3	Disco to near Maryville
June 2, 2001	8:45 PM	0	0	1.5	F0	Old Glory

Appendix B

New Madrid Earthquake Fault



Appendix C

Hazard List

	Could this Threat Affect your jurisdiction?	Is this threat a significant threat to your jurisdiction?
NATURAL HAZARDS		
Avalanche	No	No
Drought	Yes	Yes
Earthquake	Yes	Yes
Flood	Yes	Yes
Hurricane/Tropical Storm	No	No
Landshift/Erosion/Earthslide	No	No
Tornado	Yes	Yes
Tsunami	No	No
Volcano	No	No
Wildfire	No	No
Winter Storm (Severe)	Yes	Yes
Epidemic	Yes	Yes
High Wind	Yes	Yes
TECHNOLOGICAL		
Civil Disorder	Yes	Yes
Dam Failure	No	No
Haz Mat (stationary)	Yes	Yes
Haz Mat (transportation)	Yes	Yes
Nuclear Facility	No	No
Power Failure	Yes	Yes
Subsidence	No	No
Transportation Accident	Yes	Yes
Urban Fire/ Conflagration	Yes	Yes
Air Disaster	Yes	Yes
Rail Disaster	Yes	No
Other		
NATIONAL SECURITY HAZARD		
Attack		
- Conventional	No	No
- Nuclear	Yes	No
- Chemical/Biological	Yes	No
- Sabotage	Yes	No
Terrorism		
- Nuclear	No	No
- Chemical/Biological	Yes	No
- Public Utility Disruption	Yes	No
TARGET HAZARDS		
Agriculture hazard areas		
- Blight	No	No
- Infestation	No	No
- Severe Weather	Yes	Yes
Arsenals		
- Armories, storage areas	Yes	No
- Military Manufacturing center	No	No

	Could this Threat Affect your jurisdiction?	Is this threat a significant threat to your jurisdiction?
Civil disorder prone areas		
- Campuses	Yes	No
- Prisons	No	No
- Special population concent.	Yes	No
- Terrorist targets	No	No
Communications systems/networks		
Dam	No	No
Drought prone areas	No	No
Earthquake fault and risk zones	Yes	Yes
Floodplains	Yes	Yes
Hazardous waste sites		
- Chemical/biological	No	No
- Nuclear/Radiological	No	No
Institutions		
- Hospitals and Nursing Homes	Yes	Yes
- Mental health facilities	No	No
- Group homes for the handicap.	Yes	Yes
- Prisons and Jails	Yes	Yes
- Halfway houses	No	No
- School and Dormitories	Yes	Yes
Manufacturing and agricultural plants and storage facilities		
- Chemical/allied	No	No
- Coal, uranium other mining	No	No
- Gas/oil	Yes	Yes
- Hydroelectric/electric	No	No
- Nuclear	No	No
- Other		
Military bases	No	No
Missile Sites	No	No
Pipelines	Yes	Yes
Reservoirs and dams	No	No
Transportation systems		
- Airports	No	No
Commercial	No	No
Military	No	No
Private	No	No
- Highways		
County/local high density or hazardous materials route area	Yes	Yes
Federal	No	No
Interstate	Yes	Yes
State	Yes	Yes
Transportation depots or garages	Yes	No
- Waterways		
Coastal	No	No
Inland rivers, lakes, canals		
Railroads		

	Could this Threat Affect your jurisdiction?	Is this threat a significant threat to your jurisdiction?
Passenger service	Yes	No
Freight service	Yes	No
Terminals	No	No

Appendix D

Hazard Identification

Matrix 1--Hazard Identification		
List hazards	**What is the probability this an event will occur at this hazard?**	**What is your best estimate of the total population that could be affected seriously by this hazard? Consider peak population if appropriate.**
1. Tornado	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	13,250 Enter a number
2. Earthquake	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	27,500 Enter a number
3. Flood	1. ☐ unlikely 2. ☐ possible 3. ☒ likely	1,000 Enter a number
4. Winter Storm (Severe)	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	27,500 Enter a number
5. Epidemic	1. ☒ unlikely 2. ☐ possible 3. ☐ likely	10,000 Enter a number
6. Hazardous Materials Fixed Site	1. ☐ unlikely 2. ☐ possible 3. ☒ likely	1,000 Enter a number
7. Hazardous Materials - Transportation	1. ☐ unlikely 2. ☐ possible 3. ☒ likely	5,000 Enter a number
8. Power Failure	1. ☐ unlikely 2. ☐ possible 3. ☒ likely	13,500 Enter a number
9. Urban Fire/Conflagration	1. ☐ unlikely 2. ☐ possible 3. ☒ likely	500 Enter a number
10. Terrorism	1. ☒ unlikely 2. ☐ possible 3. ☐ likely	4,500 Enter a number
11. Severe Weather	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	13,500 Enter a number
12. Target Hazard National Guard Armory	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	35 Enter a number
13. Target Hazard Maryville College	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	1,500 Enter a number
14. Target Hazard Blount Memorial Hospital	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	2,000 Enter a number

Matrix 1--Hazard Identification		
List hazards	**What is the probability this an event will occur at this hazard?**	**What is your best estimate of the total population that could be affected seriously by this hazard? Consider peak population if appropriate.**
15. Target Hazard Asbury Nursing Home	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	300 Enter a number
16. Target Hazard Fairpark Nursing Home	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	250 Enter a number
17. Target Hazard Maryville Health Care	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	75 Enter a number
18. Target Hazard Shannondale of Maryville	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	550 Enter a number
19. Target Hazard Morningview Transitional Care	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	500 Enter a number
20. East Tennessee Natural Gas Pipeline	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	1,000 Enter a number
21. Local High Density Haz-Mat Route Highway 321	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	5,000 Enter a number
22. Norfolk-Southern Railroad	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	100 Enter a number
23. Maryville College Dormitories	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	1,000 Enter a number
24. Air Hazards	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	200 Enter a number
25. Downtown District	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	500 Enter a number
26. Nuclear Facility	1. ☐ unlikely 2. ☒ possible 3. ☐ likely	27,500 Enter a number

Appendix E

Vulnerability Assessment

Matrix 2 -- Vulnerability Assessment List hazards								
	HAZARDS	Danger/Destruction High=3 Moderate=2 Low=1	Economic Permanent=3 Temporary=2 Immediate short term=1	Environmental High=3 Moderate=2 Low=1	Social High=3 Moderate=2 Low=1	Political Planning Level Local=1 Regional=2 Federal=3	Total Vulnerability Ratine (Sum of all factors)	Rank 5 to 8 LOW 9 to 11 MODERATE 12 TO 15 HIGH
1	Tornado	3	3	3	3	3	15	HIGH
2	Earthquake	3	3	3	2	3	14	HIGH
3	Flood	1	1	2	1	2	7	LOW
4	Winter Storm (severe)	1	1	1	2	1	6	LOW
5	Epidemic	3	3	3	3	3	15	HIGH
6	Hazardous Materials Stationary	2	2	2	3	3	12	HIGH
7	Hazardous Materials Transportation	2	2	2	3	3	12	HIGH
8	Power Failure	1	2	2	1	1	7	LOW
9	Urban Fire/ Configuration	3	2	2	3	2	12	HIGH
10	Terrorism	1	2	2	2	3	10	MODERATE
11	Severe Weather	1	2	1	1	2	7	LOW
12	Target Hazard National Guard Armory	2	2	1	1	3	9	MODERATE

	HAZARDS	Danger/Destruction High=3 Moderate=2 Low=1	Economic Permanent=3 Temporary=2 Immediate short term=1	Environmental High=3 Moderate=2 Low=1	Social High=3 Moderate=2 Low=1	Political Planning Level Local=1 Regional=2 Federal=3	Total Vulnerability Rating (Sum of all factors)	Rank 5 to 8 LOW 9 to 11 MODERATE 12 TO 15 HIGH
13	Target Hazard Maryville Collage	2	2	2	2	2	10	MODERATE
14	Target Hazard Blount Memorial Hospital	2	2	3	3	2	12	HIGH
15	Target Hazard Asbury Nursing Home	2	2	1	2	1	8	LOW
16	Target Hazard Fairpark Nursing Home	2	2	1	2	1	8	LOW
17	Target Hazard Maryville Health Care	2	2	1	2	1	8	LOW
18	Target Hazard Shannondale of Maryville	2	2	1	2	1	8	LOW
19	Target Hazard Morningview Transitional Care	2	2	1	2	1	8	LOW
20	Natural Gas Pipeline	3	2	1	2	2	10	MODERATE
21	Local High Density/Hazardous Materials Route 321	2	2	1	2	2	9	MODERATE
22	CNX Railroad (Freight)	3	2	1	3	3	12	HIGH
23	Maryville College Dormitories (8)	2	1	1	2	1	7	LOW
24	Air Hazards	3	2	1	2	3	11	MODERATE
25	Downtown District	3	3	2	3	1	12	HIGH
26	Nuclear Facility	3	3	3	3	3	15	HIGH

Appendix F

Probability and Vulnerability Rating

List Hazards	Possibility of Occurrence			Vulnerability			Risk
	Likely (3)	Possible (2)	Unlikely (1)	High (3)	Moderate (2)	Low (1)	Rating (Probability X Vulnerability)
Tornado		X		X			6
Earthquake		X		X			6
Flood	X					X	3
Winter Storm (Severe)		X				X	2
Epidemic			X	X			3
Hazardous Materials Stationary	X			X			9
Hazardous Materials Transport	X			X			9
Power Failure	X					X	3
Urban Fire Conflagration	X			X			3
Terrorism			X		X		2
Severe Weather		X				X	2
Target Hazard National Guard Armory		X			X		4
Target Hazard Maryville College		X			X		4
Target Hazard Blount Memorial Hospital		X		X			6
Target Hazard Asbury Nursing Home		X				X	2
Target Hazard Fairpark Nursing Home		X				X	2
Target Hazard Maryville Health Care		X				X	2
Target Hazard Shannondale of Maryville		X				X	2
Target Hazard Morningview Transitional Care		X				X	2
East Tennessee Natural Gas Pipeline		X			X		4
Local High Density Haz-Mat Route		X			X		4

List Hazards	Possibility of Occurrence			Vulnerability			Risk
	Likely (3)	Possible (2)	Unlikely (1)	High (3)	Moderate (2)	Low (1)	Rating (Probability X Vulnerability)
Highway 321							
CSX Railway (Freight)		X		X			6
Maryville College Dormitories (8)		X				X	2
Air Hazards		X			X		4
Downtown District	X			X			9
Nuclear Facility		X		X			6