

Running head: ANALYSIS OF COMMUNITY RISK

Possibilities versus Probabilities: Analysis of Community Risk within the City of Merced

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Certification Statement

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Abstract

Knowledge regarding community risk that threatened the vitality of the City of Merced has been lost through personnel turnover, specifically retirements. This has created a situation, whereby, the City is vulnerable to repeat history, rather than, building upon knowledge gained through previous experience. The purpose of this research was to: (a) develop a baseline of understanding about community risk by the City employees, (b) identify the history of incidents that have significantly impacted the City, (c) determine the preferred methodology for conducting risk assessments, (d) identify risks that pose a probable threat to the City, and (e) establish mechanisms to expand and maintain the knowledge-base of the City's employees. The descriptive research methodology for this project included: a survey of City of Merced employees, data collection and analysis, document analysis, interviews, and development of a community risk analysis. Results found that 88.4% of the responding employees were at least moderately concerned about community risk, and 53.6% believe that the degree of risk has increased since they began their employment with the City. Yet, 54.5% of the respondents do not know where to locate a copy of the Emergency Operations Plan, and 49.1% claimed that they have never received any emergency preparedness training. Recommended improvements included: (a) establishment of a set schedule to regularly review, revise, and validate the City of Merced Emergency Operations Plan in order to develop a solid understanding of what risks the City faces, (b) to conduct regular reviews of and updates of the community risk assessment, (c) establishment of an employee training program that is designed to enhance the knowledge base in regards to community risk, (d) increase the frequency and complexity of drills and exercises, and (e) to conduct annual readiness assessments of the Emergency Operations Center.

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Introduction

According to an ancient Chinese Proverb: “He who fails to plan, plans to fail” (Chinese Proverb, n.d., ¶ 1). This adage has been exemplified in *Collapse*, a work of non-fiction by Jared Diamond. Diamond (2004) described numerous societies around the world that have collapsed as a result of their inability to see their vulnerabilities and to be able plan and act accordingly. He added that failure to effectively identify and understand the human and naturally caused threats has lead specific societies down irreversible paths to their destruction. Diamond (2004) concluded by emphasizing that if societies could learn from history, humans would not continue to exhaust non-replenishing resources, and would make decisions for the greater good. In the fire service, the National Fire Protection Association ([NFPA], 2004, Section 3.3.20) has defined risk as “a measure of the probability and severity of adverse effects that result from an exposure to a hazard”. Risks can be naturally occurring or human caused and must be prevented or mitigated in order to ensure the vitality of the society (USFA, 2008). Risk management has been defined as the process, which identifies and analyzes hazards to develop preventative and mitigating measures to minimize the probability and consequences of an event (USFA, 1996). To be successful, risk management must “be an ongoing, evolving, regularly refreshed, and continuously improved process” (USFA, 1996, p. i). A comprehensive understanding of the risk itself has been identified as the most fundamental component of a risk management program; risk management must begin with the identification of all possibilities. Through a comprehensive analysis process, the possibilities are evaluated so that the probabilities become identified. The City of Merced (City) has engaged in emergency preparedness planning since 1984 when it developed and adopted its first disaster plan. The plan was revised in 1995, and the current Plan

was adopted by the City Council in 2003(City of Merced, 2003, p. i). While these plans were developed based on perceived risks, there is not any evidence that a comprehensive risk analysis has been completed. A survey of all City employees was conducted to establish a baseline for their level of understanding of community risk within Merced (See Appendix C for complete results of the survey). The survey results demonstrated that the employees do not have the same understanding in regard to the definition of risk nor do they know what threats exist within the City. Furthermore, the survey identified that 65.2% work for an organization that has an emergency preparedness/ response role, yet 54.5% of the employees surveyed do not know where to locate a copy of the City's Emergency Operations Plan. Follow-up interviews with City employees identified that their knowledge of community risks is based on what they have been told by other employees or have observed in the media. Furthermore, the employees expressed that they did not know how disasters the City has faced in the past, would be presented to future employees. (P. Smith, L. Milluer, D. Arnold, & B. Karlisle, personal communication, November 20, 2008).

The research problem was that the City of Merced has continued to lose its knowledge base of community risk through retirement and attrition; without this wisdom, the City is destined to repeat history, rather than, build upon an existing knowledge base. The purpose of this research was to conduct a strategic community risk analysis that will identify the possible and probable emergency incidents within the City of Merced that can be used to maintain the knowledge base of City employees and to augment the City's Emergency Operations Plan (EOP).

Descriptive research was employed to study the situation and to formulate a foundation to address the problem. The research methodology for this project included: data collection and

analysis, document analysis, interviews, a survey, and the development of a community risk analysis. The research questions included the following:

1. What risks are viewed as the leading community risks that are most concerning to Merced City employees?
2. What types of significant emergency incidents have historically impacted the City of Merced, and what were their outcomes?
3. What are the preferred methods for conducting community risk assessments?
4. What are the possible and probable community risks that would affect the safety and stability of the City of Merced?
5. What actions are needed in order to ensure that the knowledge base of City of Merced employees and citizens is maintained?

Background and Significance

The City of Merced (CA) is located in Merced County in the heart of California's Central Valley approximately one hundred ten miles southeast of San Francisco. Incorporated in 1889, the City is the county seat for Merced County and is a Charter City that operates under a Council-Manager form of government. The City is nearly twenty square miles in size and continues to grow as a result of annexations. Since the early 1980's, Merced's population has continually grown faster than the State average (City of Merced, n.d.). In 2005, the City became the home of the newest University of California campus; this addition has altered Merced's image from being a quaint agricultural town in California's Central Valley, to a city that is the home of one of the top educational institutions in the Country (Merced California, n.d.). Merced is a diverse community that is home to 80,608 persons (City of Merced). The population of Merced is made up of 23,000 total households; seventy-three percent of which are occupied by

families. Twenty-two percent of Merced families live below the poverty level. Twenty-three percent of the population was born outside of the United States and thirty-six percent are either non-English speakers or rarely use English (U.S. Census Bureau, 2006). Economically, the City has been significantly impacted by the economic down-turn and the housing crisis. Currently, there are two thousand eight hundred vacant residences within the City limits as a result of defaults, incomplete construction, and foreclosures. The unemployment rate for the City is 10.9%, which ranks the Merced Metropolitan Statistical Area at 366 out of the 369 metropolitan areas assessed (Bureau of Labor Statistics, 2008). The City of Merced is supported by an economy that is based on agriculture, tourism, manufacturing, and retail (Bureau of Labor Statistics).

The Merced City Fire Department was initially established as the El Portal Hose Company on November 3, 1873, and it has evolved into a state-of-the-art, Insurance Services Organization Class 2, fire department. The MFD is a fully-professional organization that, on a daily basis, staffs five engine-companies and one truck-company. The Department consists of one fire chief, three division chiefs, three battalion chiefs, eighteen captains, twenty-one engineers, thirty-six firefighters, and administrative support and fire prevention staff (MFD, 1988/2007, OAG 1.295). The MFD is an all-risk emergency management entity with response disciplines in fire suppression, emergency medical services, hazardous materials, technical rescue, and aircraft rescue firefighting. Additionally, the Department is very proactive with fire prevention activities. As an example, the annual weed abatement program has nearly eradicated the incidence of wildland fires within City limits. The prevention program also encompasses fire prevention inspections, code enforcement, public education, and advocates fire safety for all citizens and visitors (MFD).

In recent years, the Baby Boomer generation has reached retirement age, and the workforce has experienced a massive loss of corporate knowledge (D. Proctor, personal communication, December 17, 2008). For the 2008-09 fiscal year, the City Council has authorized four hundred eighty positions to be filled (City of Merced, 2008). Of the eleven department heads in Merced, five have retired in the past year. This figure does not include the City Manager who formally retired in March 2008, yet continued to fill the role on an interim basis until mid-November (Jason, 2008). The new City Manager was hired from outside of California and began his employment with the City in early December 2008 (City of Merced, 2003-2008). For the day-to-day responsibilities of the City departments and employees, these transitions have been challenging. However, the successors have been well prepared for the job. In regards to high-risk, low-frequency situations associated with community risks, the City does not have a mechanism to capture and disseminate the following types of information to its new employees: corporate knowledge and experience gained from historical events. Outside of Merced's Emergency Operations Plan (EOP) and Continuity of Operations Plan (COOP), no City documents exist that elaborate on the risks that threaten the community's viability.

The current City of Merced Emergency Operations Plan is one facet of a comprehensive, countywide planning process. According to MFD Fire Chief Kenneth Mitten (personal communication, September 18, 2008), all of the political jurisdictions within Merced County collaborated to develop and implement emergency operations plans that were based the template displayed in the State of California Emergency Plan. All of the plans were formatted to contain the same sections, layout, and types of information. This dramatically improved the degree of interoperability within the County. The plans were also designed to be working resources that

can be trained to and, in the event of an emergency, pulled from the shelves and put into effect (City of Merced, 2003).

The City of Merced Emergency Operations Plan (2003), Part 1 – General Information, contained a section titled: “Hazards and Threats.” This section was developed to delineate the community risks within the City of Merced. A survey of City employees identified that only 45.5% of the employees know where to find a copy of the EOP; therefore, a majority of the employees have not been exposed to this information about the risks. The percentage of personnel who are not aware of this information has the potential to expand as a result of the retirements and the lack of codified mechanisms to educate the employees. The second area of concern is in regards to the brevity and generalized nature of the hazards and risks identified in the plan. While some of the information is specific to the City of Merced, much of the data is based on countywide generalities. By not identifying all potential risks, analyzing the likelihood of occurrence, and planning accordingly, the vulnerability for harm to the City is increased (FEMA, 2001). This gap in the assessment will affect prevention, as the City cannot effectively plan to prevent an event that is not expected to occur.

Merced has only needed to activate its emergency operations center (EOC) for four floods since it was established in the late 1990’s. As such, a gap between perceived and actual risks has developed. It has been stated that since Merced has not experienced a major disaster, the optimist would see the City as the safest community to live in; whereas the pessimist would see Merced as being due for a disaster (R. Williams, personal communication, September 11, 2008). “For approximately half a century, disaster researchers have observed a persistent disconnect between the perception of certain disaster-related events and the actual events” (Fischer, 2006, p. 1). This applied research project is being developed to address the gap between

unknowns and perceptions and the real risks that threaten the City of Merced. This project directly correlated with the United States Fire Administration's operational objective: "to promote within communities a comprehensive, multi-hazard risk-reduction plan led by the fire service organization" (USFA, 2005, p. 3). The project also correlated with the terminal and enabling objectives of the *Strategies for Community Risk Reduction* (USFA, 2008) Executive Fire Officer Program (EFOP) course. The problem and purpose of this project, and the identified need to conduct a community risk assessment, develop the foundation for a direct correlation with the aforementioned USFA and EFOP objectives.

Literature Review

It has been demonstrated that risk is everywhere; everything in life has its risks (Carson, 2008; Grose, 1987). To elaborate upon this point Carson (2008) noted that thirty-five percent of all stories in daily newspapers are based on the risks of the contemporary lives of Americans. This literature review was completed to ascertain the breadth and depth of knowledge and information that existed about community risk in Merced. The literature review was organized according to the research questions of the project. The aspects of risk within the City of Merced that are not currently in any written documents are included in the Results Section of this report.

The first benchmark this project was to ascertain the knowledge base of the City's employees in regards to the community risks within the City of Merced. Research of the past and current emergency operations plans (City of Merced, 1993; 2003), continuity of operations plans (City of Merced, 2008), City Charter and Municipal Code (City of Merced, n.d.), and City Council Meeting Minutes (City of Merced, 2003-2008) revealed very little information about the level of understanding and perceptions of the City employees. The 1993 revision of the City of Merced Disaster Plan (City of Merced) cited information from state and federal sources in

addition to Merced Fire Department (MFD) response data. The Disaster Plan included a one-page list of risks: accidents & manmade, weather & natural, medical incidents, human incidents, and communications failure. The Plan covered disaster operations and the activation of an emergency operations center. It did not provide guidance on training employees about the risks within the City, nor did it discuss any mechanisms to measure an employee's degree of understanding of risk or emergency operations. The Disaster Plan was revised and approved by the City Council in 2003; the plan revision included a title change to: City of Merced Emergency Operations Plan (EOP) (City of Merced). The EOP was organized into five sections: General Information, Initial Response, Extended Response, Recovery, and Appendices; however, none of the sections specified the training, drill, exercise, or review/revision frequencies. There were not any intrinsic mechanisms identified in the review to ensure City employees and/or citizens received training about the vulnerabilities within Merced. The assessment of the City Council Meeting Minutes (2003-2008) revealed several motions and actions about emergency preparedness and emergency management, a majority of which were in regards to the acceptance and allocation of various state and federal grants. The most notable City Council action identified in the minutes was the adoption of the City's EOP in June 2003. Additional actions by the City Council in regards to community risk were related to gang violence and other assorted law enforcement threats. Outside of Incident Command System (ICS) training and emergency operations center drills for City executive staff, there are not any training records that identify that City employees have been educated to the possible and/or probable risks in Merced (S. Raney, personal communication, October 27, 2008). Additionally, the author was unable to locate any additional documents that about community risk in the City. Further, there were no

sources identified that defined the training requirements for employees, including who should be present for training sessions about the risks that exist in the City of Merced.

In regards to the literature review, the historical records of emergency incidents that have affected Merced were difficult to locate and identify. Outside of National Fire Incident Reporting System (NFIRS) (MFD, n.d.) and California Fire Incident Reporting System (CFIRS) (MFD, n.d.) data, very little written information was available. Incident data was retrieved through the NFIRS and CFIRS databases; however, the data did not clearly identify the extent or the outcome of the incidents. According to the data, Merced has routinely experienced all-types of incidents: fires (structural, wildland, and vehicle), emergency medical services (in-home, vehicle accidents, and multi-casualty incidents), technical rescue (water, confined space, and extrication), and hazardous materials incidents. On average, the MFD (MFD) responds to four thousand eight hundred incidents on an annual basis. Forty-five percent of calls were medical assists, thirty percent were good intent calls, ten percent were fires (all types), ten percent were false alarms/calls, and five percent were service calls (MFD). In terms of significant incidents where multiple families or citizens were impacted, no written corroboration could be identified. The crime and law enforcement related incidents within the City of Merced have been on a downward trend for the past three years (Merced Police Department [MPD], 2008). A fact sheet produced by the MPD (2008) revealed that there were a total of 6210 major crimes in 2004, a majority of which were theft related. 2007 had the lowest total for any year listed on the report with 5393 major crimes. Specific data and/or statistics regarding gang involvement in major crimes were not available.

To ascertain the preferred methods for community risk assessments, the literature review was organized into the following sections: general information regarding risk assessments, and

the components of a comprehensive risk assessment model. The fire service has readily identified that there are scientific components of fire protection (FEMA, 2001). For all risks, including fire, the compilation and analysis of statistics and data have been used to predict and to develop plans that were designed to prevent and mitigate potential impacts. An important distinction asserted was that statistics are developed after an event has occurred; statistics do not exist for events that have not yet happened (FEMA; Wilson et al., 2008). According to *Managing Risk* (Grose, 1987) and *Risk Management Practices in the Fire Service* (USFA, 1996), accurate data is required by managers to be able to make educated decisions. Accurate data is obtained through a comprehensive risk assessment that should focus on the potential severity of an event and the probability that the event will occur. In his article *Prove It!*,” Jim Crawford (2008) emphasized that decisions, which are based on empirical evidence, are typically sound decisions. Decisions that are based on “hunches, agendas, and egos” (p. 113) can greatly compound the situation in a negative manner. In emergency management, these types of decisions can result in safety issues for responders and citizens. Jablonowski (2002) expanded on this concept by asserting that it is the credibility and applicability of the data as well as the credibility of the decision makers that are the key fundamentals in determining the validity of the risk assessment. He added that astute risk managers have been able to bridge the gap that is created by imperfect risk data by applying proven statistical theories. He cautioned the readers by noting that incomplete or imperfect data is different than false data; a risk assessment will only be as accurate as the data that is captured and applied in the equations.

The National Fire Protection Association (NFPA) Standard 1600 – *Standard on Disaster/Emergency Management and Business Continuity Programs* (2007) states: “The entity (fire department or jurisdiction) shall identify hazards, monitor those hazards, the likelihood of

their occurrence, and the vulnerability of people, property, the environment, and the entity itself to those hazards” (Section 5.3.1). In addition to NFPA 1600, several references cited that a risk assessment should be organized into three specific areas: natural hazards, human-caused events, and technological-caused events (Indian River County, 2007; NFPA, 2007; Schmidt, 2008; USFA, 2008). *Disaster and Fire Defense Planning* (USFA, 2000) also suggested identifying target hazards as a specific area in a risk assessment. In the *Strategies for Community Risk Reduction* (SCRR) student manual (USFA, 2008), strategic analysis of risks was defined as the process of gathering and analyzing for the specific purpose of accomplishing an organizational goal or objective. Furthermore, SCRR identified risk analysis as a four-step process: identify and prioritize the risks, identify the chain of events that lead to the occurrence of the risk, identify preventative and mitigating factors, and address political concerns. In contrast, the *Southwest Utah Regional Wildfire Protection Plan* (Five County Association of Governments, 2007) utilized a risk assessment methodology to identify the potential and frequency of the risk, to identify contributing factors that could allow the risk to occur, to identify the values at risk, and to determine the ability of the agencies to mitigate the incident. The Workshop on Community Risk Assessment (University of Cape Town, 2006) expanded on the concept employed in Southwest Utah by posing the following questions: (a) “Who is at risk?” (p. 1), (b) “Why are they at risk?” (p. 1), (c) “What is increasing the risk?” (p. 2), (d) “When are they most at risk?” (p. 2), and (e) “How does the community manage its risk?” (p. 3). The *Risk, Hazard, and Value Evaluation* (RHAVE) manual (Commission on Fire Accreditation International [CFAI], 2001) stated that in addition to the risk, there must be a potential for a loss; in other words, a jurisdiction must identify the consequences of the vulnerability that has been identified. Furthermore, RHAVE declared that the likelihood of the vulnerability to occur must be

determined through a “frequency analysis” (CFAI, p. 32) in order for the jurisdiction to clearly and definitively understand the risk within the community. NFPA 1250 (2004) published a three-step process for conducting risk assessments. The first step was to identify existing and probable risk through evaluation processes, followed by an analysis where the risks were evaluated for frequency, severity, and probability of occurrence. As a result of the previous two steps, NFPA (2004) recommended establishing priorities to prevent and/or mitigate the risk. From a national security perspective, the Governor’s Office of Homeland Security (2008) and the Office for Domestic Preparedness (2003) have identified risk assessments as the process which evaluate threats, vulnerabilities, and consequences. In *Managing Fire and Rescue Services*, Murrey Loflin and Russell Sanders (2002) defined a risk assessment as having three specific phases: risk identification, risk analysis, and risk prioritization. They stated that is not feasible for a jurisdiction to address all risks within a community, therefore, an analysis to determine the degree of risk, followed by prioritization, will enable the jurisdiction to effectively plan and mitigate risks. *Risk Management Practices in the Fire Service* (USFA, 1996) concurred with Loflin and Sanders by outlining a methodical process to address community risks; however, it expanded the concept by adding a fourth step to implement control actions. The *SCRR Student Manual* outlined a six-step process for identifying and addressing risk management needs. The steps in the process included: community assessment, identify hazards and casual factors, assess vulnerability, establish priorities based on rated risks, define acceptable risk, and create risk reduction objectives. The foundation for this assessment model was the assessment of the community to establish an understanding of the possible risks; while acknowledging that each community differs from all others. *SCRR* also provided a systematic model for assessing community risk, including numerous worksheets. Regarding risk categorization, Grose (1987)

suggested dividing the risks into four categories: speculative, static, dynamic, and inherent. He defined speculative risk as the potential for loss as a result of something new; as a result of the newness, the degree of risk can only be speculated. Static risk was a constant, undesirable situation; based on the static nature of this type of risk the situation was predictable and, therefore, preventable. Dynamic risk is a result of irregular, unpredictable situations where risk was difficult to predict and/or prevent. Lastly, he defined inherent risks, which are those risks that “are unavoidable associated with operational phenomena” (p. 31). Grose also affirmed that once a risk has been identified and broken down into the causative factors, a hazard severity should be applied to each step so as to identify the potential impact the risk could have. His hazard severity levels consisted of: (a) negligible – no real impact, (b) marginal – some impact, (c) critical – significant impact, and (d) catastrophic – crippling impact. Several reports, including RHAVE(CFAI, p. 28), the *Fire & Emergency Service Self-Assessment Manual*(Commission on Fire Accreditation International [CFAI], 2006, p. 52), the SCRR Student Manual (USFA, p. 2-5), *Risk Management* (USFA, 1996, p. 36), and a chapter on risk assessment in the International City/County Management Association (ICMA) *Managing Fire and Rescue Services* (Loflin & Sanders, p. 42), all recommended the use of a four-quadrant frequency and severity assessment tool (see Appendix A for an example of the tool) to identify which risks require immediate attention or emphasis. In greater detail than the assessment tool, *Disaster and Defense Planning* (USFA, 2000) proposed the use of a numeric rating system to prioritize and categorize community risks. NFPA 1250 – *Recommended Practice in Emergency Service Organization Risk Management* (2004) emphasized the importance of periodically reviewing and revising risk assessments so as to ensure information remains current and applicable. On the importance of planning based on risk assessments, John Granito (2004) stated

that “hoping for the best is not an action plan,” so “hope for the best, but plan for the worst” (¶ 1).

The purpose of this section of the literature review was to collect data regarding possible risks within the City of Merced. The methodology of the review included the gathering information for all possible risks within the City and organizing the data into three categories: natural, human caused, and technological.

California has been identified as being subject to frequent and destructive earthquakes; the State experiences more than one hundred earthquakes per day, most of which are very low on the Richter Scale (United States Geological Survey [USGS], 2008b). The USGS (2008b) issued a fact sheet that focused on identifying the potential of a significant earthquake striking California within the next thirty-years. “In a comprehensive study, scientists have determined that the chance of having one or more magnitude 6.7 or larger earthquakes in the California area over the next 30 years is greater than 99%” (USGS, 2008b, p. 1). Furthermore, the USGS (2008b) identified the possibility that an earthquake with a magnitude greater than 7.5 will occur within the next thirty years to be 46%. The California Geological Survey ([CGS], 2003a; 2003b) has published numerous maps and reports that were designed to identify the potential for significant shaking and ground acceleration based on specific regions in the State. The City of Merced has been identified on two of the geographic maps: the Central Coast Region (CGS, 2003a) and the San Francisco Bay Region (CGS, 2003b). In both instances, Merced was identified as having a low risk. Furthermore, in regards to the areas that are similar to Merced, both reports (CGS, 2003a, 2003b) stated: “These regions are distant from known, active faults and will experience lower levels of shaking, less frequently.” The *Seismic Shaking Hazards in California* report (CGS, 2003c) identified that Merced County, and, more specifically, the City

of Merced is located in an area that has been identified to have the lowest level of Peak Ground Acceleration (PGA). The CGS (2003c) cited a symposium report that was based in ground acceleration research following the 1999 magnitude 7.6 earthquake in Taiwan (Tsai, 2001). The report identified a distinct relationship between the rate of acceleration of the ground, both vertical and horizontal, and the extent of damage within fifty kilometer radius. The report concluded that the faster the acceleration of the ground, greater damage would result. An independent report: California Probabilistic Seismic Hazard Maps (Cao, Bryant, Rowshandel, Branum, & Willis, 2003) concurred with the findings of the CGS (2003c) and the USGS (2008b). The report provided data and extensively discussed the probability of earthquakes in California. The data was based on fault and area sources so as to provide the most accurate results. In discussions about the Central Valley, the report identified that there were not any known faults and the probability of a seismic event with an epicenter in the Valley is very remote (Cao et al.).

California has the most diverse fuel models and is one of the most active states in regards to wildfire fire incidents and threats to infrastructure in the wildland-urban interface (California Department of Forestry and Fire Protection [CAL-FIRE], 2001). Several sources cited that wildland fires burn faster uphill, than downhill; they burn faster with the wind, than against it, and they burn faster in grass fuel models, than they do in brush or timer models (National Wildfire Coordinating Group [NWCG], 2006; 2008). Predictive services were organized at the state and national levels to coordinate and disseminate fire intelligence and fire weather information (Southern California Geographic Area Coordination Center [OSCC], 2008). Based on the collected intelligence, which included fuel moisture, fuel loading, seasonal precipitation, and weather predictions, a fire danger rating is developed and published. The danger rating also

took into account the fire history for specific areas to further refine the level of potential danger. Several references identified locations with heavy brush and timber fuel models, and low fuel moistures as having the most extreme potential (NWCG, 1982; 2006; 2008). Further, both CAL-FIRE (2001) and the predictive services (OSCC, 2008) have also identified mountainous areas to have greater risk due to topographical influences on fire spread and wind speed. According to Google Maps (Google, 2009a) the City of Merced ranged in elevation from one hundred seventy-one feet at the Merced Municipal Airport to two hundred feet at the University of California – Merced campus. The terrain feature in Google Maps also identified that there are not any hills or drainages that could affect fire spread as identified by the wildland fire references above. On May 22, 2008 the City of Turlock, which is located twenty-six miles north of and has the same topography as Merced (Google, 2009c), experienced a wind-driven wildland fire that resulted in one fatality, several homes destroyed, and dozens of acres burned (Staff, 2008). Similarly, on June 10, 2008, the City of Stockton suffered a wind driven fire that destroyed thirty-two residences (CBS5, 2008; KCRA, 2008). Stockton is located sixty-four miles north of Merced and is geographically and socioeconomically similar to Turlock and Merced (Google, 2009b). The author was unable to locate any records that identified if there have been any structures lost within the City as a result of a wildland fire. Based on the geographic and topographic features of California in combination with a weather phenomenon known as subsidence, the State has annually faced extreme wind and fire conditions (NWCG, 2008). According to the *Intermediate Wildland Fire Behavior Instructor Manual* (NWCG, 2008), Northern California has historically dealt with the North Winds, whereas Southern California has been pushed to the limit with the Santa Ana Winds. These winds have caused extreme behavior situations by increasing temperatures, dropping the relative humidity to critical levels, and

producing sustained and gusting wind speed up to seventy-five miles-per-hour. The North Winds, in combination with the light, flashy fuels synergistically increase the risk to the City. To minimize the risk of wildfire to Merced, the MFD has developed and employed an aggressive weed abatement program. The program, as it exists today, started in the late 1980's. MFD Record Management System (MFD, n.d.) data revealed that the Department is typically required to issue notices against approximately two thousand properties. As a result of foreclosures and incomplete construction projects, the department served 3750 notices in 2007 and 3682 in 2008. The MFD (n.d.) was also required to abate one hundred thirteen properties in 2008.

In terms of life and property losses, floods have been identified as one of the most significant natural events (Jonkman & Vrijling, 2008). Specific data of lives lost has challenged the scientific community, as most of the significant life-loss events have occurred in third-world countries where the information is often inaccurate or flawed. Jonkman and Vrijling expanded on the impact of floods by identifying flood damage in two categories: direct and indirect. Direct losses are those that are created as a result of the water itself: property, life, and livestock. Whereas, they identified indirect losses as the areas that are impacted by the loss: damage to outside companies as a result of crop or property losses in the flood zone, temporary housing of evacuees, and overwhelming the government or infrastructure. As noted previously, there have been four flood conditions within the City of Merced over the last decade. The MFD National Fire Incident Reporting System ([NFIRS], MFD, n.d.) records confirmed the information obtained in the second research question. Floods have been identified as a widespread risk to most regions of the United States, but the impact of floods varies with the locality and topography (National Weather Service [NWS], 2005). Numerous resources have been developed to provide information and guidance about the risks of a flooding event, and they strongly agree

with one another. A plethora of information has been made available on the following websites: the American Red Cross (n.d.), the National Weather Service (NWS), the Federal Emergency Management Agency ([FEMA], 2008a), the U.S. Geological Survey (2008a), and the National Weather Service ([NWS], n.d.). Floods have been categorized based on their severity: minor, moderate, and major (NWS). The NWS (2005, p. 1) defined minor as causing “minimal or no property damage,” moderate as causing “some inundation of structures and roads near streams,” and major as causing “extensive inundation of structures and roads” requiring extensive evacuations. Floods have been further classified by the mechanism that causes them: flash floods, river floods, and inland floods. Flash floods have been defined by the NWS as a rapid rise of water along a stream or in low-lying areas, whereas, river floods occur in areas next to major water ways and typically cause widespread flooding. Inland flooding was defined by the NWS (n.d.) as significant flooding events caused by torrential rain storms or major melting of an establish snowpack. A FEMA Flood Insurance Rate Map of Merced (FEMA, 2008b) identified that the entire downtown area of the City is at risk for moderate flooding and the areas proximate to Bear Creek are at risk for major flooding (California Department of Water Resources [DWS], n.d.; FEMA, 2008a). In contrast, the areas of north Merced were identified to pose little to no flood risk. The *Journal of Flood Risk Management* (Hankin, Waller, Astle, & Kellagher, 2008) placed emphasis on the importance of mapping to plan and prepare a jurisdiction to be able to prevent and mitigate the impact of flood events. Maps have been used to identify areas of risk and to subsequently take actions in community planning to mitigate the impact of potential flood events.

Heat and cold events associated with weather patterns have historically impacted the City of Merced. The National Weather Service (2009) identified the average winter temperature to be

fifty-four degrees Fahrenheit, and the average summer temperature to be ninety-eight degrees Fahrenheit. The NWS also noted that hard freezes, where temperatures drop below thirty-two degrees Fahrenheit for a period of several hours and typically kill vegetation, do occur in Merced, but they are limited to two to three nights per year. No resources could be located, which identified the history of snow or sleet within the City of Merced. Conversely, Merced has been regularly challenged with heat related situations as a result of the summer weather pattern (NWS, 2009). Both the National Weather Service (2005) and the Centers for Disease Control and Prevention (2006), have identified that hundreds of Americans succumb to heat exposure on an annual basis. In recent years there have not been any fatalities within the City as a result of a heat exposure (MFD, n.d.). The NWS (2005) pointed out that cities typically pose a greater heat hazard. This is due to structures that block the normal wind pathways and the use of asphalt and other construction materials. The CDC (2006) stressed that illness from heat exposure is preventable; public awareness about heat illness and the associated risk factors could greatly reduce the number of deaths. Beginning in 2007, the City of Merced began the use of a cooling center for the citizens who are unable to get out of the heat (City of Merced, 2008). A cooling center has been defined pre-designated facility that has been equipped with air conditioning and stocked hydration supplies to protect vulnerable citizens from extreme temperatures. The City (2008) identified that the creation and use of the centers have reduced the number of emergency room visits.

In recent years, both the City of Merced (2007) and Merced County (2006) have developed and adopted pandemic influenza response plans. Both plans provided a categorical approach to a pandemic outbreak, ranging from a few ill personnel, to widespread illness that could impact the daily operations of the City/County. The *Bird Flu Manual* (Bird Flu Manual

Online, 2007) defined an epidemic as an “illness that spreads exponentially” (p. 3). The *Manual* noted that a pandemic is an epidemic on a global scale. “Pandemics occur when a new disease, to which human has no natural resistance, emerges and which has the ability to easily transmit from person to person” (Bird Flu Manual Online, p. 3). Pandemics have occurred throughout history. The *Manual* used historical data from the 1918 flu pandemic to conclude that outbreaks typically come in waves and affect different portions of the population at different times. The occurrence of waves implied the presence of different strains of the pathogen emerged to affect different population groups at different times. Lastly, the *Manual* stated that a pandemic will typically burn-out after one to two years. The Centers for Disease Control ([CDC]; 2007) found that seventy-five percent of a sample group stated that they would not stay at home if someone in their household was ill, thereby, exponentially increasing the risk of spread. The CDC further noted that seventy-four percent of the respondents stated that they would have serious financial troubles if they were required to miss seven days of work. Lastly, the CDC identified that of the one hundred sixteen million households in the United States, both parents are required to work in more than one-half of the households, and nearly ten percent of all households are managed by a single parent. The CDC used this data to demonstrate that a voluntary home quarantine may not occur, which could greatly contribute to the outbreak. While all should plan to prevent and mitigate an influenza pandemic, the Occupational Safety and Health Administration ([OSHA], 2007) emphasized that there are specific occupations that society cannot live without and should, therefore, be proactive to isolate these workers from exposure. These occupations included power generation, food supply systems, finance, water, sewer, public safety, and transportation. OSHA stated that agencies should develop and implement administrative controls to “encourage ill employees to stay at home without fear of reprisals” (p. 19).

A tropical storm is defined as a cyclonic storm having sustained winds ranging from 39 to 73 miles per hour (National Weather Service, 2008). Tropical storms have been common occurrences in the United States. California has faced numerous storms annually, but with very rare exception were any of these weather events categorized as tropical storms (Williams, 2005a). In a series of articles in the *USA Today*, Williams (2005a; 2005b) stated that approximately eighteen tropical storms are generated in the Pacific Ocean every year; half of which mature into hurricanes. According to Williams (2005a; 2005b) and the National Weather Service (2007) no hurricane has ever landed on the west coast of the United States. This is attributed to the temperature of the Pacific Ocean and because the winds through the tropics blow from east to west (Williams, 2005b). Although only one tropical storm that met the definition has ever landed in California, the state is challenged annually with the fallout from these storms. Williams (2005a) stated that although the storms weaken before they make landfall, they still deliver heavy rain to California and the southwest United States.

As a result of orographic and thermal lifting mechanisms, California experiences numerous thunderstorms on an annual basis (NWCG, 2008). On June 21, 2008, a widespread mass of unstable air passed over Northern California. This air mass enabled the development of thunderstorms, specifically dry-lightening thunderstorms, that resulted in the ignition of 3500 wildland fires that ultimately consumed hundreds of thousands of acres (California Department of Forestry and Fire Protection [CALFIRE], 2008). According to *Intermediate Wildland Fire Behavior* (2008), thunderstorms can pose a large risk to communities through gusting, erratic winds; heavy precipitation; and lightning strikes. Furthermore, Laura Edwards (2005) declared that thunderstorms can develop into super cells and potentially produce tornadoes. Edwards stated that tornadoes are most commonly known from the mid-western states; however, the

Central Valley of California has an extensive history of tornado activity. In the article, Edwards cited that from 1950-1992 there were two hundred and forty-two tornadoes that touched-down in central California. Unlike the tornadoes in the mid-west, one hundred ninety four of California's tornadoes occurred during the winter months. The tornadoes in California have also proven to be less severe and cause less damage than those that occur in Tornado Alley, in the mid-western states. Of the two hundred forty-two tornadoes reported to have occurred in the Central California, one hundred forty-four were categorized and reported by Edwards as follows: seventy were in the lowest rank of the Fujita scale: F0 intensity; fifty were ranked as F1 intensity; twenty-three were F2 intensity; and one was F3 intensity. The Tornado Project (n.d.) identified three hundred twenty-three California tornadoes between 1880 and 2000; eleven of which were in Merced County. Four of the tornadoes listed in Merced County had an intensity of F1 with the remainder having an intensity of F0. The National Climatic Data Center ([NCDC], n.d.) reported ninety-nine significant wind events, tornadoes and funnel clouds, in Merced County between 1950 and 2008. These events resulted in one fatality, twenty injuries, twenty-three million dollars in property damage, and sixty million dollars in crop damage. Based on the data provided by the NCDC (n.d.), the events have increased in regularity over the past decade; no theories were identified to support this pattern.

The human caused risks that have been identified to have the potential of causing significant vulnerabilities to Merced include: terrorism, agroterrorism, civil disturbances/gang activities, and the immigration crisis. Although terrorism has been around since the beginning of mankind, it was not until September 11, 2001 that Americans became overtly concerned about the potential of future attacks and their vulnerabilities (American Red Cross [ARC], 2001). The Foreign Policy Association (2005) has identified four different types of terrorism: nationalist-

separatist terrorism, religious terrorism, left-wing terrorism, and right-wing terrorism. While the motivation of each type of terrorism differs, the purpose is the same: accomplish a result through violence and fear. The type of terrorism that has been most evident in recent years is religious based where the perpetrators use violence to accomplish divinely commanded purposes.

According to terrorism expert Amy Zalman, PhD. (n.d), recent years have identified Al Qaeda, a religious terrorism group, as the primary terrorist organization that threatens the vitality of the United States; however terrorism has affected America since the Boston Tea Party when Americans terrorized the British by throwing tea into the harbor to oppose the British Tea Act of 1773. The Boston Tea Party was the first documented event in the United States where the Sons of Liberty instilled terror or fear to accomplish a result (Zalman, n.d.). While terrorism has taken on a different image and has threatened homeland security in recent years, it continues to be defined as: “The unlawful use of force or violence against persons or property to intimidate or coerce a Government, the civilian population, or any segment thereof, in furtherance of political or social objectives” (Federal Bureau of Investigation [FBI], n.d., ¶ 4). As reported in the San Francisco Chronicle (Thanawala, 2008), an individual sent more than one hundred twenty envelopes containing sugar, which was labeled as anthrax. A motive was not listed; however terror was the outcome by all who received the mailing. Outside of bombings and the hijacking of aircraft as experienced on 9/11, the most prevalent form of terrorism that has caused countless injuries and fatalities are chemical agents (Centers for Disease Control and Prevention [CDC], 2001). Based on the low concentration levels that is needed to damage a human life, chemical agents, such as Sarin gas, have grown in popularity among terrorist sects (CDC). According to the CDC (2001) and the FBI (n.d.), the identification of potential targets and target groups within a community is the first step in preventing and mitigating a terrorist event. California’s Central

Valley is one of the most fertile and productive agricultural regions in the world (California Research Bureau, 1997); as a result, agroterrorism has caused much concern in recent years due to significant improvements in technology and agents. The improvements in technology, agents, and methods, have raised awareness and have reportedly led to an increase in agroterrorism events (California Research Bureau). Steve Cain (2001) has defined agroterrorism as malicious acts that are aimed at damaging agricultural and/or food supply industries through the use of biological or chemical agents. Cain and Monke (2004) stressed that this form of terrorism has wide spread implications, both direct and indirect. The loss of food, crops, or livestock will have a direct impact on food supply, the economy, and possible human casualties. Indirect impacts could include a lack of confidence in government and food supply industries. With advances in technology, Cain asserted that agroterrorism has transitioned into a probability, rather than just a possibility. Monke noted that agriculture is at risk based purely on the nature of the industry: open, unsecured environment; concentrated in specific areas; mass transportation of the commodity; the feed and the fertilizers; and the number of contagious agents for plants and stock is greater than it is for humans. Noah, Noah, and Crowder (2002) found that chemical agents that have thus far proven to be effective on human beings will have similar impacts on most breeds of livestock.

Gang activity within a community has proven to affect the vitality of certain areas of communities and has impacted the desire for individuals to reside in certain areas (National Alliance of Gang Investigators Association [NAGIA], 2005). The NAGIA has estimated that there are more than 21,500 gangs in the United States with more than 730,000 members. Gangs affect communities through the fear they invoke in the citizens as a result of continual violence, drugs, and increased crime rates. The NAGIA identified that gangs utilize drug trafficking as the

primary means of financial gain, while approximately forty-four percent of gangs are affiliated with organized crime. In short, NAGIA stated that gangs have an overall negative impact on a community. As demonstrated in Los Angeles in 1992 during the Rodney King Riot, a gang mentality has the potential to escalate to civil unrest levels and threaten the lives and security of all who become trapped in the melee (Gutierrez, Feldman, & McDermott, 2002). A civil unrest situation can result in widespread panic and fear, as well as theft, violence, and arson crimes at unprecedented rates (Gutierrez et al.). Civil unrest or riots require a catalyst, like the Rodney King acquittal, and very high levels of emotional involvement, in this case, based on race, in order for a mass of normally content citizens to lash out on society (Gutierrez et al.).

NAGLIA noted that in recent years gangs have begun to include illegal immigrants in their membership. According to Hans Johnson (2006) tens of millions of illegal immigrants reside in the United States with nearly a half million entering every year. He stated that California has more illegal immigrants than any other state in the Nation; eighty percent of which are from Mexico and Latin America. Johnson cited that the minimum wage in California is approximately ten-times greater than it is in Mexico; this has resulted in the influx of immigrants for economic purposes. Johnson's research identified that nearly seventy-five percent of adult illegal immigrants are active in the workforce, yet they continue to live below the poverty line. Johnson and Wagner (2007) agreed that the cost of illegal immigrants continues to rise every year. They noted that although a majority of the adult immigrants are in the workforce, they do not have documentation and therefore, most do not pay taxes. Further, their children are being educated in public schools and uninsured healthcare costs have grown exponentially. Wagner cited a direct correlation between crime rates, gang activity, and poverty levels where concentrations of illegal immigrants reside. Conversely, Davidson (2006) found that illegal

immigrants typically are employed in low-skill, low-wage fields that most Americans do not fill. He stated that this arrangement helps to keep the cost of certain products, such as produce, affordable for all Americans.

The third and final general category of risk to the City of Merced is technology. This section of the literature review will focus on threats to the City that are a result of advances in technology. Dam failure was readily identified as a potential risk to Merced when researching the possibility of flooding within the City. Merced is in the inundation area of two earthen dams: Lake Yosemite and Bear Reservoir (City of Merced, 1995). Lake Yosemite was constructed just outside of Merced on the northeast corner; whereas Bear reservoir was built approximately twenty miles east of Merced in Mariposa County. The threat to Merced identified from dam failures was determined to be identical to the areas subjected to flooding as identified by the California Department of Water Services ([DWS], n.d.). FEMA (n.d.) identified that dams fail as a result of one or more of the following: overflow due to exceeded capacity, sabotage, faulty dam materials, failure of the foundation, settlement or cracking, internal erosion, or insufficient maintenance. Both of the dams that have the potential to impact Merced have been identified as being earthen-fill types of structures (City of Merced, 2005). In a separate report, FEMA (2005) identified earthen-fill dams as being very flexible and resilient to seismic activity. The report asserted that the greatest vulnerability to these types of dams is overflowing. Previous failures of earthen-fill dams identified that when the capacity is exceeded and overflow occurs, the structure washes-out and ultimately fails. In another report regarding dam safety, FEMA (2004) identified a hazard potential classification system. The system was developed to identify the potential significance of a dam failure. The classification system rating was determined by assessing the potential for life loss and the potential environmental and property losses. FEMA (2004)

classified a low risk as possibly causing no life loss and very little, if any, property or environmental damage. On the other hand, a high rating identified the probability of at least one life lost and widespread property and environmental impacts.

According to the Federal Railroad Administration ([FRA], 2009), two railway easements existed in the City of Merced. One easement was used by the Union Pacific Railway (UP), and the other was shared by the Burlington Northern-Santa Fe Railway (BNSF) and by Amtrak. FRA revealed that during 2008, BNSF carried various types and quantities of cargo a total of 157,098,605 miles. The FRA safety records for BNSF identified that the carrier was involved in 0.91 track related accidents for every one million miles traveled. On average, forty-five BNSF trains pass through the 6.65 miles of track in Merced on a daily basis. Similarly, the FRA identified that UP traveled a total of 154,925,754 miles and was involved in 1.28 track related accidents for every one million miles traveled. On average, twenty UP trains pass through the 5.60 miles of track in Merced on a daily basis. To place this data into perspective, the Association of American Railroads ([AAR], 2008) released data for one week, which ended on October 11, 2008. During this week, the AAR identified that a combination of all U.S. railroads had traveled a total of 35.2 billion ton-miles. A total of 331,402 cars and 234,732 intermodal containers arrived at their destination during the identified week. The *Audit of the Highway-Rail Grade Crossing Safety Program* (Federal Railroad Administration [FRA], 2004) and the *Highway-Rail Crossing Safety and Trespass Prevention* (United States Department of Transportation [DOT], 2004) both articulated that although the numbers of incidents remain high, there has been a downward trend in the number of rail crossing incidents since 1993. This has been attributed to improved design features of crossings, improved signals, and the closing of a large number of unsafe crossings. The FRA (2004) identified that nearly ninety-four percent of

all crossing incidents have been due to risky driver decisions or poor judgment. In total, the FRA (2009) identified that there were one hundred track related accidents and one hundred twenty-one rail crossing incidents in California in 2008. Based on the confidentiality of the information contained in the hazardous materials density report, specific data could not be expressed in this project; however, the impact of the data has been acquired and applied to the severity of the community risk analysis.

According to the U.S. Energy Information Administration ([EIA], n.d.) and Pacific Gas and Electric ([PG&E], 2006), California Gas Transmission (CGT) has utilized the Union Pacific (UP) and Burlington Northern-Santa Fe (BNSF) right-of-ways to maintain PG&E's high-pressure natural gas transmission and gas assets. Two gas lines merge within the City limits of Merced (PG&E, 2006). A 6" line entered the city from the east along the BNSF Railway easement. The line leaves the BNSF easement and follows Highway 140 to Parsons Avenue, where it turns and follows Parsons to Childs Avenue. The line then turned right and crossed under Highway 99 where it tied into the second gas line at the intersection of Childs Avenue and the UP Railway easement. The second line was an 8" high-pressure gas line that follows the UP Railway easement through the City. The Pipeline Group (2006) has published a manual that specifically identifies crude oil and natural gas lines that are owned by Chevron Pipeline Company and Shell Pipeline Company, which pass through Merced County. The references included therein stated that both pipelines followed the Interstate 5 corridor along the western edge of the County. The lines have been identified to exist approximately forty miles from the nearest portion of the City of Merced.

Merced Municipal Airport was initially developed in the late 1950's (City of Merced, n.d.). The City of Merced cited that the airport is primarily for light, privately owned aircraft;

however, a Federal Aviation Administration (FAA) approved commercial carrier has also operated out of the terminal. The National Traffic Safety Board ([NTSB], 2008) records revealed that there have been seventy-seven aircraft incidents at the Merced Municipal Airport since 1964; of which, eight suffered fatalities. According to the data, the most recent accident was in 2007; it was a non-injury event and was the result of a mechanical failure. The most recent fatality incident was in 1989, and it was the result of an experimental aircraft failure. Although the conditions no longer exist since its closure in 1994, the Castle Air Force Base generated a very large volume of air traffic over and around the City (Castle Air Museum, 2006). The Castle Air Museum (2006) website identified that the City was in the flight path of B-52's. Over the lifespan of the base, there were multiple incidents that involved crashes, engine fires, and dropped ordinance; none of which occurred within the city limits.

Historically, on highway transportation incidents have regularly impacted the Merced Fire Department (MFD, n.d.). Merced has had one of California's major north-south arteries pass through the City: Highway 99. The City has also been known as the Gateway to Yosemite; one of the primary highways to access the park originates in Merced (City of Merced, n.d.). The MFD has routinely responded to accidents involving tractor-trailer units and has not had to mitigate a major hazardous materials release as a result. On nearly an annual basis, Highway 99 has been subjected to multi-casualty collisions as a result of dense fog. On December 11, 2008, there was a fifty-three vehicle collision on highway 99 ninety miles south of Merced near the town of Caldwell. The collision was a result of poor visibility due to foggy conditions (Jalopnik, 2008). On November 3, 2007 there was a 108 vehicle collision in Fresno that resulted in two fatalities; this collision was also the result of dense fog (KSEE 24 News [KSEE], 2007).

“While residential structure fires account for only 25 percent of fires nationwide, they account for a disproportionate share of losses: 83 percent of citizen fire deaths, 77 percent of citizen fire injuries, and 64 percent of direct dollar losses” (National Fire Protection Association [NFPA], 2008b, p. 1). NFPA (2008b) identified cooking as the leading cause of residential fires in the United States; between thirty-one and thirty-nine percent. This statistic was remarkably similar to the MFD, where twenty-nine percent of fire responses within the past three years were a result of cooking (MFD, n.d.). Fire has been proven to be a significant problem in the United States; as documented in *Vision 20/20* (Institution of Fire Engineers, 2008b). The report identified that in 2007 there were 1.6 million fires, of which 524,000 were structure fires. It stated that every nineteen seconds a fire department responds to a fire, any type. Every sixty seconds a fire department responds to a structure fire and every seventy-six seconds a fire department responds to a residential structure fire. More than three thousand civilians are killed in fires every year, eighty percent occur in homes (Institution of Fire Engineers, 2008a). A recent survey by the NFPA (2008a) found that seventy-nine percent of Americans are concerned that the down turn in the economy may lead to an increase in residential fires. This conclusion is based on an increase in improper heating and cooking techniques as a result of an inability to afford utility bills. *Socioeconomic Factors and the Incidence of Fire* (Federal Emergency Management Agency [FEMA], 1997) identified some commonalities that affected the number of and the magnitude of fires. These commonalities included: parental presence, poverty, under-education, home ownership versus rental, and housing crowdedness. Additional factors included vacancy of and the age of the structures.

Infrastructure vulnerabilities have proven to cripple a community for days and weeks. For example, in 2003 a power outage in the north-eastern U.S. occurred when twenty-one power

plants simultaneously shutdown and caused a multiple-day blackout for nearly one million households (CNN, 2003). This outage has since been referred to as the Great Northeast Power Failure (Glenn, 2008). Glenn wrote that three vulnerabilities have been identified for electric transmission systems: weather, neighbors, and terrorism. Emphasis was placed on the ability of the system to withstand hot, cold, wind, and other weather threats to the system. In regards to neighbors, Glenn referred to the pathway of the transmission system: what the electrical system must pass through to arrive at its destination. Lastly, Glenn addressed the concern of terrorist targeting. Another type of blackout that has affected California in recent years was the rolling-blackout (California electricity crisis, n.d.). In 2000 and 2001, as a partial result of the deregulation and extreme energy prices, power distributors throughout California were required to conduct rolling blackouts to reduce costs. This practice was conducted during peak use times, specifically, the summer months when temperatures were at the highest levels (California electricity crisis). The American Red Cross ([ARC], 2001) has issued a fact sheet designed to educate the public about how to prepare for blackouts.

This portion of the literature review was developed to identify what actions the City of Merced can take to ensure its employees and citizens are informed about risks in the community. In their article in the *Journal of Rescue & Disaster Medicine*, Wilson, et al (2008, p. LRC 36) found that, “People tend to perceive flood disasters as somewhat predictable periodic phenomena, instead of as probable and random phenomena”. This article articulated a gap between actual and perceived risks with communities. Similarly, *America Burning* (National Commission on Fire Prevention and Control, 1973, p. x) stated: “The Nation’s fire problem is the indifference with which Americans confront the subject.” *America Burning: Revisited* (United States Fire Administration [USFA], 1987) identified that the level of complacency had reduced;

however the United States was still a long way from where it should be. Most recently, *Vision 20/20* (Institution of Fire Engineers, 2008, p. 4) found: “Despite significant progress in the last 30 years, the United States still has one of the worst fire loss records of the industrialized world.” *Vision 20/20* (2008) stressed that in order for progress to occur, attitudes among the public, legislators, and most importantly, fire service personnel must change to advocate that prevention is equally important as firefighting. As identified in the first section of the literature review, research was unable to locate any City documents that were developed to ensure that teaching, training, reinforcing, or dissemination of information about the risks that exist within the community occurred. Stephen Foley (2005) stated that the most important function a fire department can perform is to keep the municipal officials and the community informed about the hazards of the community. Foley recognized that risk analysis was never a consideration until the late 1980’s, but with the adoption of new national standards and legislation, all jurisdictions should apply the risk assessment concept to determine the minimum level of service it will provide. Similarly, John Harrald (2005) expressed that all of the stakeholders must be identified in the prevention and preparation stage of a disaster response. He stated that if the stakeholders are not identified in advance of an event, they cannot be expected to be educated, prepared, or able to respond in an adequate manner. Harrald identified a number of critical success factors. One factor was, “situational awareness is obtained and shared across distributed organizational network” (p. 5). He used the example of the establishment of the Department of Homeland Security (DHS) after the attacks on September 11, 2001. According to Harrald, DHS was developed to coordinate strategies, plans, and organizations to collect, analyze, and disseminate information to reinforce the security of the United States. Donald Schmidt (2008) identified that, at a minimum, all employees should be trained in emergency mitigation. He wrote, “Everyone

should know emergency plans including evacuation, shelter-in-place, and lock down procedures” (p. 5). He continued by stressing that community response team members need to be trained to higher levels so as to provide a higher level of service/ support in the event of a widespread emergency. He concluded by recommending the local adoption of NFPA 1600 as a model for developing and implementing a codified program. The use of modern technology was the focus of an article by Nancy Jackson (2008) titled: *Blog City*. Jackson illustrated examples of web blogs used by various cities and counties to communicate with the members of the community in a less formal manner. Not only did this use of technology allow for the dissemination of the information, but it also allowed for interactive communication with members of the public. *Get Ready* (National Fire Protection Association [NFPA], 2005) was developed with a Department of Homeland Security Grant in 2005 for the purpose of being an off-the-shelf training program for communities to use to train their citizens about emergency preparedness. The program includes brochures, banners, posters, presentation materials, and mechanisms for measuring program success. As identified in *American Burning* (National Commission on Fire Prevention and Control, 1973), *America Burning: Revisited* (USFA, 1987), and *Vision 20/20* (Institution of Fire Engineers, 2008) success in addressing the fire problem, or any other threat to the community, it must be a collaborative effort between all stakeholders.

Procedures

The qualitative methods utilized to address this research project were organized into four steps, each of which was developed to further define the problem, refine the purpose, and ultimately to develop a comprehensive risk analysis for the City of Merced. The first step was employed to validate and further define the problem of the project. This step was administered through the development, dissemination, and collection of a survey of the City of Merced

employees, and the analysis of the raw data generated from the survey (See Appendix C for a blank copy of the survey). The purpose of the survey was to identify the employees' understanding of risk and to identify the risks that were most concerning to them. The survey was distributed to all four hundred eighty employees of the City of Merced (2008). It was decided to survey the entire population of City employees, rather than select a representative sample, this was based on the ability to effectively collect, manage, and analyze the data. The survey was distributed through SurveyMonkey.com, via the City's email system. Each employee was sent an email that contained a link to the survey. The survey consisted of eighteen questions. The validation of the content of the survey was completed through an assessment conducted by other Executive Fire Officer Program (EFOP) students. The validation assessment involved the distribution of the draft survey to the students, which included: the draft questions, itemized answers for the multiple choice questions, and a description of the intent for each question. Based on input received, the survey was revised, finalized, and distributed to the City employees. The survey was designed to be short in length to help to ensure all members would take the time to complete it, and would be more likely to thoroughly and accurately answer the questions based on their experiences. The questions for the survey were developed to assess four specific areas: (a) understanding of risk in general and risks that threaten the City of Merced, (b) risk mitigation and prevention, (c) their role in emergency management and preparedness, and (d) the background and experience of each participant. The results of the survey were analyzed and used to help to identify and validate the problem of this research: the City of Merced has continued to lose its knowledge base of community risk through retirement and attrition; without this wisdom, the City is destined to repeat history, rather than build upon an existing knowledge base.

Limitations to the survey included the subjectivity of some of the responses, and the lack of a mechanism to ensure all members of the population size completed the survey.

The second step was to conduct research into the magnitude and outcome of incidents that have occurred in Merced. The question posed was: what types of significant emergency incidents have historically impacted the City of Merced and what were their outcomes? This step also included the identification of components that required analysis to gain further understanding of the problem. Information was obtained through interviews and analysis of existing raw data. The purpose of the interviews was to specifically identify the types of incidents that have posed the greatest risk to the City, and to seek guidance with the development of a comprehensive risk assessment. The research also included the analysis of written reports retained in the Merced Fire Department Firehouse Record Management System and National Fire Incident Reporting System (NFIRS) documents. The limitation to this step was the limited quantity of hard data upon which to develop conclusions.

The third step was to be conducted using a detailed analysis of existing raw data in the areas of risk, risk assessments, and risks that could affect the vitality of Merced. This step was designed to answer the two research questions: what are the preferred methods for conducting community risk assessments? And, what are the possible and probable community risks that would affect the safety and stability of the City of Merced? Risk assessments are a compilation of data to be used to forecast vulnerabilities and plan accordingly (FEMA, 2001). Crawford (2008) stressed that decisions should be made on empirical evidence and statistics; otherwise the plans and actions would not be based on the facts of a situation. NFPA 1600 (2007) and NFPA 1250 (2004) both stressed the importance of identifying all possible risks, and refining the analysis to determine which risk truly pose a threat to the community. The focus of this portion

of the research was to identify risks that could impact large areas or populations within the City; not focus on routine or day-to-day risks within the community. The methodology of this step included a keyword search through the National Fire Academy's Learning Resource Center (LRC). The keywords included: risk, risk assessment, strategic risk assessment, risk assessment methods, natural risks, human caused risks, manmade risks, societal risks, technological risks, and Merced, CA risks. Additional keyword searches were completed on Google Scholar, Google, and various fire sites, including: Fire Engineering, Fire Chief, and Firehouse. Keyword searches were also completed at the Merced County and Tuolumne County Libraries. An additional aspect was to identify all City documents that identified the risks that exist within in Merced. These documents included books, periodicals, media, City of Merced operational and governance documents, informational publications, and national standards. The areas of focus included: fire service specific publications, international approaches to risk, community preparedness, and risk management from a corporate perspective. Once the possible risks were identified, several reports (Indian River County, 2007; NFPA, 2007; Schmidt, 2008; USFA, 2008) recommended dividing the risks by the catalysts that created them: natural caused, human caused, and technology caused. This method was designed to aid the assessor to further classify and refine the risks into manageable groups. Next, the assessor needed to identify what was being threatened in order to understand which of the possibilities actually threaten the community. The Workshop on Community Risk Assessment (University of Cape Town, 2006) recommended using the following model to ascertain is the threat actually created a risk for the community: (a) "Who is at risk?" (p. 1), (b) "Why are they at risk?" (p. 1), (c) "What is increasing the risk?" (p. 2), (d) "When are they most at risk?" (p. 2), and (e) "How does the community manage its risk?" (p. 3). If the assessor cannot answer one or more of the previously noted questions, then a risk

most likely does not exist. Additionally, the *Risk, Hazard, and Value Evaluation* (RHAVE) manual (Commission on Fire Accreditation International [CFAI], 2001) stated that in addition to the risk, there must be a potential for a loss; a jurisdiction must identify the potential severity of consequences for the risk. RHAVE also stated that the potential frequency for the vulnerability to occur must be assessed in order for the jurisdiction to clearly and definitively understand the risk within the community. Lastly, the Frequency and Severity Assessment Tool (see Appendix A for an example of the tool) was applied to assess the degree of risk and to categorize the potential impact of each risk. Each of the possible risks will be categorized as: low, moderate, high, or severe. Risks that have been identified as being improbable or impossible to occur within Merced or are categorized as being a low risk to the community were determined to be outside the purpose of this project and were excluded from the research so as to focus on risks that were a realistic threat to the vitality of the City of Merced. The limitations to this step were a result of the surfeit of information about risk and risk assessments that existed and the ability to differentiate the probable from the improbable risks that threaten the City of Merced.

The intent of the fourth step was to answer what actions are needed in order to ensure the knowledge base of City of Merced employees and citizens is maintained. The previous three steps were employed to develop an understanding of the knowledge, identify processes to maintain the knowledge base, identify risks that threaten the City of Merced, and to ascertain the potential impact of the risks. This purpose of this step was to determine the best practices to employ in order to keep the City employees educated and to maintain the knowledge base as it pertains to community risk and emergency preparedness. The limitations identified for this step encompassed the application and follow-through of the recommended actions. No limitations were identified for this step; however, the challenge to this step was to determine the best

mechanism to reach the greatest number of employees and citizens so as to achieve the greatest impact.

Results

As described in the background and significance section, the City of Merced has experienced a major turnover of department heads and staff over the last twenty-four months as a result of retirements; more are expected in the near future (City of Merced, n.d.). This not only led to a loss of corporate knowledge, but has exposed areas that require policy revisions, training, additional experience, or all of the above. The problem is that there has been a loss of expertise in the emergency preparedness arena. If it is not addressed, the City will continue to lose the knowledge it has gained through its experiences. This loss would also situate the City to repeat history, rather than learning and growing from it. The first research question was developed to either validate the problem, or prove it to be false. The methodology of the first question involved a survey of all city employees (See Appendix D for the complete results of the survey). The City had four hundred eighty allocated positions at the time the survey was administered. A total of 112 (23.3%) of the employees responded to the survey. The first two questions of the survey revealed that the participants are aware of what community risk means. The first question asked the participants to check all answers that define community risk. The participants identified that community risk is a vulnerability of harm to community vitality, a vulnerability of harm to life, and a vulnerability of harm to property as the top three responses. Beyond the top three, there is a twelve percent gap to the next tier of answers. While it is clear that the respondents understand that risk is a vulnerability, the understanding of what creates the risk is not as clear. An interesting paradigm exists in the answers to question two where the participants were asked to make selections that best describe an accident. 75 (67.0%) responded that an

accident is a preventable occurrence; however, 51 (45.5%) declared that accidents are unavoidable. This pattern identifies that there is a lack understanding of what an accident means: 14 (12.5%) answered that accidents are both preventable and unavoidable. Question two also identified that 65 (58.0%) employees cited that accidents are a sequence of events. Question three differed from the first two questions by using free text answers to allow the respondents to name the top three risks to the City. The reconciliation of the answers to this question identified thirty-six areas of risk to the City of Merced. The responses identified flood (36.6%), gang activity (32.1%), railways (29.5%), the economy (28.6%), and crime (27.7%) as the top five risks to the City. Other listed risks include: transportation, fire, hazardous materials, earthquakes, unemployment, and illegal drugs. When asked how concerned the employees are that one of their top three risks will occur in Merced, 99 (88.4%) expressed that they are at least moderately concerned. 55 (49.1%) of the respondents reported that have been provided information about the risks in the community since their employment with the City began. 74 (66.1%) stated that they are not aware of a particular fire risk within the City. Alarmingly, 60 (53.6%) stated that the degree of risk within the City has increased since they started working for Merced. To refine the understanding of the risks within the City, the participants were asked to identify how many trains pass through Merced on a daily basis; 35 (31.3%) believe that 26-50 train pass, while 33 (29.5%) believe there are 1-25, and 23 (20.5%) believe there are 51-75. The survey asked the participants to identify the greatest risk to Merced by choosing one of the following: natural disasters, economy, political issues, transportation, terrorism or intentional acts, and accidents. This question was developed to validate the answers from question three. 60 (53.6%) responded that the economy is the greatest risk to Merced which differs from question three where only 32 (28.6%) of the respondents identified the economy as one of the greatest risks. Questions eleven,

twelve, and thirteen confirmed that the problem of this project exists: 61 (54.5%) do not know where to locate a copy of the City's Emergency Operations Plan (EOP) or the Continuity of Operations Plan (COOP), and 55 (49.1%) have never received any training about the EOP or COOP. Yet, 73 (65.2%) cite that they work for a department that has a vital role in emergency management. The demographics of the participants are identified in the remaining five questions. Question fourteen revealed that 49 (44.5%) have less than five-years experience with the City of Merced, and the number two category is 6-10 where 25 (22.7%) answered affirmatively. Only 53 (48.2%) expressed that they have had any experience in emergency management. 27 (24.5%) of the respondents currently hold the job classification of line personnel, 25 (22.7%) are employed in an administrative support role, and 24 (21.8%) are in middle management. 35 (31.8%) of the participants are in their forties and 28 (25.5%) are in their thirties. Lastly, 67 (60.9%) are male.

Although the Merced Fire Department has a 135-year history and the City of Merced has been incorporated since April 1, 1889, the available written history of significant incidents is scarce. The research methodology for this project focused on major incidents that affected large areas or large numbers of civilians. Interviews with Fire Chief Ken Mitten (personal communication, September 18, 2008; January 20, 2009) identified that there have been flood events, major arson fires, influenza outbreaks, and transportation incidents that have affected large areas of the City. There have been four flood events within the City during the last decade. According to Mitten after action reports had been developed following each of the floods, but neither hard nor electronic copies could be located. He articulated there were significant flooding issues in Merced before the 1970's; however, actions were taken to improve drainage infrastructure and to reinforce the banks of Bear Creek. Subsequently, the number of floods has dramatically been reduced. Since these improvements were made, two significant floods have

occurred: March 1998 and March 2007. Chief Mitten identified that the 1998 flood lasted for three days and caused extensive evacuations and property damage. In certain locations of the City, the water was three to four feet deep. In contrast, the 2007 flood only lasted twelve hours, but it forced the evacuation of 3400 citizens and damaged numerous structures. Another factor of the 2007 flood was that it caused a sanitary sewer treatment plant in a neighboring town to overflow; leading to widespread contamination issues. The total impact of the 2007 flood cannot be ascertained as many issues are continuing to be litigated today. The floods have varied in magnitude; however, each posed a significant impact on the safety of the citizens, and greatly challenged the City's infrastructure (K. W. Mitten, 2009).

In regards to fires caused by arson, Chief Mitten (personal communication, January 20, 2009) discussed an eighteen month period in the early 1980's when there were six major fires that were determined to be arson in origin. The State Fire Marshal's Office and the Department of Alcohol, Tobacco, and Firearms were requested to investigate and seek convictions of the offenders. In total, there were six fires that caused an estimated nine million dollars in damage. As a result, the City has adopted ordinances to require fire sprinkler systems in all commercial occupancies greater than 5000 square feet, and uses a codified fire prevention inspection program to minimize the risk of fire to the community. As compared to the \$9 million in losses from the fires in the early 1980's, Mitten identified that the average fire losses for the last three years is \$1.8 million within the City. Chief Mitten also identified that there have not been any structures lost within the City as a result of a wildland fire. Mitten stated that the weed abatement program started in the late 1980's. MFD record management system (MFD, n.d.) data revealed that the Department is typically required to issue notices against approximately two thousand properties. As a result of foreclosures and incomplete construction projects, the department

served 3750 notices in 2007 and 3682 in 2008. The MFD was also required to abate one hundred thirteen properties in 2008. According to the MFD Fire Marshal Bryan Donnelly (personal communication, January 21, 2009), it is anticipated that the impact on the Department will be significantly greater in 2009.

In the early 1970's, the City of Merced was greatly impacted by an influenza epidemic that impaired the fire department's ability to fulfill its mission (K. W. Mitten, personal communication, January 20, 2009). According to Chief Mitten, the outbreak was so extreme that all personnel were polled each morning and requested to rate how they felt on a scale of one to ten. Personnel who were five or above were directed to report to duty where they spent the shift in bed, except for responding to emergencies.

In regards to technological emergencies, Merced Fire Chief, Ken Mitten (personal communication, January 20, 2009) revealed that in the early months of 1998 twenty-six cars of a southbound Union Pacific cargo train derailed within the city limits of Merced. The incident occurred in heavy fog, and response times were extended due to difficulty locating the incident. The train only consisted of refrigerator and box cars; no hazardous materials were being transported. In regards to potential significant hazardous materials incidents, Chief Mitten stated that this was a near-miss and would have been much worse if hazardous cargo was being transported.

The third step is a result analysis of existing raw data identified in the literature review, survey, and interviews contained herein. These results focus on the areas of risk, risk assessments, and risks that could affect the vitality of Merced. This step is designed to answer the two research questions: what are the preferred methods for conducting community risk assessments? And, what are the possible and probable community risks that would affect the

safety and stability of the City of Merced? Risks that are identified as being improbable or impossible to occur within Merced or are categorized as being a “low risk” to the community have been excluded from these results so as to focus on the risks that pose a realistic threat to the vitality of the community.

Based on the research and analysis of processes, the development of the risk assessment for the City of Merced is based on the compilation of an exhaustive list of all possible risks to the community. Based on the research and input from numerous references, the listing of risks is organized into general classes: natural caused, human caused, and technology caused (Indian River County, 2007; NFPA, 2004; NFPA, 2007; Schmidt, 2008). Next, the risks will be analyzed, as applicable, to identify who, what, where, when, and how the City is at risk. The risk assessment is organized in to a matrix to aid the assessor with the analysis and to provide an easy to read reference for city employees and community groups (see Appendix E for the 2009 City of Merced Community Risk Assessment).

Natural caused risks that pose a realistic threat to the City and are categorized as moderate, high, or extreme risks are: earthquakes, floods, heat/cold, pandemic/epidemic, thunderstorms, tornadoes, tropical storms, and wildland fires.

Earthquakes are a very real threat for all Californians. As identified by the USGS (2008b) there is an almost 100% certainty that a significant earthquake will strike the State within the next 30 years. Further assessment has identified that the City of Merced, being in the middle of the Central Valley is a sizeable distance from any known active seismic fault (CGS, 2003a; 2003b). In terms of what is at risk, all citizens and visitors are at equally at risk, with the only exception being the specific indoor or outdoor location where someone is present when the predicted earthquake strikes. Public and private structures are all at risk, with a variation applied

due to the age of the structure and construction materials used to build it. Additionally, transportation routes and infrastructure are also at risk of damage. As noted in the Literature Review, there are not any identified seismic faults with the Central Valley, therefore the impact on Merced will be greatly influenced by the magnitude of the event and the distance the epicenter is from the City (CGS, 2003c). A major earthquake is predicted to strike California within the next thirty-years; although science and technology have dramatically improved, it is not possible to accurately predict the specific timing or magnitude of the event (USGS, 2008b). Merced will possibly be impacted by falling objects, collapsing structures, transportation routes being disrupted, and possible hazardous materials releases. Based on the number of earthquakes that strike California on a daily basis, the frequency of the risk is identified as high; however, based on the distance the City is from a seismic fault, the potential severity is low. Overall, earthquakes pose a moderate risk to the City of Merced.

Based on the history of events that have impacted Merced and the data obtained through research, flood events are nearly certain to impact the City again in the future. According to Fire Chief Ken Mitten (personal communication, January 20, 2009), floods have caused millions of dollars worth of direct and indirect damage to the City over the last decade. While proactive actions have been put into place to reduce the impact of damage from floods, the City exists within a floodplain (FEMA, 2008). Flood events place civilians, pets, property, crops, and livestock at risk for injury, death, or damage from the static and swift water conditions that will most certainly exist. The Floodplain Map (FEMA, 2008) identifies all areas south of Bear Creek, including the downtown area, to be directly at risk. Further, the areas along north Highway 59 will also be greatly impacted. While it is not possible to accurately predict when a flood event will occur based on the data from the most recent events, it can be assumed that a flood will

occur, on average, every two and one-half years. Floods will impact the City by inundating certain areas with an overwhelming amount of water resulting in injuries/death, displacement, property damage, and impaired infrastructure. Based on the frequency that floods have impacted Merced as compared to other natural risks, the frequency of the risk is categorized as high. The degree of severity is categorized as high as a result of the data of recent events as compared with the potential impact flood could have on the City. Overall, floods pose a severe risk to the City of Merced.

According to Meteorologist Cindy Bean (personal communication, November 13, 2008) California, specifically Merced, exists in an area that experiences four distinct seasons per year. As such, the City experiences mild temperatures in the spring and fall, some freezing temperatures in the winter, and extreme heat in the peak summer months. The National Weather Service (2005) and the Centers for Disease Control and Prevention (2006) have identified that hundreds of Americans succumb to the exposure to heat on an annual basis. Fortunately, in recent years there have not been any fatalities within the City as a result of heat exposure (MFD, n.d.). All segments of society are at risk from extreme temperatures; however, it is the elderly, young, and homeless that are most at risk. Also at risk is the infrastructure of the City, including power grids that supply electricity to Merced. All areas of the City are equally at risk when temperature extremes exist; there are not any topographical changes or influences that can create significant temperature changes from one side of the City to another (C. Bean, personal communication, November 13, 2008). Based on the large number of days that Merced experiences extreme temperatures on an annual basis, the frequency of the risk is identified as high; however, based on the proactive efforts by the City and the lack of any fatalities due to

extreme temperatures, the potential severity is low. Overall, extreme temperatures pose a moderate risk to the City of Merced.

In recent years, the potential for a Bird Flu pandemic has been greatly discussed throughout the United States (Bird Flu Manual Online, 2007). The Bird Flu Manual Online (2007) stated that a pandemic occurs when an illness spreads at an exponential rate and impacts humans on a global scale. The City of Merced (2007) and Merced County (2006) identified a pandemic as being a credible threat to the community. All segments of society will be either be directly or indirectly affected by a pandemic (CDC, 2007). A widespread pandemic will result in a lack of critical resources due to the illness, which will greatly exacerbate the impact. Influenza outbreaks occur annually in the winter months: some years the extent and severity of the viral strain are much worse than others. The CDC predicts that a bird or avian strain will result in countless fatalities and overtax the medical and emergency response industries. Based on the regularity that viruses and influenza run their courses in the United States and California, the frequency of the risk is identified as high. However, the frequency of a pandemic or epidemic is very low; therefore the frequency for this risk is low. Based on the projected rates of spread and degree of illness, the potential severity is high. Overall, pandemic/epidemics pose a high risk to the City of Merced.

Thunderstorms occur in California throughout the year, regardless of the month or degree of heating. Unstable air masses, in conjunction with thermal and/or orographic lifting mechanisms, cause stratocumulonimbus cloud development and enable thunderstorms to mature (C. Bean, personal communication, November 13, 2008; NWCG, 2008). Anyone who is outside when an active thunderstorm is passing overhead is at risk from lightening strikes and will be subjected to strong, gusty winds and potentially heavy precipitation (NWCG). Furthermore,

thunderstorms pose a significant fire risk. On June 21, 2008, more than 3000 wildland fire were ignited throughout the northern part of California as a result of a large, unstable, air masses and widespread dry thunderstorms with lightening strikes (C. Bean, personal communication, November 13, 2008; CAL-FIRE, 2008; NWCG, 2008). Based on the ability of thunderstorms to develop at any time of year and the semi-regular frequency in which they develop, the frequency risk is high; however, based on the lack of open grasslands within the City and the flat terrain, the severity is low. Overall, thunderstorms pose a moderate risk to the City of Merced.

Surprisingly, tornadoes pose a significant risk to the City of Merced. Tornadoes are most commonly identified as occurring within the “Tornado Alley” in the mid-western states; however, the Central Valley experiences fairly large numbers of tornadoes (Edwards, 2005). The Tornado Project (n.d.) identified that eleven tornadoes touched down in Merced between 1880 and 2000, one every 10.9 years; therefore the frequency risk is low. Although the tornadoes that touched down in Merced were low in intensity, damage occurred. Today the population density and number of structures are greater than they ever have been; however, the low intensity of the tornadoes poses a low severity risk. Therefore the overall the risk posed by tornadoes is low.

A tropical storm is defined as storm that manifests with sustained winds that range from 39-73 miles per hour (NWS, 2008). Approximately eighteen tropical storms are developed over the Pacific Ocean on a yearly basis; only one tropical storm has ever been recorded to have made landfall in California (Williams, 2005a). This is attributed to the cold temperature of the Pacific Ocean water and the jet stream that moves from east to west within the tropics (C. Bean, personal communication, November 13, 2008; Williams, 2005b). This is the same reason that hurricanes are an improbable occurrence in California. As a result of the research, tropical storms and hurricanes are identified to be a low risk to the City of Merced.

In contrast to tropical storms, wildland fires pose a very real threat to the City of Merced. Although the terrain is flat, Merced is surrounded by grasslands that contain thousands of acres of light, flashy, grass fuels, and is subject to moderate afternoon winds that drive fires (Google, 2009a; NWCG, 1982). The risk of wildland fires within the city limits has been greatly reduced as a result of an aggressive weed abatement program; since the 1960's there have not been any structure or life losses as a result of wildland fires (K. Mitten, personal communication, January 20, 2009; MFD, n.d.). Civilian, pets, and livestock that reside in proximity to open lands are most at risk to the effects of a wildland fire. Crops, structure, outbuildings, and outside storage areas are also at risk. As noted above, the weed abatement program has all but eradicated wildland fires from within the city limits; however all properties in on the outer edges of the City are directly at risk. Based on the fuel models of short and tall grass, the fuels become receptive to fire in the late spring and continue well into the autumn months (NWCG, 1982). The frequency of wildland fires in and about the City of Merced is high, but the severity is low due to the weed abatement program and response times. Overall the risk from wildland fire to the City of Merced is moderate.

Human caused risks that pose a realistic threat to the City and are categorized as moderate, high, or severe risks are: agroterrorism, civil disturbances, gang activity/crime, immigration crisis, and terrorism.

Agroterrorism, although the concept has been around since the early ages, has moved up the list of terrorist priorities in recent years. Agroterrorism is a result of intentional acts, which are intended to destroy crops and/or livestock to ultimately disrupt food supply chains (Cain, 2001). Typically, chemical or biological agents are used to impose this type of terrorism on the population. Direct costs include the loss of food products, such as crops and livestock, and the

revenue associated with the loss. Indirect costs include the lack of confidence in food producers, distributors, and the government for not keeping food safe (Cain). Agriculture is a relatively vulnerable target because the crops and livestock are produced in open, unsecured, fields that exist in concentrated agricultural areas (Monke, 2004). Agroterrorism poses a risk to ranchers, farmers, and the consumers of the agricultural products. The threat is a risk to all crops and livestock in and around Merced as well as the entire Central Valley. As with all types of terrorism, the ability to predict timing is all but impossible (A. Stover, personal communication, October 29, 2008). The frequency of a agroterrorism event is low, on the other hand, the severity from an event has the potential to be extremely high. Overall the risk associated with agroterrorism to the City of Merced is high.

Civil disturbances, although rare in occurrence, impact a community for many years following the event. Take for example the Rodney King Riot or the Watts Riot and the reputation they continue to impose today (Gutierrez et al., 2002). Civil disturbances typically follow a catalyst or event that has lead to an emotional outcry by a segment of society. Anyone and anything that is present in the area of the disturbance is directly at risk for harm. The frequency of civil disturbances is very low; though the severity of the event can impact a community for many years to come. Based on the low frequency and high severity of civil disturbances to the City of Merced, this risk is identified as high; however, the probability of occurrence is remote.

While gang activity continues to exist in all regions of the United States and in the Central Valley, interviews with Federal Bureau of Investigation (FBI) Special Agent Anthony Stover (personal communication, October 28, 2008) and Merced Police Department Commander Floyd Higdon (personal communication, September 27, 2008) explained that a preponderance of gang violence and crime is targeted at other gangs and gang members. While innocent citizens

are sometimes directly affected, they are not typically the target of the activity. 32.1% of the respondents to the community risk survey identified gang activity as a top concern. The National Alliance of Gang Investigators Association (2005) identified that a majority of gangs are deeply involved in drug trafficking and 44% are associated with organized crime. While gang activity statistics are down from previous years, the frequency remains high (Higdon, personal communication, September 27, 2008). Major crime statistics are available for Merced, but they do not differentiate gang activity from other types of criminal activity (MPD, 2008). The potential severity of direct and indirect risks associated with gang activities is also high. Overall, the level risk to the City of Merced created by gang activities is severe.

Illegal immigration has been increased to crisis levels in recent years (Johnson, 2006). While there are direct benefits to the illegal immigration crisis, the negative impacts far outweigh any positives. One out of seven U.S. jobs are being filled by illegal immigrants, yet they continue to live below the poverty line and thereby impact the financial stability of the community through a lack of tax generation, an increase in education expenses for their children, and increased healthcare costs (Johnson; Wagner, 2007). All Merced citizens are potentially at risk from the effects of illegal immigration. Businesses, governmental agencies, and the stability of the local and state economies are also at risk. The potential frequency and severity of risk from illegal immigration is high. Overall, the risk to the City of Merced for illegal immigration is severe.

Terrorism, in general, has been brought to the forefront since the tragedies of September 11, 2001. Terrorism can exist in many forms, but the intent remains the same: accomplish an end through the instillation of fear in those who oppose or block the progress of the terrorist sect. As identified from interviews with Fire Chief Ken Mitten (personal communication, January 20,

2009) and FBI Special Agent Stover (personal communication, October 29, 2008), although the City of Merced has some targets of special interest, such as the U.C. Merced, it has not been categorized as a prime target for terrorism. Stover (2008) cautioned that terrorist sects all have different motives and intents; therefore terrorism cannot ever be ruled out entirely. Based on the potential for terrorism of different types and motives, all areas of Merced are at risk, but the frequency of such an occurrence is low. Overall the risk of terrorism to the City of Merced is high.

Technology caused risks that pose a realistic threat to the City and are categorized as moderate, high, or extreme risks are: airport/aircraft, dam failures, urban fires, highway, pipelines, railway, and utilities.

The City of Merced is the home of the Merced Municipal Airport, which is an Federal Aviation Administration (FAA) approved facility for a small commercial carrier. A majority of aircraft traffic is small, private planes, with some larger business planes using the airport for visitors to access Yosemite National Park. Since the airport was developed there have been seventy-seven aircraft incidents, eight of which suffered fatalities. Since the closure of Castle Air Force Base in the early 1990's the risk from aircraft has greatly diminished (NTSB, 2008). Persons and structures that exist within the flight paths are at risk from a downed aircraft; based on the size of the aircraft that frequent the airport, this risk is low. Further, based on historical data, the frequency of aircraft incident is approximately one per year. This statistic includes all types of aircraft incidents: from crashes to minor mechanical failures. The frequency of the risk is low. Overall the Merced Municipal Airport poses a low risk to the City.

The City of Merced exists in the inundation area for two dams. Should one or both of them fail the City would suffer widespread flooding, which would result in property damage and

possibly fatalities (City of Merced, 1995). Fortunately for Merced, both the Lake Yosemite and Bear Reservoir dams are earthen-fill constructed (DWS, n.d.). FEMA (n.d.) identified that earthen-fill dams are the most flexible and reliable form of dam for the type of application they are being used for outside of Merced. The greatest vulnerability of these types of dams is overfilling. Should a torrent of precipitation strike north or east of Merced, these bodies of water could quickly rise and result in an overflow situation where the integrity of the structures would be compromised. The areas of greatest concern of flooding from the dam failure would be the same as those areas identified in the flood section of the Literature Review. Civilians, pets, livestock, public and private properties, infrastructure, and crops are all potentially at risk should a dam fail. The timing of the failure will be either during or immediately following a torrential rainstorm. Based on the technology, workmanship, and quality of materials, dam failures are very rare; the frequency is low. Conversely, should a dam fail, the severity would most likely be high. Overall, the risk of dam failure pose on the City of Merced is high.

All citizens and businesses are at risk for fire. The degree of the risk varies based on engineered and administrative controls that are in place. In the early 1980's the City suffered from a rash of arson fires that caused more than nine million dollars in damage (K. Mitten, personal communication, January 20, 2009). Soon thereafter, the City adopted an ordinance to require automatic sprinkler systems for all commercial occupancies that exceed five thousand square feet. Most residential fires within the City are a result of cooking or unattended cooking; this statistic is consistent with the national average (FEMA, 1997; MFD, n.d.). While the frequency of structural fires within the City remains high, the severity is low as a result of short response times and aggressive fire attack operations. Overall, the risk to the City from structural fires is high.

Accidents on highways and roadways are a regular occurrence; however a vast majority of these do not pose a risk to the City as a whole. With three highways passing through the City, a large array of commodities and types of vehicles travel these routes on a daily basis (California Partnership with the San Joaquin Valley Transportation Work Group [CPSJVTWG], 2007). Specifically, citizens and over-highway carriers are most at risk, while interstate commerce and travel routes could be greatly affected from a significant event. Historically, it has been heavy fog and excessive speed that have resulted in major incidents that have posed risk to Central Valley towns. According to Chief Mitten (personal communication, January 20, 2008) it has been several years since a major pile-up has occurred within the City. Based on the potential for a major collision and/or hazardous materials release as a result of highway incidents, the frequency is high. The potential severity for highway incident is also high. Overall, highway incidents pose a severe risk to the City of Merced.

Two major high-pressure natural gas distribution pipelines pass through the City of Merced within the Burlington Northern-Santa Fe Railway and the Union Pacific Railway easements (EIA, n.d.; PG&E, 2006). The pipelines are six inches and eight inches in diameter, respectively. The pipelines transport high pressure natural gas to communities throughout the State of California. From these pipelines, connections are made and the pressure is reduced to provide gas distribution services to the communities. Should an incident occur that either breaches or compromises the integrity of the pipelines, many of the citizens within the City would become affected. Such an incident would greatly affect businesses, the railways, highway transportation routes, and the environment. Based on the rare occurrence of pipeline incidents and the significant impact that these types of incident pose to communities, the overall risk to Merced is high.

According to the Federal Railroad Administration ([FRA], 2009), two railway easements exist in the City of Merced. One easement is used by the Union Pacific Railway (UP), and the other is shared by the Burlington Northern-Santa Fe Railway (BNSF) and by Amtrak. FRA (2009) revealed that during 2008, BNSF carried various types and quantities of cargo a total of 157,098,605 miles. The FRA (2009) safety records for BNSF identified that the carrier is involved in 0.91 track related accidents for every one million miles it travels. On average, forty-five BNSF trains pass through the 6.65 miles of track in Merced on a daily basis. Similarly, the FRA (2009) identified that UP traveled a total of 154,925,754 miles in 2008 and is involved in 1.28 track related accidents for every one million miles it travels. On average, twenty UP trains pass through the 5.60 miles of track in Merced on a daily basis. Analysis of the data identified that BNSF travels 299.25 miles per day through Merced. Therefore it will take BNSF 3341.69 days to reach one million miles on the stretch of track within the City limits. At a rate of 0.91 accidents per one million miles traveled, the frequency of a track related accident by BNSF will occur once every 3672.19 days or 10.06 years, on average. Similarly, UP travels 112 miles per day through Merced. Therefore it will take UP 8928.57 days to reach one million miles on the Merced tracks. At a rate of 1.28 track related accidents per one million miles traveled, the frequency of a track related accident by UP will occur once every 6975.45 day or 19.11 years. Conversely, the severity of a railway accident can be extreme, resulting in fatalities, hazardous materials releases, fire, explosions, and extensive property damage. Additionally, the railway will be close for the transportation of goods for an extended period of time. Overall, the risk that the railways pose to the City of Merced is high.

Electrical utilities and distribution systems have numerous vulnerabilities: lines run through unprotected areas, poles are subject to damage by weather and collisions, wind and

weather greatly affect power distribution grids (Glenn, 2008). Power outages occur in and around Merced on a regular basis. The outages are typically caused by downed lines or by a transformer failure due to a system overload. While the frequency of power outages is high, the severity is quite low as most impairments last less than one-hour and result in little to no permanent damages. Overall, power outages can pose an extreme inconvenience; however the risk is moderate based on the frequency and severity of the occurrences.

The City of Merced and the Fire Department have a solid history and reputation of being progressive and aggressive organizations, and their members pride themselves in getting the job done to the best of their ability. Furthermore, the City of Merced has a very proactive and professional approach to emergency preparedness and management. It is the author's experience that the management of the City is diligent about meeting the expectations and mandates that are imposed by outside forces; however, mechanisms to ensure the ongoing follow-through, training, and plan revision need to be reinforced. The strategic aspects of this project are to not only identify the possible and probable risks, but to also to identify mechanisms and processes to ensure the employees of the City remain informed and involved in regular training sessions. *America Burning* (National Commission on Fire Prevention and Control, 1973) stated that Americans tend to be complacent when it comes to the threat of fire impacting their lives. NFPA 1600 (2007), Schmidt (2008), Foley (2005), and Harrald (2005) all concur that risk management and emergency preparedness cannot stop once the assessment and plan are completed. Ongoing training, education of stakeholders, reevaluation of risk, evaluation of effectiveness, and plan revisions are the minimum actions that should occur at least annually. The survey of City employees identified that most respondents do not know where to locate a copy of the Emergency Operations Plan; it can be assumed that they most likely do know what is contained

in the Plan or what to do in the event of a widespread emergency. Additionally, the survey revealed that there is a direct disconnect between what the employees believe the top risks to the City to be and what top risks are identified. As revealed in *American Burning* (National Commission on Fire Prevention and Control), *America Burning: Revisited* (USFA), and *Vision 20/20* (Institution of Fire Engineers) success in addressing the fire problem, or any other threat to the community, must be a collaborative effort between all stakeholders.

Discussion

The purpose of this research is to conduct a strategic community risk analysis that identifies the possible and probable emergency incidents within the City of Merced to be used to maintain the knowledge base of City employees and to augment the City's Emergency Operations Plan (EOP). The research has identified that there is a gap between the perceived risk and the actual risk within the City of Merced. This research project has proven to have one core limitation: the ability to accurately determine the frequency and severity of a specific risk. This question proves the message articulated by RHAVE (FEMA, 2001) and *The Lack of Disaster Preparedness by the Public and It's Affect on Communities* (Wilson et al., 2008): statistics and data do not exist for events that have not yet occurred. Additionally, the extent of risk in any of the events identified in the research can be greatly influenced and affected by human interaction.

The first research question asks: What are viewed as the leading community risks that are most concerning to Merced City employees? The purpose of this portion of the research was to establish a baseline of knowledge and understanding by the City of Merced employees as compared to results of the Community Risk Assessment. Many aspects of the survey affirmed data obtained in the literature review: a codified mechanism to ensure employees are informed and received regular training in emergency preparedness does not exist. Past and present versions

of the Emergency Operations Plan (EOP) do not outline the need for training, recurrent training, drills, exercises, or evaluations (City of Merced, 1993; 2003). A troubling 54.5% (61) of the respondents to the survey do not know where to obtain a copy of the EOP, and 49.1% (55) stated that they have never received any training about the Plan. The only formal training identified for any City employees in regard to emergency preparedness is the National Incident Management System (NIMS) and the Incident Command System (ICS) classes that are required by Presidential Directive (S. Raney, personal communication, October 27, 2008). The recent retirements of department heads and other management staff, plus the lack of a codified training and evaluation system, corroborates the answers that were provided in the survey. The analysis of this data has identified a deficiency that requires immediate action to bring the City's emergency preparedness program into a state of operational readiness. Donald Schmidt (2008) identified that all stakeholders need to be involved from the beginning of the planning process, otherwise, they cannot be expected to perform at an acceptable level.

The second research question asks: What types of significant emergency incidents have historically impacted the City of Merced and what were their outcomes? The purpose of this question is to build upon the data obtained in question one, as well as to establish a foundation of potential risks through the assessment of incidents that have previously affected Merced. Personal interviews are the greatest source of information for this question. Outside of the National Fire Incident Reporting System (NFIRS) (MFD, n.d.) records, written information are not available to define what has occurred nor do any records corroborate the information obtained in the interviews. The results of this question reveal that floods, urban fires, influenza outbreaks, and transportation incidents have posed the greatest risk to the City over the last thirty years (K. W. Mitten, personal communication, January 20, 2009). While the MFD responds to all

types of emergency incidents, most are routine situations that are mitigated within a very short period of time (MFD, n.d.). The flood events have ranged from a short-duration event (12-hours), to an extended operation where hundreds of civilians were evacuated and the City's Emergency Operations Center (EOC) was activated to effectively manage the situation.

According the Fire Chief Mitten (personal communication, January 20, 2009), the magnitude of previous incidents has stressed the capabilities of the MFD, City staff, and infrastructure. The outcome for each was successful: no lives were lost and property damage was minimized.

The third question asks: What are the preferred methods for conducting community risk assessments? The purpose of this research question is to identify the best methodology to further assess community risk so as to expand upon the previously identified knowledge base. The results to this question are based on the analysis of information that was obtained in the Literature Review section of this project. The City of Merced Emergency Operations Plan contains a brief section that provides a generic risk assessment for the City (City of Merced, 2003). It briefly touches on what risks may affect Merced, but does not indicate the degree of risk each poses. The research to this question is subcategorized into: general information about risk, and the components of a comprehensive risk model. The research for this question identified a plethora of data on risk; too much to be included in this project. However, the most common and relevant philosophies and approaches are captured herein. *Managing Risk* (Grose, 1987), *Risk Management in the Fire Service* (USFA, 1996), and *Prove It!* (Crawford, 2008) all agree that an assessment must be based on factual data; if any of the data is not accurate or complete, then the results of the assessment will be faulty. Jablonowski (2002) concurs with the previous statement, but adds that the credibility of the assessor also affects the results of an assessment. A large number of references state that a risk assessment needs to begin with an

exhaustive listing of all possibilities, which will be refined through an assessment to identify the probabilities (Carson, 2008; CFAI, 2001; Crawford; FEMA, 2001; Five County Association of Governments, 2007; Governor's Office of Homeland Security, 2008; Granito, 2004; Grose; Indian River County, 2007; Institution of Fire Engineers, 2008a, 2008b; NFPA, 2004; NFPA, 2005; NFPA, 2007; Schmidt, 2008; USFA, 2000; USFA, 2008; University of Cape Town, 2006). Further, a majority of these references suggest categorizing the potential risks into smaller categories so as to improve the organization and administration of the assessment. The Indian River County Emergency Plan (2007), *Disaster and Defense Planning* (USFA, 2000), NFPA 1600 (2007), *Planning for Disasters* (Schmidt), and *Strategies for Community Risk Reduction* (USFA, 2008) all recommend categorizing the risks into: natural caused, humans caused, and technology caused. To identify if a situation poses a risk, the assessor must determine what, if anything, is at risk. The method recommended by the Workshop on Community Risk Assessment (University of Cape Town) is an integral component of the risk assessment contained herein. This method applies five questions to each possible risk: who is at risk, why are they at risk, what is increasing the risk, when are they most at risk, and how does the community manage its risk? These questions establish the foundation for the assessment; however they have been adjusted to meet the needs of Merced. The changes to the questions are as follows: who is at risk, what is at risk, where is the risk greatest, when is the risk most likely to occur, and how does the risk affect the community? Lastly, a risk assessment needs to identify the degree of risk that each threat poses. To accomplish this, the recommendations by *RHAVE* (CFAI, 2001), *Disaster and Defense Planning* (USFA, 2000), NFPA 1600 (2007), *Planning for Disasters* (Schmidt), and *Strategies for Community Risk Reduction* (USFA, 2008) are applied to the assessment. Each of these references recommends a risk assessment tool that is similar to the

one demonstrated in Appendix A. The purpose of this tool is to assess each threat by the frequency of potential occurrence (low or high) and by the potential severity (low or high). As a result of this assessment, each threat can be categorized as a low, moderate, high, or severe risk to the community. Most threats that have been categorized as a low risk have been excluded from this project for brevity and application purposes.

The fourth question asks: What are the possible and probable community risks that would affect the safety and stability of the City of Merced? The purpose of this question is to apply the information acquired thus far, to develop a complete risk assessment for the City of Merced. The final result of this question is the development of a matrix that can be used to augment the City's Emergency Operations Plan and to educate City employees (see Appendix E – 2009 City of Merced Community Risk Assessment). The research for this question includes the development of an exhaustive list of possible risks that began with the Literature Review. The list was expanded and refined through interviews and through the analysis of data obtained from the MFD NFIRS reports (n.d.). Many of the possible risks are identified as improbable or of low risk and were excluded as they are outside the scope of this research: threats that can affect great portions or the entire City of Merced. The risks that were excluded from the research include, but are not limited to: fuel spills, routine vehicle accidents, emergency medical services responses, and technical rescue incidents. Of the twenty threats that are identified to pose a reasonable degree risk to the City, four pose a severe risk and seven pose a high risk. The threats that pose a severe risk are: floods, gang activity/crime, illegal immigration, and highway events. The threats with a high degree of risk are: pandemic, agroterrorism, civil disturbances, terrorism, dam failures, pipelines, and railways. Interestingly, the City employees identified the following as the top risks to the community, in rank order: flood, gang activity, railway, economy, crime,

transportation, fire, and hazardous materials. The results of the survey for this question are much closer to actuality than initially expected. A limitation identified in the data analysis of this step is in regard to low frequency, high severity threats. By definition, these types of the threats pose a high degree of risk. For some of the threats the potential for occurrence is possible but not probable; however the magnitude of the occurrence would be extreme. In these instances it is not possible to effectively apply the risk assessment tool as the frequency and impact are at extreme ends of the spectrum. Therefore, the City should address the planning and training processes for these types of incidents based on their potential to greatly affect the community.

The fifth question asks: What actions are needed in order to ensure the knowledge base of City of Merced employees and citizens is maintained? The strategic aspects of this project is to ensure the City is prepared to prevent and/or mitigate events that could greatly impair the community for extended periods of time. *America Burning* (National Commission on Fire Prevention and Control, 1973, p. x) stated: “The Nation’s fire problem is the indifference with which Americans confront the subject.” *Vision 20/20* (Institution of Fire Engineers, 2008, p. 4) states: “Despite significant progress in the last 30 years, the United States still has one of the worst fire loss records of the industrialized world.” It is the responsibility of the leaders to take a proactive stance and force a paradigm shift: communities need to be better prepared, not because of a Presidential Directive, but because they want to be prepared. This difference is the essence of the *America Burning* quote above. Whether it is based on denial or a false sense of security, every community needs to educate and motivate their citizens to become more aware of the actual risks so that preventative measures can take place. As an example, this author suggests that not many citizens or City employees would believe that the United States has one of the worst fire loss records in the industrialized world (Institution of Fire Engineers, 2008)?

Education should not just be limited to the prevention of cooking fires; rather, civic leaders need to educate the citizens to not build their homes in a floodplain, instead of teaching them to use sand bags. This is not always realistic, but it should be the vision all stakeholders strive for. In *Collapse*, Jared Diamond (2004) presents case after case where societies failed to see or understand the big picture. There are a plethora of resources available for communities to disseminate information and to educate the citizens and employees. Some can be quite costly, while others are practically free: such as a blog or website. Regardless of the mechanism, education must occur, sooner than later; complacency is a hazardous attitude that affects all.

Recommendations

The results of this community risk assessment applied research project identify that immediate action is necessary to correct the misconceptions, Emergency Operations Plan (EOP) deficiencies, and the lack of training and drills. The recommendations contained in this report are inclusive of the following process: analysis, planning, implementation, and evaluation. The issue, identified as the problem of this research project, is the loss of knowledge through attrition within the City of Merced. The project identifies the root cause of the problem to be a combination of a lack of review and validation processes for the EOP and a lack of realistic and pertinent training. The options to address this issue were numerous; the challenge is in the paring down and prioritization of the options to determine the best course of action for the City. The best options and the recommended plan of action are as follows:

First, establish a set schedule to regularly review, revise, and validate the City of Merced Emergency Operations Plan (EOP). The EOP should be a living document, whereby, it is reviewed and revised regularly or whenever something within the City or County changes. A failure to do so, will result in the Plan becoming dated and obsolete. How can a community

expect a paradigm shift to make the citizens passionate about emergency preparation, if the overall guiding document is out of date?

Second, to develop a solid understanding of what risks the City faces, the risk assessment needs to be regularly reviewed and updated. Most importantly, the assessment needs to be published so that all stakeholders can maintain awareness about the actual risks. A current and valid risk assessment is needed to be able to train and prepare accordingly.

Third, the City needs to establish a codified employee training program that is designed to enhance the knowledge base in regards to community risk and is designed to accomplish two purposes: increase the overall sphere and scope of knowledge, and to enable the paradigm shift to create a codified emergency preparedness culture. The scope of the training needs to include community risk and planning. It also needs to enhance the emergency response training, to include: emergency operations center activities, planning functions, logistical support functions, finance/administration functions, and enhance the documentation of incidents.

Fourth, the City needs to increase the frequency and complexity of planned and spontaneous drills and exercises. Currently, the City conducts annual drills; however they do not adequately prepare the stakeholders, nor do the exercises effectively evaluate the effectiveness of the system.

Last, an assessment of the EOC organization needs to occur at least annually. Technology, process, procedures, and requirements are constantly evolving and changing. The goal of the EOC is to maintain the highest level of operational preparedness and readiness as possible. Therefore, ongoing assessments should be completed in the form of a gap analysis to identify what actions, if any, need to be made in order to achieve the desired level performance.

References

- American Red Cross (n.d.). *Preparing for events: Floods*. Retrieved January 19, 2009, from <http://www.redcross.org/portal/site/en/menuitem.86f46a12f382290517a8f210b80f78a0/?vgnextoid=fdb4510f935ea110VgnVCM10000030f3870aRCRD&vgnextfmt=default>
- American Red Cross. (2001). *Fact sheet: Safety information for short-term power outages or “rolling blackouts”* [Fact sheet]. Retrieved from <http://www.redcross.org/portal/site/en/menuitem.86f46a12f382290517a8f210b80f78a0/?vgnextoid=4b0d6b9128c2b110VgnVCM10000089f0870aRCRD&vgnextfmt=default>
- American Red Cross. (2001). *Terrorism: Preparing for the unexpected* [Brochure]. Washington D.C.: Author.
- Association of American Railroads. (2008). *Rail freight volume off slightly* [Press release]. Retrieved from <http://www.aar.org/pressroom/pressreleases/2008>
- Bird Flu Manual Online, (2007). *Bird flu home preparedness manual*. Retrieved from Bird Flu Manual Online: www.birdflu-manual.com
- Bureau of Labor Statistics. (2008). *Unemployment Rates for Metropolitan Areas Monthly Rankings: September 2008* [Data file]. Available from Bureau of Labor Statistics Web site: <http://www.bls.gov/web/laummtrk.htm>
- CBS5 (2008). *NorCal wildfires burn, torch 32 Stockton homes*. Retrieved October 26, 2008, from <http://cbs5.com/local/stockton.homes.burned.2.744985.html>
- CNN (2003). *Major power outage hits New York, other large cities*. Retrieved January 18, 2009, from <http://www.cnn.com/2003/US/08/14/power.outage/>
- Cain, S. (2001, September 24). *Agroterrorism*. West Lafayette, IN: Purdue University.

California Department of Forestry and Fire Protection (2001). *Characterizing the fire threat to wildland-urban interface areas in California*. Sacramento, CA: Author.

California Department of Forestry and Fire Protection. (2008). *CAL FIRE incident information* [Fact sheet]. Retrieved from http://www.fire.ca.gov/index_incidents_info_page3.php

California Department of Water Resources. (n.d.). [Awareness floodplain mapping: Floodplain boundaries - Merced County]. *Merced Quadrangle*. Retrieved from http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/awareness_floodplain_maps/merced/merced.cfm

California Geological Survey. (2003). *Earthquake shaking potential for the San Francisco Bay region* [Fact sheet]. Retrieved from <http://www.conservation.ca.gov/cgs/Pages/Index.aspx>

California Geological Survey. (2003). *Earthquake shaking potential for the central coast region* [Fact sheet]. Retrieved from <http://www.conservation.ca.gov/cgs/Pages/Index.aspx>

California Geological Survey. (2003). *Seismic shaking hazards in California* [Fact sheet]. Retrieved from <http://www.conservation.ca.gov/cgs/Pages/Index.aspx>

California Partnership with the San Joaquin Valley Transportation Work Group (2007, April 4). *Meeting summary*. Retrieved from California Partnership for the San Joaquin Valley: http://www.sjvpartnership.org/uploaded_files/WG_doc/04_04_07TransportationWGMeetingSummary.pdf

California Research Bureau. (1997, August). *A statistical tour of California's great central valley* (CRB-97-009). Sacramento, CA: Author.

California electricity crisis. (n.d.). Retrieved January 25, 2009, from Wikipedia: http://en.wikipedia.org/wiki/California_electricity_crisis

Cao, T., Bryant, W. A., Rowshandel, B., Branum, D., & Willis, C. J. (2003, June). *The revised 2002 California probabilistic seismic hazard maps*. unknown: Author.

Carson, B. (2008). *Take the risk; Learning to identify, choose, and live with acceptable risk*. Grand Rapids, MI: Zondervan.

Castle Air Museum (2006). *History*. Retrieved January 20, 2009, from <http://www.castleairmuseum.org/>

Centers for Disease Control and Prevention. (2001). *The public health response to biological and chemical terrorism*. Washington D.C.: Author.

Centers for Disease Control and Prevention. (2006). *Extreme heat: A prevention guide to promote your personal health and safety* [Fact sheet]. Retrieved from http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp

Centers for Disease Control and Prevention. (2007). *Community strategy for pandemic influenza mitigation* [Fact sheet]. Retrieved from <http://www.pandemicflu.gov/community>

Chinese Proverb (n.d.). *Planning quotes*. Retrieved October 30, 2008, from www.thinkexist.com

City of Merced (2008). *City of Merced continuity of operations plan*. Merced, CA: Author.

City of Merced (2008). *Top non-manufacturing employment*. Retrieved October 28, 2008, from <http://cityofmerced.org/services/business.asp>

City of Merced (n.d.). *History of Merced*. Retrieved October 17, 2008, from www.cityofmerced.org/about/history.asp

City of Merced, (2003-2008). *Meeting minutes*. Paper presented at the Merced City Council, Merced, CA.

City of Merced. (1993). *City of Merced disaster plan*. Merced, CA: Author.

City of Merced. (1995, January 3). *Merced vision 2015 general plan (94-04)*. Merced, CA:

Author.

City of Merced. (2003). *City of Merced emergency operations plan*. Merced, CA: Author.

City of Merced. (2007). *Pandemic influenza plan* [Brochure]. Merced, Ca: Author.

City of Merced. (2008, July 7). *Heat wave hits: Cooling center open* [Press release]. Retrieved from <http://www.cityofmerced.org/civica/press/display.asp?layout=1&Entry=146>

City of Merced. (n.d.). *City of Merced municipal code*. Seattle, WA: Book Publishing.

Commission on Fire Accreditation International. (2001, July). *RHAVE: Risk, hazard, and value evaluation (FA 213)*. Emmitsburg, MD: United States Fire Administration.

Commission on Fire Accreditation International. (2006). *Fire & emergency service self-assessment manual (7th ed.)*. Chantilly, VA: Center for Public Safety Excellence.

Crawford, J. (2008, July). Prove it!. *FireRescue*, 113.

Davidson, A. (2006, March 30). Q&A: Illegal immigrants and the U.S. economy. *NPR.org*. Retrieved from <http://www.npr.org/templates/story/story.php?storyId=5312900>

Diamond, J. (2004). *Collapse: How societies choose to fail or succeed*. Ney York: Penguin.

Edwards, L. (2005). Spin, spin, spin. *California Climate Watch*, 1-7. Retrieved from <http://www.calclim.dri.edu>

Federal Bureau of Investigation (n.d.). *Counterterrorism*. Retrieved January 22, 2009, from <http://www.fbi.gov/terrorinfo/counterterrorism/waronterrorhome.htm>

Federal Emergency Management Agency (2001, July). *Risk, hazard, and value evaluation (FA 213)*. Emmitsburg, MD: Author.

Federal Emergency Management Agency (2008). *Flood*. Retrieved January 19, 2009, from <http://www.fema.gov/hazard/flood/index.shtm>

- Federal Emergency Management Agency. (1997, June). *Socioeconomic factors and the incidence of fire* (FA 170). Emmitsburg, MD: Author.
- Federal Emergency Management Agency. (2004, April). *Federal guidelines for dam safety: Hazard potential classification system for dams* (FEMA 333). Washington D.C.: Author.
- Federal Emergency Management Agency. (2005, May). *Federal guidelines for dam safety: Earthquake safety and design of dams* (FEMA 65). Washington D.C.: Author.
- Federal Emergency Management Agency. (2008). [Flood insurance rate map: Merced County, California]. *06047C0440G*. Retrieved from http://map1.msc.fema.gov/idms/IntraView.cgi?ROT=0&O_X=7200&O_Y=3343&O_ZM=0.060000&O_SX=462&O_SY=340&O_DPI=400&O_TH=99033725&O_EN=99177167&O_PG=1&O_MP=1&CT=0&DI=0&WD=14400&HT=10346&JX=600&JY=400&MPT=0&MPS=0&KEY=99032623&ITEM=1&BIRDS_EYE.x=86&BIRDS_EYE.y=64
- Federal Emergency Management Agency. (n.d.). *Why dams fail* [Fact sheet]. Retrieved from <http://www.fema.gov/hazard/damfailure/why.shtm>
- Federal Railroad Administration. (2004, June 16). *Audit of the highway-rail grade crossing safety program* (MH-2004-065). Washington D.C.: Author.
- Federal Railroad Administration. (2009). *Safety Data* [Data file]. Available from Federal Railroad Administration: <http://safetydata.fra.dot.gov/officeofsafety/>
- Fischer, H. W. (2006, September). Disaster myths and their implication for disaster planning and response. *Natural Hazards Observer*, XXXI(1), 1-4.
- Five County Association of Governments. (2007). *Southwest Utah wildfire protection plan*. St. George, UT: Author.

- Foley, S. N. (2005, April 1). The roles and responsibilities of the chief, municipal officials, and citizens in today's protection environment. *A Public Entity Risk Institute Symposium*, 1-5.
- Foreign Policy Association (2005). *Classifying terrorism*. Retrieved December 17, 2008, from http://www.fpa.org/newsletter_info2478/newsletter_info.htm
- Glenn, J. (2008). Debating distance and disasters. *Disaster Recovery Journal*, 2(), 1-4.
- Google (2009). *Google Maps: Merced, CA*. Retrieved January 18, 2009, from <http://maps.google.com/maps?hl=en&tab=wl>
- Google (2009). *Stockton, CA*. Retrieved January 18, 2009, from <http://maps.google.com/maps?hl=en&tab=wl>
- Google (2009). *Turlock, CA*. Retrieved January 18, 2009, from <http://maps.google.com/maps?hl=en&tab=wl>
- Governor's Office of Homeland Security. (2008). *State of California homeland security strategy 2008* (OHS). Sacramento, CA: Author.
- Granito, J. (2004, May). *All-hazards assessments and response plans for volunteer fire departments*. Poster session presented at the Risk Assessment and Planning for Volunteer Fire Departments, Fairfax, VA.
- Grose, V. L. (1987). *Managing risk: Systematic loss prevention for executives*. Arlington, VA: Omega Systems Group.
- Gutierrez, T., Feldman, C., & McDermott, A. (2002, April 29). Los Angeles riot still echoes a decade later. *CNN.com*. Retrieved from <http://archives.cnn.com/2002/US/04/28/la.riot.anniversary/index.html>
- Hankin, B., Waller, S., Astle, G., & Kellagher, R. (2008). Mapping space for water: Screening for urban flash floods. *Journal of Flood Risk Management*, 1(5), 13-22.

- Harrald, J. R. (2005, April 1). Raising awareness: Informing and educating the public and local leadership. *A Public Entity Risk Institute Symposium*, 1-8.
- Indian River County. (2007, September 4). *Comprehensive emergency management plan (2007-085)*. Vero Beach, FL: Author.
- Institution of Fire Engineers (2008). *Synthesis of fire-related data from USFA and NFPA*. Retrieved October 27, 2008, from [http://www.strategicfire.org/ckfinder/userfiles/files/fire%20in%20the%20US%20synthesized%2004_17_08\(1\).pdf](http://www.strategicfire.org/ckfinder/userfiles/files/fire%20in%20the%20US%20synthesized%2004_17_08(1).pdf)
- Institution of Fire Engineers. (2008). *Vision 20/20: National strategies for fire loss prevention*. Washington D.C.: Author.
- Jablonowski, M. (2002, August). Are formal risk assessments of any use?. *Risk Management*, 49(8), 24-26.
- Jackson, N. M. (2008). Blog city. *American City & County*. Retrieved from <http://americancityandcounty.com/searchresults/?terms=blog+city>
- Jalopnik (2008, December 12). California highway 99 crippled by 53 vehicle pileup. Message posted to <http://njection.com/blogs/jalopnik/archive/2008/12/11/california-highway-99-crippled-by-53-vehicle-pileup-highway-99-accident.aspx>, archived at
- Jason, S. (2008, October 24). Marshall bows out: Merced city manager retires after 16 years. *Merced Sun-Star*, p. A1.
- Johnson, H. P. (2006, April). *Illegal immigration* (Public Policy Institute of California). San Francisco: Public Policy Institute of California.
- Jonkman, S. N., & Vrijling, J. K. (2008). Loss of life due to floods. *Journal of Flood Risk Management*, 1(5), 43-56.

- KCRA (2008). *Blaze fed by strong winds*. Retrieved October 26, 2008, from <http://www.kcra.com/print/16559929/detail.html>
- KSEE 24 News (Producer). (2007, November 3). KSEE 24 News [Television broadcast]. Fresno, CA: None.
- Loflin, M. E., & Sanders, R. E. (2002). Evaluating local risks and planning for the necessary resources. In International City/County Management Association (Ed.), *Managing fire and rescue services* (pp. 39-66). Washington D.C.: ICMA.
- Merced California. (n.d.). Retrieved October 17, 2008, from Wikipedia, the free encyclopedia: http://en.wikipedia.org/wiki/merced_california
- Merced County. (2006). *Pandemic influenza response plan* [Brochure]. Merced, CA: Author.
- Merced Fire Department. (1988/2007). *Official action guides* (ed.). Merced, CA: AuthorMerced City Fire Department.
- Merced Fire Department. (n.d.). *California Fire Incident Reporting System* [Data file]. Available from Merced Fire Department: N/A
- Merced Fire Department. (n.d.). *National Fire Incident Reporting System data* [Data file]. Available from Merced Fire Department Record Management System: N/A
- Merced Police Department. (2008). *Major crimes* [Fact sheet]. Retrieved from <http://www.cityofmerced.org/depts/police/default.asp>
- Monke, J. (2004, August 13). *Agroterrorism: Threats and preparedness* (Congressional Research Service). Washington D.C.: The Library of Congress.
- NFPA, (2004). *NFPA 1250, Recommended practice in emergency service organizational risk management* (Rev. ed.). Quincy, MA: Author.

- NFPA. (2007). *NFPA 1600: Standard on disaster/emergency management and business continuity* (ed.). Quincy, MA: Author.
- National Alliance of Gang Investigators Association (2005,). *2005 national gang threat assessment* (). Washington D.C.: Author.
- National Climatic Data Center. (n.d.). *Merced County, California* [Data file]. Available from National Climatic Data Center: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>
- National Commission on Fire Prevention and Control. (1973, May). *American burning* (FA-264). Washington D.C.: Federal Emergency Management Agency.
- National Fire Protection Association (2008, October 2). *Survey finds concerns about economy may increase incidence of home fires* (N/A). Quincy, MA: Author.
- National Fire Protection Association. (2005). *Get ready: Preparing your community for a disaster* [Brochure]. Quincy, MA: Author.
- National Fire Protection Association. (2008). *Residential structure and building fires*. Quincy, MA: Author.
- National Traffic Safety Board. (2008). *September 20* [Data file]. Available from National Traffic Safety Board: <http://www.nts.gov/nts/response2.asp>
- National Weather Service (2007). *National Hurricane Center: Eastern Pacific hurricanes*. Retrieved January 20, 2009, from <http://www.nhc.noaa.gov/index.shtml?epac>
- National Weather Service (n.d.). *Floods*. Retrieved January 19, 2009, from <http://usasearch.gov/search?v%3Aproject=firstgov&query=flood&affiliate=nws.noaa.gov>
- National Weather Service. (2005). *Heat wave: A major summer killer* [Fact sheet]. Retrieved from http://www.nws.noaa.gov/brochures/heat_wave.shtml

- National Weather Service. (2005, March). *Floods: The awesome power* (NOAA/PA 200467). Washington D.C.: United States Department of Commerce.
- National Weather Service. (2008). *Glossary of NHC terms* [Fact sheet]. Retrieved from <http://www.nhc.noaa.gov/aboutgloss.shtml>
- National Weather Service. (2009). *Average temperatures: Merced, CA* [Fact sheet]. Retrieved from <http://www.wrh.noaa.gov/hnx/>
- National Wildfire Coordinating Group. (1982, April). *Aids for determining fuel models for estimating fire behavior* (INT-122). Boise, ID: Author.
- National Wildfire Coordinating Group. (2006). *S-190: Introduction to wildland fire behavior*. Boise, ID: Author.
- National Wildfire Coordinating Group. (2008). *S-290: Intermediate wildland fire behavior*. Boise, ID: Author.
- Noah, D. L., Noah, D. L., & Crowder, H. R. (2002). Biological terrorism against animals and humans: A brief review and primer for action. *Journal of the American Veterinary Medical Association*, 15-20.
- Occupational Health and Safety Administration. (2007). *Guidance on preparing workplaces for an influenza pandemic* (OSHA 3327-02N 2007). Washington D.C.: Author.
- Office for Domestic Preparedness. (2003). *State homeland security assessment and strategy* (ODP). Washington D.C.: Department of Homeland Security.
- Pacific Gas and Electric (2006). *About California's gas transmission*. Retrieved January 24, 2009, from http://www.pge.com/pipeline/about/about_cgt.shtml
- Schmidt, D. L. (2008). Planning for disasters. *Fire Protection Engineering*. Retrieved from http://www.fpemag.com/archives/article.asp?issue_id=46&i=361

- Southern California Geographic Area Coordination Center. (2008). *Seasonal outlook for southern and central California* [Fact sheet]. Retrieved from <http://gacc.nifc.gov/oscc/predictive/outlooks/index.htm>
- Staff (2008, May 23). Hwy 99 vehicle accident fatality, Turlock fire evacuation. *Turlock City News*, p. A1.
- Thanawala, S. (2008, October 30). FBI: Anthrax hoax from Calif. man still in mail. *San Francisco Chronicle*, p. B1.
- The Pipeline Group. (2006). *Emergency Response Manual*. Kerman, CA: Author.
- Tornado Project. (n.d.). *California tornadoes 1880-2000* [Data file]. Available from The Tornado Project: <http://www.tornadoproject.com/>
- Tsai, Y. (2001). *implication of ground motion data recorded in the M7.6 Chi-Chi, Taiwan earthquake of September 21, 1999*. Poster session presented at the SMIP01, Chung-Li, Taiwan.
- USFA (2005, October). *Executive development: EFOP applied research self-study guide* (NFA). Emmitsburg, MD: Author.
- USFA. (1987, December 2). *America burning: Revisited* (N/A). Washington D.C.: Federal Emergency Management Agency.
- USFA. (1996). *Risk management practices in the fire service*. Emmitsburg, MD: Author.
- USFA. (2000). *Disaster and fire defense planning: Course guide*. Emmitsburg, MD: Author.
- USFA. (2007, January). *California: Four years later*. Emmitsburg, MD: Author.
- USFA. (2008). *Strategies for community risk reduction: Student manual* (1st. ed.). Emmitsburg, MD: Author.

United States Census Bureau. (2006). *2006 American community survey* (U.S. Census Bureau). Washington DC: Author.

United States Department of Transportation. (2004). *Highway-rail crossing safety and trespass prevention*. Washington D.C.: Author.

United States Energy Information Administration (n.d.). *Natural gas pipelines in the western region*. Retrieved January 24, 2009, from http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/western.html#north

United States Geological Survey (2008). *Natural hazards: Floods*. Retrieved January 19, 2009, from <http://www.usgs.gov/hazards/floods/>

United States Geological Survey. (2008). *Forecasting California's earthquakes: What can we expect in the next 30 years?* (USGS Fact Sheet 2008-3027). Menlo Park, CA: Author.

University of Cape Town, (2006, March). Report of the TEAM community risk assessment workshop in Doornbach. In Disaster Mitigation for Sustainable Livelihoods Programme (Chair), *Report of the TEAM community risk assessment in Doornbach*. Symposium conducted at the Workshop on Community Risk Assessment, Doornbach, South Africa.

Wagner, P. F. (2007). *The dark side of illegal immigration*. San Francisco: Author.

Williams, J. (2005, May 17). Background: California's tropical storms. *USA Today*, p. B2.

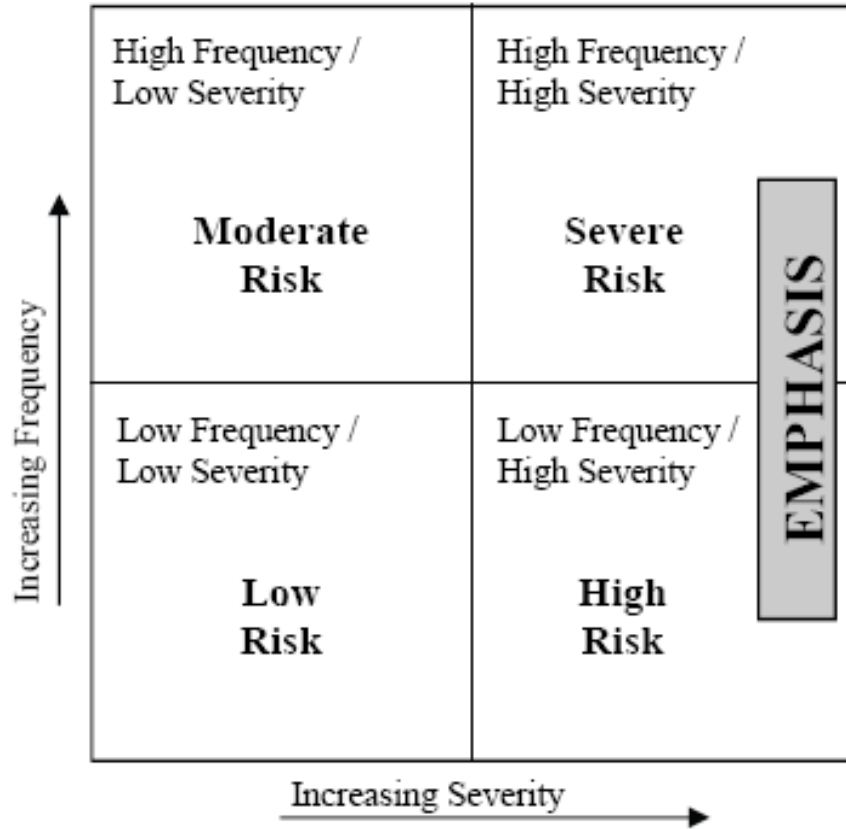
Williams, J. (2005, May 18). Understanding eastern Pacific hurricanes. *USA Today*. Retrieved from <http://www.usatoday.com/weather/whpacg.htm?loc=interstitialskip>

Wilson, S. A., Temple, B. J., Milliorn, M. E., Vazquez, C., Packard, M. D., & Rudy, B. S. (2008). The lack of disaster preparedness by the public and it's affect on communities. *Journal of Rescue & Disaster Medicine*, 7(2), LRC 33-LRC 44.

Zalman, A. (n.d.). Terrorist groups: A list of terrorist groups by type. *About.com*. Retrieved from <http://terrorism.about.com/od/groupsleader1/a/TerroristGroups.htm>

Appendix A

Frequency and Severity Assessment Tool



Appendix B

City of Merced Community Risk Assessment Survey - Blank



City of Merced Community Risk Assessment

<p>1. Community risk is: (Please select all that apply.)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Vulnerability of harm to life <input type="checkbox"/> Vulnerability of harm to property <input type="checkbox"/> Vulnerability of harm to community vitality <input type="checkbox"/> Human caused <input type="checkbox"/> A natural occurrence <input type="checkbox"/> Preventable <input type="checkbox"/> Accidental <input type="checkbox"/> A political issue <input type="checkbox"/> Likely to occur <input type="checkbox"/> A hazard
<p>2. Which of the following describe an “accident?” Select all that apply.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Preventable <input type="checkbox"/> Unavoidable <input type="checkbox"/> Predictable <input type="checkbox"/> Sequence of events
<p>3. In your opinion, what are the top <u>three</u> community risks to the City of Merced?</p>
<p>4. On a scale of 1 to 10, how concerned are you that the greatest threat you listed above will occur in the City of Merced?</p> <ul style="list-style-type: none"> a. 1 = least b. 10 = most
<p>5. If it was entirely your decision, what measures would you take to prevent and/or mitigate the greatest threat? Check all that apply.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engineering changes <input type="checkbox"/> Enforcement of existing rules <input type="checkbox"/> Education programs <input type="checkbox"/> Economic incentives to citizens and businesses <input type="checkbox"/> Expand the scope and capability of emergency response organizations
<p>6. During your employment with the City of Merced, have you been provided any information about the risks in our community?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown
<p>7. Are you aware of a particular fire risk to the City?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Yes, please explain. <input type="checkbox"/> No

<p>8. Has the degree of risk to Merced changed since you started working for the City?</p> <p><input type="checkbox"/> Increased</p> <p><input type="checkbox"/> Decreased</p> <p><input type="checkbox"/> No change</p> <p><input type="checkbox"/> Unknown</p>
<p>9. How many trains do you believe pass through the City of Merced on a daily basis?</p> <p><input type="checkbox"/> 1-25</p> <p><input type="checkbox"/> 26-50</p> <p><input type="checkbox"/> 51-75</p> <p><input type="checkbox"/> 76-100</p> <p><input type="checkbox"/> 101-125</p>
<p>10. In your opinion, which of the following poses the greatest risk to the City of Merced?</p> <p><input type="checkbox"/> Natural disasters</p> <p><input type="checkbox"/> Economic issues</p> <p><input type="checkbox"/> Political issues</p> <p><input type="checkbox"/> Transportation issues</p> <p><input type="checkbox"/> Terrorism or intentional acts</p> <p><input type="checkbox"/> Accidents</p>
<p>11. Do you know where to locate a copy of the City's Emergency Operations Plan (EOP) and the Continuity of Operations Plan (COOP)?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>
<p>12. Have you read or received training about the Emergency Operations Plan (EOP) and/or the Continuity of Operations Plan (COOP)?</p> <p><input type="checkbox"/> Yes – EOP</p> <p><input type="checkbox"/> Yes – COOP</p> <p><input type="checkbox"/> Yes – Both</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>
<p>13. Do you work for an organization that is involved in emergency response or do you have a role in the City's Emergency Operations Plan (EOP)?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>
<p>14. How many years have you worked for the City of Merced?</p> <p><input type="checkbox"/> 1-5 years</p> <p><input type="checkbox"/> 6-10 years</p> <p><input type="checkbox"/> 11-15 years</p> <p><input type="checkbox"/> 16-20 years</p> <p><input type="checkbox"/> 21-25 years</p> <p><input type="checkbox"/> 26-30 years</p> <p><input type="checkbox"/> 30+ years</p>
<p>15. Do you have any emergency management experience?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>

<p>16. What is your job classification?</p> <ul style="list-style-type: none"><input type="checkbox"/> Line Personnel<input type="checkbox"/> Administrative Support<input type="checkbox"/> Line Supervisor<input type="checkbox"/> Middle Management<input type="checkbox"/> Department Head<input type="checkbox"/> Other
<p>17. What is your age?</p> <ul style="list-style-type: none"><input type="checkbox"/> 18-30<input type="checkbox"/> 31-40<input type="checkbox"/> 41-50<input type="checkbox"/> 51-60<input type="checkbox"/> 61-70<input type="checkbox"/> 70+
<p>18. What is your gender?</p> <ul style="list-style-type: none"><input type="checkbox"/> Male<input type="checkbox"/> Female

Appendix C

City of Merced Community Risk Assessment Survey - Results



City of Merced Community Risk Assessment

1. Community risk is: (Please select all that apply.)		
Vulnerability of harm to life	80	71.4%
Vulnerability of harm to property	79	70.5%
Vulnerability of harm to community vitality	81	72.3%
Human caused	67	59.8%
A natural occurrence	59	52.7%
Preventable	59	52.7%
Accidental	49	43.8%
A political issue	37	33.0%
Likely to occur	49	43.8%
A hazard	65	58.0%
2. Which of the following describe an “accident?” Select all that apply.		
Preventable	75	67.0%
Unavoidable	51	45.5%
Predictable	23	20.5%
Sequence of events	65	58.0%
3. In your opinion, what are the top <u>three</u> community risks to the City of Merced?		
Flood	41	36.6%
Gangs	36	32.1%
Railroad	33	29.5%
Economy & Housing Crisis	32	28.6%
Crime & Violence	31	27.7%
Transportation (accidents, roads, etc.)	26	23.2%
Fire (conflagration, wildland, etc)	17	15.2%
Hazardous Materials Release	17	15.2%
Drugs	13	11.6%
Earthquakes	13	11.6%
Unemployment	11	9.9%
Pollution (air, water, ground)	8	7.2%
Storms	7	6.3%
Terrorism	7	6.3%
Education (lack of)	6	5.4%
Infrastructure Failure (roads, pipelines, etc.)	5	4.5%
Dam Failure	4	3.6%

Drought	4	3.6%
Healthcare (lack of)	4	3.6%
Regulation (Over/Under)	4	3.6%
Water System Contamination	4	3.6%
Epidemic / Pandemic	3	2.7%
Homeless	3	2.7%
Airport (Aircraft emergencies)	2	1.8%
Apathy (no public involvement)	2	1.8%
Childcare / Supervision	2	1.8%
Morals (lack of)	2	1.8%
Civil Disturbance	1	0.9%
Cultural Differences	1	0.9%
Dispatch / 911 System	1	0.9%
Emergency Response Time (police & fire)	1	0.9%
Immigration	1	0.9%
Litigation Against City	1	0.9%
Language Barriers	1	0.9%
Public Education (insufficient)	1	0.9%
Teen Pregnancy	1	0.9%
4. On a scale of 1 to 10, how concerned are you that the greatest threat you listed above will occur in the City of Merced?		
Not concerned	2	1.8%
Slightly concerned	11	9.8%
Moderately concerned	42	37.5%
Very concerned	41	36.6%
Extremely concerned	16	14.3%
RATING AVERAGE	3.52	
5. If it was entirely your decision, what measures would you take to prevent and/or mitigate the greatest threat? Check all that apply.		
Engineering changes	42	37.5%
Enforcement of existing rules	64	57.1%
Education programs	72	64.3%
Economic incentives to citizens and businesses	37	33.0%
Expand the scope and capability of emergency response organizations	56	50.0%
Other	16	14.3%
6. During your employment with the City of Merced, have you been provided any information about the risks in our community?		
Yes	55	66.1%
No	42	37.5%
Unknown	15	13.4%

7. Are you aware of a particular fire risk to the City?		
Yes, please explain	38	33.9%
No	74	66.1%
8. Has the degree of risk to Merced changed since you started working for the City?		
Increased	60	53.6%
Decreased	11	9.8%
No change	24	21.4%
Unknown	17	15.2%
9. How many trains do you believe pass through the City of Merced on a daily basis?		
1-25	33	29.5%
26-50	35	31.3%
51-75	23	20.5%
76-100	19	17.0%
101-125	2	1.8%
10. In your opinion, which of the following poses the greatest risk to the City of Merced?		
Natural disasters	7	6.3%
Economic issues	60	53.6%
Political issues	5	4.5%
Transportation issues	22	19.6%
Terrorism or intentional acts	5	4.5%
Accidents	13	11.6%
11. Do you know where to locate a copy of the City's Emergency Operations Plan (EOP) and the Continuity of Operations Plan (COOP)?		
Yes	51	45.5%
No	61	54.5%
12. Have you read or received training about the Emergency Operations Plan (EOP) and/or the Continuity of Operations Plan (COOP)?		
Yes – EOP	24	21.4%
Yes – COOP	3	2.7%
Yes – Both	22	19.6%
No	55	49.1%
Unknown	8	7.1
13. Do you work for an organization that is involved in emergency response or do you have a role in the City's Emergency Operations Plan (EOP)?		
Yes	73	65.2%
No	26	23.2%
Unknown	13	11.6%

14. How many years have you worked for the City of Merced?		
1-5 years	49	44.5%
6-10 years	25	22.7%
11-15 years	7	6.4%
16-20 years	20	18.2%
21-25 years	4	3.6%
26-30 years	3	2.7%
30+ years	2	1.8%
15. Do you have any emergency management experience?		
Yes	53	48.2%
No	57	51.8%
16. What is your job classification?		
Line Personnel	27	24.5%
Administrative Support	25	22.7%
Line Supervisor	17	15.5%
Middle Management	24	21.8%
Department Head	6	5.5%
Other	11	10.0%
17. What is your age?		
18-30	17	15.5%
31-40	28	25.5%
41-50	35	31.8%
51-60	21	19.1%
61-70	9	8.2%
70+	0	0.0%
18. What is your gender?		
Male	67	60.9%
Female	53	39.1%

2009 City of Merced Community Risk Assessment

NATURAL CAUSED RISKS

Risk	Frequency	Severity	Category	Comments
Earthquake	California experiences nearly 100 earthquakes per day. They are typically centered along the San Andreas Fault, throughout the Los Angeles basin and in the Sierra Nevada range. HIGH	Based on the distance from seismic faults and the sedimentary soils, the degree of severity will be typically low, but high potential exists. LOW	High frequency Low severity MODERATE RISK	Who: All civilians and responders in Merced What: private and public property, infrastructure, transportation routes. Where: All areas of Merced possess the same degree of risk, with minor local variations. Earthquakes are not typically centered in the Central Valley, but are impacted by the faults that surround it. When: Approximately 100 earthquakes occur on a daily basis. How: Structural collapse, falling objects, transportation routes compromised, hazardous materials releases.
Flood	Since improvements in the late 1970's, no floods until: <ul style="list-style-type: none"> • Jan 1998 • Feb 1998 • Mar 1998 • Mar 2007 4 flood events in a 10-year period; 2.5-year average HIGH	<ul style="list-style-type: none"> • Evacuations • No life loss • Extensive property damage • Contamination issues HIGH	High frequency High severity SEVERE RISK	Who: Civilians, pets, and livestock in the areas identified below What: Life safety issues – static and swift water situations. Property damage and/or loss. Where: All areas south of Bear Creek including downtown (except, small islands), areas along Highway 59 – north. When: Approximately every 2.5 years following extended periods of rainfall or shorter periods of extremely heavy precipitation. How: Failure of levees and/or overflow of Bear Creek or Black Rascal Creek. Dam failure at Yosemite Lake or Bear Reservoir.

<p>Heat/Cold</p>	<p>Annually, summer temperatures reach into the 100's and winter temperatures drop below freezing.</p> <p>HIGH</p>	<p>Illness related to heat and/or cold exposures occur with the temperature extremes. There have not been any documented fatalities as a result.</p> <p>LOW</p>	<p>High Frequency</p> <p>Low Severity</p> <p>MODERATE RISK</p>	<p>Who: The elderly and young are most at risk from temperature extreme emergencies. The homeless are also at a higher degree of risk than a typical cross section of the population.</p> <p>What: Infrastructure. Power grids exceeding their capability.</p> <p>Where: All areas of Merced are equally at risk.</p> <p>When: Summer and winter months</p> <p>How: Exposure to extreme temperature can cause unsafe changes to the body temperature and cause City infrastructure to fail or become otherwise compromised.</p>
<p>Pandemic / Epidemic</p>	<p>Annual influenza outbreaks during winter months; however, widespread pandemics are rare in occurrence: 1-2 per 100-years.</p> <p>LOW</p>	<p>Predictions from the Centers for Disease Control indicate that a Bird Flu Pandemic could result in unprecedented consequences.</p> <p>HIGH</p>	<p>Low Frequency</p> <p>High Severity</p> <p>HIGH RISK</p>	<p>Who: All segments of society; particularly the elderly and the young.</p> <p>What: Widespread illness that could result in critical resources becoming unavailable due to a lack of personnel to staff and/or operate.</p> <p>Where: Parameters are not established or defined; case-by-case.</p> <p>When: Influenza season; winter months</p> <p>How: Human-to-human vector viral or bacterial infections</p>

Thunderstorm	Numerous thunderstorms develop and mature on an annual basis. In the Central Valley, the numbers of storms are less than in mountainous areas. HIGH	Based on the topography of Merced, the overall severity of a thunderstorm would be limited to direct lightening strikes, wind damage, and precipitation. LOW	High frequency Low severity MODERATE RISK	Who: Humans, pets, and livestock who are outside. What: Property and wildland areas Where: All areas of California, especially mountainous areas for orographic lifting When: All times of the year How: Thermal and orographic lifting to create thunderstorms. The risks stem from lightening, strong winds, and potentially heavy precipitation.
Tornado	Two hundred forty-two tornadoes touched down in the Central Valley between 1950 and 1992. Average: 5.8 tornadoes per year in Central California. LOW	144 of the 242 tornadoes were rated in the Fujita Scale: F0 – 70 F1 – 50 F2 – 23 F3 – 1 LOW	Low frequency Low severity LOW RISK	Who: All humans, pets, and livestock in the path of the tornado. What: All property in the path of the tornado. Where: Central Valley; specificity cannot be predicted. When: Unlike Tornado Alley, California tornadoes typically occur in winter months. How: Thunderstorm develops into a Supercell.

<p>Tropical Storm</p>	<p>Tropical Jet Streams push multiple storms into California on an annual basis.</p> <p>LOW</p>	<p>The storms that make landfall in California are not tropical storms, but are reduced to tropical depressions. These storms can result in widespread and localized flooding, and property damage as a result of strong winds.</p> <p>LOW</p>	<p>Low frequency Low severity</p> <p>LOW RISK</p>	<p>Who: All Californians What: Private and public property Where: All areas When: Fall, winter, and spring months How: Winds and precipitation from storms</p>
<p>Wildland Fire</p>	<p>The MFD responds to multiple wildland fire within and about the City on an annual basis.</p> <p>HIGH</p>	<p>Data, dated back to the mid-1960's indicates that there has not been a residence, commercial structure, or life lost due to a wildland fire. Outbuildings, and items stored outside have been damaged.</p> <p>LOW</p>	<p>High frequency Low Severity</p> <p>MODERATE RISK</p>	<p>Who: civilians, pets, and livestock that reside in or near grassland areas. What: Crops, property that exists in an interface zone. Where: Properties that exist in the rural outer edges of the City or in County areas. Weed abatement programs have minimized the risk within City limits. When: Multiple vegetation fires on an annual basis. How: Wind and/or fuel driven fires in light, flashy fuels that spread toward populated areas.</p>

HUMAN CAUSED RISKS

Risk	Frequency	Severity	Category	Comments
Agroterrorism	The concept of agroterrorism has moved to the forefront in recent years due to improved technology. Although instances are rare, it is anticipated that the frequency will increase. LOW	The direct and indirect impact could be extreme. HIGH	Low frequency High severity HIGH RISK	Who: Farmers, ranchers, and consumers What: Livestock and crops Where: In and around Merced When: Unknown How: Contamination and/or destruction of livestock, crops, or food supply chains.
Civil Disturbance	Civil disturbances or riots are rare occurrences that require a catalyst and a high degree of emotion. LOW	Depending in numerous circumstances, the severity could range from low to high. HIGH	Low frequency High severity HIGH RISK	Who: All civilians and responders What: businesses (looting and damage), infrastructure Where: Any location When: Unknown How: outrage as a result of a catalyst and a high-degree of emotion.

<p>Gangs/Crime</p>	<p>Gang activity and crime are a daily occurrence in the City of Merced.</p> <p>HIGH</p>	<p>According to law enforcement officials (MPD & FBI), most gang activity involves members of other gangs; civilians are typically not targeted. Crime, and drugs do affect the community</p> <p>HIGH</p>	<p>High frequency</p> <p>High severity</p> <p>SEVERE RISK</p>	<p>Who: Civilians, responders, especially other gang members.</p> <p>What: Businesses</p> <p>Where: All areas, with specific emphasis in certain neighborhoods.</p> <p>When: Anytime</p> <p>How: Homicide, theft, drugs</p>
<p>Immigration</p>	<p>The number of illegal immigrant in the United States increases on a daily basis. Although the rate of increase in California is less that it has been in recent year, it remains at a very high level.</p> <p>HIGH</p>	<p>Impacts on the economy, schools, healthcare system, and enforcement agencies has increased exponentially.</p> <p>HIGH</p>	<p>High frequency</p> <p>High severity</p> <p>SEVERE RISK</p>	<p>Who: All citizens</p> <p>What: Businesses, governmental agencies, and the economy.</p> <p>Where: All areas</p> <p>When: Concurrently</p> <p>How: Increasing numbers of illegal immigrants results in an increased demand on systems that are already stressed.</p>

<p>Terrorism</p>	<p>With few exceptions, Merced has not been identified to be a target for terrorism. As a whole, Merced does not have a high-profile, high-impact target that is typically associated with a terrorist act.</p> <p>LOW</p>	<p>Although Merced is not categorized as a target, should a terrorist event occur, the impact would be extreme.</p> <p>HIGH</p>	<p>Low frequency High severity</p> <p>HIGH RISK</p>	<p>Who: All civilians and responders. What: All property and infrastructure Where: All areas are equally at risk, although Merced is not identified as a primary target. When: Unknown How: Unknown</p>
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TECHNOLOGY CAUSED RISKS

Risk	Frequency	Severity	Category	Comments
Airport/Aircraft	<p>According to the FAA, there have been 77 aircraft incidents at the Merced Municipal Airport since the late 1950's. Most were minor incidents; eight involved fatalities. Average of 1.28 incidents per year.</p> <p>LOW</p>	<p>Merced Municipal Airport has an FAA commercial carrier that arrives and departs twice daily. All other flights are small private aircraft. The severity is based on location, size of aircraft, and number of souls on board.</p> <p>LOW</p>	<p>Low frequency Low severity LOW RISK</p>	<p>Who: Civilians, pets, and livestock What: Property, infrastructure, and crops Where: Adjacent to the airport or in the flight path. When: Unknown How: Aircraft mechanical or operator failures</p>

<p>Dam</p>	<p>Based on technology, workmanship, and the quality of materials, dam failures in the United States are extremely rare.</p> <p>LOW</p>	<p>Failure of either the Lake Yosemite or Bear Reservoir dams, the impact would range depending on the extent of the breach and any concurrent precipitation.</p> <p>HIGH</p>	<p>Low frequency</p> <p>High severity</p> <p>HIGH RISK</p>	<p>Who: Civilians, pets, and livestock What: Property, infrastructure, and crops Where: Downstream and in identified floodplain areas. When: Times of heavy precipitation or terrorist events How: Both dams are earthen-fill constructed. These types are very flexible and are generally resistant to seismic activity. Failure is typically associated with overflow.</p>
<p>Fire</p>	<p>Residential and commercial fires occur on a regular basis; however incidents that involve fatalities, conflagration, or require general alarms to control occur, on average, 2 times per year.</p> <p>HIGH</p>	<p>Aggressive fire prevention and public education programs have significantly reduced the risk from fire within the City. The last fire that resulted in a fatality within the City was in 2006.</p> <p>LOW</p>	<p>High frequency</p> <p>Low severity</p> <p>MODERATE RISK</p>	<p>Who: Residents and visitors to Merced What: private, commercial, and government property Where: All areas of the City When: Anytime How: Cooking, carelessness, intentional</p>

<p>Highway</p>	<p>Vehicle collisions are a daily occurrence; however major incidents that involve multiple casualties or hazardous materials releases are significantly less frequent.</p> <p>HIGH</p>	<p>Collisions on highways in the Central Valley have, on occasion involved 100+ vehicles and hundreds of patients. Collisions have also resulted in the release of hazardous materials.</p> <p>HIGH</p>	<p>Low frequency</p> <p>High severity</p> <p>SEVERE RISK</p>	<p>Who: Citizens, visitors, over-highway motor carriers What: Interstate commerce, travel routes Where: Highways 59, 99, and 140 When: Anytime How: Excessive speed, fog, mechanical issues</p>
<p>Pipelines</p>	<p>Major distribution pipeline failures are rare occurrences. No documented incidents have occurred on Line 300, which passes through Merced.</p> <p>LOW</p>	<p>6” and 8” high-pressure natural gas pipelines pass through Merced on the Union Pacific and Burlington Northern-Santa Fe Railway easements.</p> <p>HIGH</p>	<p>Low frequency</p> <p>High severity</p> <p>HIGH RISK</p>	<p>Who: Civilians and responders What: Businesses, railway, highways, and infrastructure. Release of hazardous materials and/or fire from pipeline. Where: Proximate to Union Pacific Rail easement When: Anytime How: Derailed train, pipeline failure</p>

Railway	<p><u>*BNSF</u></p> <ul style="list-style-type: none"> • 157,098,605 miles/year • 0.91 accidents per 1-million miles • 45 trains per day • 6.65 miles of track in City <p>1 track related accident every 10.06 years.</p> <p><u>*UP</u></p> <ul style="list-style-type: none"> • 154,925,754 miles/year • 1.28 accidents per 1-million miles • 20 trains per day • 5.6 miles of track in City <p>1 track related accident every 19.11 years</p> <p>LOW</p>	<p>Based on cargo (hazardous materials), proximity of homes and businesses to tracks, and potential threat to lives, the potential impact is extreme.</p> <p>HIGH*</p> <p>*A factor included in the determination of the severity is the confidential density report that is published by the rail carriers.</p>	<p>Low frequency</p> <p>High severity</p> <p>HIGH RISK</p>	<p>Who: Civilians and responders</p> <p>What: Businesses, railway, highways, infrastructure, and pipelines. Release of hazardous materials from rail cargo.</p> <p>Where: Immediate proximity or downwind</p> <p>When: Unknown – *See frequency</p> <p>How: derailment or other railway accident</p>
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<p>Utilities</p>	<p>Electrical distribution systems have numerous vulnerabilities that can result in a breach in service. Overloaded systems can result in rolling blackout where a downed line or pole can also compromise service.</p> <p>HIGH</p>	<p>With seldom exceptions, in California outages are usually a short duration, 1-hour or less, on average. As a result long-term or significant impacts are possible, but not probable.</p> <p>LOW</p>	<p>High frequency</p> <p>Low severity</p> <p>MODERATE RISK</p>	<p>Who: Citizens, visitors, and anyone who requires utilities (electricity)</p> <p>What: Residential and business occupancies, infrastructure, traffic signals</p> <p>Where: All areas could be equally affected</p> <p>When: Anytime</p> <p>How: Loss of generation facility or distribution grid.</p>
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