

Tornado Shelter Needs Assessment

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Certification Statement

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### Abstract

The problem is that Santa Barbara Estates, a mobile housing community, does not have a tornado shelter for its residents. The purpose of this project was to conduct a tornado shelter needs assessment for Santa Barbara Estates. Descriptive research was used to discuss the research questions (1) how are other communities using tornado shelters? (2) what is the likelihood of a tornadic event in Olathe? (3) what is the risk-benefit of tornado shelters? The procedures included extensive literature review; personal interviews and correspondence; and, a survey (Appendix A) completed by emergency and non-emergency service professionals. The results illustrated the need for personal preparedness and tornado shelter for residents of Santa Barbara Estates. The recommendations were for the creation of a formal severe weather plan at Santa Barbara Estates; the crafting of a new resident guide to include personal preparedness information for Santa Barbara Estates residents; the encouraged use of NOAA weather radio by residents of Santa Barbara Estates; the presentation of a disaster preparedness course to Santa Barbara Estates staff and residents; and the construction of appropriate shelter on the property of Santa Barbara Estates. Future readers should conduct a shelter needs assessment for communities and target populations, such as mobile home residents, that are at greater risk for injury or death related to tornado events.

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### Tornado Shelter Needs Assessment

Tornadoes are powerful phenomena that occur around the globe. They are a unique and unpreventable force whose devastation can be seen in news headlines across the country.

Community risk reduction efforts are an integral part of diminishing the potential loss of life and property that may be caused by a tornado. This is especially true in areas of the United States where a tornado is more likely to occur. Targeted risk reduction efforts are particularly critical to those specific populations that have a higher frequency of injury or death during a tornado. Risk reduction efforts may include notification systems, personal preparedness and shelters.

There is a plethora of information available about tornado shelters. However, some of the industry specific language potentially could be confusing if not first understood. The terms “safe rooms” and “shelters” may be used synonymously for research purposes. “Both ‘storm shelters’ and ‘safe rooms’ employ the same wind load design criteria and thus the same tornado protection” (National Storm Shelter Association, n.d.).

The problem is that Santa Barbara Estates, a manufactured housing community, does not have a proper tornado shelter for its residents. The Federal Emergency Management Agency (FEMA) uses the terms “manufactured home” and “mobile home” as synonyms. FEMA’s definition: “Manufactured (Mobile) Home – A structure built on a permanent chassis, transported to its site in one or more sections, and affixed to a permanent foundation” (Federal Emergency Management Agency, n.d.). The term “mobile home” was used as an appropriate synonym for “manufactured home” in this research.

The purpose of this project was to conduct a tornado shelter needs assessment for Santa Barbara Estates. Descriptive research was used to discuss the following research questions: (a)

how are other communities using tornado shelters? (b) what is the likelihood of a tornadic event in Olathe? (c) what is the risk-benefit of tornado shelters?

### **Background and Significance**

Olathe is located in northeast Kansas and is the county seat of Johnson County. Johnson County is Kansas' most populous county. Olathe is the second largest community in Johnson County. Olathe is located just 20 miles southwest of downtown Kansas City. Named for the Shawnee Indian word for "beautiful," Olathe was incorporated in 1857 and established by ordinance in 1871. The City of Olathe was incorporated 11 years before Kansas was founded.

Approximately 128,000 Olatheans live within the city's more than 60 square miles and are served by the Olathe Fire Department's (OFD) 132 staff. Of those, 102 career firefighters comprise the department's emergency service operations which deploy from seven stations.

In August of 2012, the Commission on Fire Accreditation International bestowed "accredited agency" status upon the OFD. The OFD is one of two fire departments in Johnson County; one of three fire departments in the Kansas City metropolitan area; and, one of four fire departments in Kansas to achieve international accreditation.

OFD emergency services include fire suppression, emergency medical care via basic and advanced life support services, technical rescue, hazardous materials mitigation, explosive ordnance disposal (bomb squad), and disaster response. In addition, administrative employees provide non-emergency services such as fire prevention and inspections, safety education, emergency preparedness, emergency management, building codes, community enhancement, plan review, and internal support services.

The OFD is responsible for emergency management and preparedness for the City of Olathe. Fire Chief Jeff DeGraffenreid is the director of emergency management. Assistant Fire

Chief Tim Richards is the deputy director of emergency management. The OFD has two “seasonal” emergency management technicians. “Seasonal” staff are similar to “part-time” employees and work no more than 1,000 hours throughout each calendar year. The emergency management technicians have a combined 47 years of experience in the fire service at the firefighter, fire officer, and chief officer levels (T. Hufft, & T. Maxton, personal communication, September 26, 2012). In addition, one of the technicians is a Kansas certified emergency manager.

The OFD has a personal preparedness initiative in the Community Emergency Response Team (CERT) program. CERT was started with a one-time funding opportunity of \$7,500 from Project Impact in 2001 (J. G. DeGraffenreid, personal communication, November 14, 2012). Since its inception, the program has taught disaster preparedness and survival to over 2,200 CERT volunteers (J. Sanches, personal communication, September 25, 2012). The program is managed by CERT Manager and Captain John Sanches who is supported by CERT Coordinators and Firefighters Steve Hill and Kevin Joles. A CERT class has not been specifically conducted for Santa Barbara Estates staff or residents.

The OFD also manages the community’s state-of-the-art outdoor warning (siren) system. The division chief of logistics and support services manages the public notification system that is comprised of 37 sirens (D. Dock, personal communication, September 26, 2012). The sirens are Federal Signal Model 2001-130. The 2001-130 has a two-way status monitoring siren controller which allows for around-the-clock system observation. The system performs an automated self-check every day at 3 a.m. In addition, the system initiates around-the-clock electronic notification via text to chief officers whenever it perceives a system issue to be present. The system is also tested manually during the countywide system check at 11 a.m. on the first

Wednesday of the month (Johnson County Emergency Management and Homeland Security website, n.d.). Johnson County Emergency Management and Homeland Security conducts the monthly test. Automated severe weather notifications from the National Weather Service (NWS) are available to those whom “follow” or “like” the user “OlatheFire” on Twitter or Facebook.

Since 2001, the OFD has also proactively encouraged the use of National Oceanic and Atmospheric Administration (NOAA) weather radios to residents (J. G. DeGraffenreid, personal communication, November 14, 2012). The use of weather radios as a reliable medium to receive severe weather information has been regularly communicated to residents via brochures, public speaking, CERT, radio, television, newspaper, Olathe Link (City of Olathe newsletter), City of Olathe website, OFD website, and social media channels.

Santa Barbara Estates is a mobile housing community located at 1600 N. Ridgeview in Olathe, Kansas (Appendix B). The property is situated in Station 2’s static response area. Santa Barbara Estates is in emergency service zone (ESZ) 202 (Appendix C). ESZs are one square mile in area. The zones were derived from the existing Johnson County dispatch grid system that was developed in 1985 when the county created the specifications for the first computer aided dispatch (M. Whelan, personal communication, October 5, 2011). ESZ 202 has a metropolitan population density with an estimated populace of 4,953 people (Olathe Fire Department, 2012, p. 75). ESZ 202 had the second most emergency service incidents in 2011 (Olathe Fire Department, 2012, p. 76).

Santa Barbara Estates, established in 1969, occupies 82.57 acres in Olathe (Johnson County Kansas Appraiser’s Office, 2012). Home site acreage accounts for 64 of the 82.57 acres. Santa Barbara Estates has 400 of the 485 available home sites occupied (M. Shryock, personal



communication, October 15, 2012). All tenants of Santa Barbara Estates pay \$485 per month for each home site. Santa Barbara Estates has an estimated tenant population between 1,200 to 1,500 people (M. Shryock, personal communication, October 15, 2012).

Santa Barbara Estates has no formal severe weather or tornado policy (M. Shryock, personal communication, October 15, 2012). The current severe weather and tornado course of action plan, for Santa Barbara Estates employees, is casual and verbally communicated to staff in conversation. For notification purposes, Santa Barbara Estates employees have four NOAA weather radios which are monitored around the clock – two are located on the property and two are located off of the property. The radios located off of the property are in the possession of Santa Barbara Estates employees.

It is unknown how many residents of Santa Barbara Estates have used NOAA weather radio to receive weather-related alert notifications. However, the residents do receive outdoor notification of tornado warnings via Olathe's outdoor warning system (sirens). The closest outdoor warning system siren is located at 1301 E. 123<sup>rd</sup> Street (Appendix B), which is .3 miles from the Santa Barbara Estates community office. The outdoor warning siren is also .6 miles from the furthest home site at 48 Pasadena Drive, which is located on the property's northeast corner.

The informal tornado course of action plan, used by Santa Barbara Estates employees, is that they will open a locker room as the "safe room" at Santa Fe Trail Middle School (SFT) if a tornado warning occurs "in the area" (M. Shryock, personal communication, October 15, 2012). SFT is located at 1100 N. Ridgeview (Appendix B), which is .9 miles away from Santa Barbara Estates. The route to SFT starts with a two-lane private drive located within Santa Barbara Estates. The private drive has numerous speed bumps and leads through the property to a stop

sign at Ridgeview Road. There are no other traffic devices at this intersection - Ridgeview Road traffic does not stop. Ridgeview Road is a four-lane public thoroughfare that leads to SFT. The locker room is located on the north side of SFT near a parking lot. This researcher drove the route in a sport-utility-vehicle at 2 p.m. on a weekday, when school was in session, and the route took three minutes in travel time. During peak travel periods, the travel time is significantly increased, according to Santa Barbara Estates Co-Manager Kevin Shryock. The time needed to notify and relocate the residents of Santa Barbara Estates to the SFT locker room is unknown to Santa Barbara Estates management and the OFD.

People moving to Santa Barbara Estates have received only verbal information about the community, such as United States Postal Service locations (M. Shryock, personal communication, October 15, 2012). There has not been a formal new resident guide to provide community-based information.

In 2008, the Multi-Jurisdictional Hazard Mitigation Project (Appendix D) was completed by OFD emergency management staff. The assessment determined the vulnerability of Santa Barbara Estates to severe thunderstorms and tornadoes. The methodology used was Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE). STAPLEE may be used to prioritize mitigation actions and conduct a systematic feasibility review of alternatives that appear to provide a long-term solution to the problem (Federal Emergency Management Agency, 2008, p. 15). The assessment information was placed into the Johnson County Multi-Hazard Mitigation Plan (JCMHMP). The assessment created a STAPLEE action item that called for the creation of a shelter for Santa Barbara Estates residents. This assessment also deemed the shelter action item as a high priority (Johnson County

Emergency Management and Homeland Security, 2009, table 4.13). Although deemed a high priority, no further action was found in regard to the construction of “safe rooms.”

In 2009, OFD emergency management technicians completed a Mitigation Action Implementation Worksheet (Appendix E) of Santa Barbara Estates (T. Hufft, & T. Maxton, personal communication, September 26, 2012). The worksheet helped identify potential mitigation actions and implementation strategies. The technicians’ completed worksheet called for the construction of two safe rooms to accommodate the residents of Santa Barbara Estates. The action timeline recommended that the first safe room structure would be completed in 2010. Since the implementation timeline for the construction of “safe rooms” was created in 2009, no updates or further action towards its goals were found.

The OFD’s Continuous Improvement Team (CIT) assessed Olathe’s risk level classifications and conclusions as part of the Community Risk and Emergency Services Analysis and Standard of Cover (CRESA-SOC) in 2011. The CIT analyzed seven unique community risk evaluation factors within every ESZ. The seven factors were incident frequency, population density, occupancy vulnerability assessment profile, property value, at-risk populations, target hazards, and local considerations. The seven factor ratings were aggregated and assigned a comprehensive risk level classification specific for the respective ESZ (Olathe Fire Department, 2012, p. 156). The risk level classifications were low, moderate, high, and special. The CIT determined the community risk level of ESZ 202, where Santa Barbara Estates is located, as high.

A tornado shelter needs assessment of Santa Barbara Estates was a concerted effort to evaluate community risk. In addition, the shelter needs assessment correlated to the following United States Fire Administration strategic goals: (a) reduce risk at the local level through

prevention and mitigation, (b) improve local planning and preparedness, and (c) improve the fire and emergency services capability for response to and recovery from all hazards.

### **Literature Review**

A tornado is a violently rotating column of air extending from a thunderstorm to the ground (National Oceanic and Atmospheric Administration, n.d., para. 3). Tornadoes are fierce and destructive atmospheric storms. On April 27, 2011, 122 tornadoes resulted in 313 deaths and more than 2,400 injuries in the southeastern United States (National Weather Service, 2011, p. iv). Paths for eight of these tornadoes were over 50 miles in length.

The rotating wind speed of a tornado can be over 200 miles per hour (mph). The Enhanced Fujita (EF) Scale (Appendix F) is used to assign a tornado rating based on estimated wind speeds and related damage (National Weather Service Weather Forecast Office Norman, OK, 2011, para. 1). The EF Scale ratings are from the weakest, EF-0, to the strongest, EF-5. Tornadoes with a three-second wind gust of over 200 mph are classified as an EF-5. Tornadoes are a powerful force of nature.

Tornadoes occur around the globe. Although more tornadoes occur in the United States, the “United Kingdom (UK) gets more tornadoes per square kilometer than the USA” (*What is?*, 2012, para. 3). According to the Met Office, which is the UK’s national weather service, the UK averages about 30 tornadoes annually, and they are usually “much weaker” than those in the United States.

Although the terms “safe room” and “shelter” are different by definition, they were often used by many as synonyms before the 2008 version of the Standard for the Design and Construction of Storm Shelters, which is commonly referred to as International Code Council (ICC) 500-2008. The ICC 500-2008 standard created the foundational principles of shelter

construction requirements. The standard was published jointly by the ICC and the National Storm Shelter Association. ICC 500-2008 “provides minimum design and construction requirements for storm shelters that provide a safe refuge from strong storms that produce high winds, hurricanes, and tornadoes” (International Code Council, n.d., para. 2).

The release of the ICC 500-2008 standard, as well as other national, state, and local protection initiatives, identified a need to distinguish between the shelters that meet the stringent FEMA “criteria for near-absolute protection and those that do not” (Federal Emergency Management Agency, n.d., para. 4). All shelters, buildings, or spaces that are designed to the rigorous FEMA criteria, which are cited in their publications numbered P-320 or P-361, are referred to as “safe rooms.” FEMA P-320 is titled “Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business.” FEMA P-361 is titled the “Design Guidance for Community Safe Rooms.” FEMA safe room criteria meet or exceed the ICC 500-2008 standard requirements. “Both ‘storm shelters’ and ‘safe rooms’ employ the same wind load design criteria and thus the same tornado protection” (National Storm Shelter Association, n.d.). The difference between ICC 500-2008 and FEMA guidelines are that the federal criteria require special considerations of “human factors,” such as accessibility. The terms “safe rooms” and “shelters” were used synonymously for research purposes.

Communities use tornado shelters in different ways. A community tornado shelter can be used for sheltering alone or it can have other uses. A structure used for only sheltering is considered single-use. A structure used for other purposes, in addition to sheltering, is considered multi-use. An example of a multi-use room would be a shelter that also serves as a community center, community room, reception hall, or class room. The minimum usable recommended floor area, for single-use and multi-use shelters, should be built based on the

appropriate square footage recommendations of the occupants it will serve (Federal Emergency Management Agency, 2008). The decision to design and construct a single-use or a multi-use shelter is usually made by the owner (Federal Emergency Management Agency, 2008, p. 5.4).

The City of Edwardsville, Kansas remodeled a “storm shelter” in 2000. The multi-purpose building is used as a storm shelter and community center. The main function of the building still serves as storm shelter for the Edwardsville Mobile Home Village during inclement weather (City of Edwardsville, n.d., para. 1). The shelter may also be rented for use as a banquet hall.

There are two stand-alone, single-use shelters in Mapleton, Kansas. These above-ground shelters, which resemble shipping containers, are located on the same property as the fire station and community center building. Mapleton is a rural community located in southeast Kansas.

Shelters are also located along the Kansas Turnpike. There are 29 single-use public shelters. The shelters are located in nearly all of the Turnpike service areas and toll plazas. The Tonganoxie/Eudora site is the only Kansas Turnpike Authority (KTA) location that does not have a shelter (*KTA Shelter Locations*, n.d., p. 1). Many of the KTA shelters are underground.

The Kansas Hazard Mitigation Grant Program (HMGP) has funded “about 200 shelters across the state” (C. McGonigle, personal communication, October 30, 2012). Most of the shelters are multi-use and located in schools. Shelters must be built to the ICC 500-2008 and FEMA 361 criteria to be eligible for funding by the HMGP. Of the approximately 200 shelters across the state, which received HMGP funding, about 20 of those shelters were in community centers (C. McGonigle, personal communication, October 30, 2012). In addition, the HMGP helped construct shelters at the Theodore Naish Scout Reservation, also referred to as Camp Naish. Camp Naish is a popular camp used by the Boy Scouts of America, located in northeast

Kansas. Camp Naish is a 1,300 acre camp that served nearly 55,000 campers in 2008 (Wyandotte County Emergency Management Department, 2009, Chapter 2.2.9).

On May 3, 1999 a tornado, in Wichita, Kansas, destroyed the Jefferson Elementary School “breakfast building” during the morning meal. Although no injuries occurred, school officials recognized a critical vulnerability, of their district, to a tornado strike. In 2000, Wichita Public Schools took preventative measures and became the first school district in the United States to build a “safe room” (Federal Emergency Management Agency, n.d.). The room, located at Jefferson Elementary School, was also the first room of its kind built in accordance with the construction guidance of FEMA 361. The district has 61 safe rooms which is more than any other district in the country (*BOE Agenda*, 2011, p. 1). The Wichita Public Schools “safe rooms” are all multi-use. The rooms are purposed for different uses such as physical education, athletics, lunch, performances, assemblies, and classrooms. During school hours, the rooms have been available for community sheltering.

Cullman County, Alabama, was devastated by a tornado in 2011. Community tornado shelters did not exist and were therefore unavailable during the tornado strike. In 2012, the construction of a multi-use facility began in Cullman County. The Cullman County Career Center for the Developmentally Disabled is a building project that will have a 7,000 square foot below grade community tornado shelter (Bullard, 2012). The multi-use facility, which is projected to be completed in 2013, will also house the American Red Cross.

In 2010, the legislature of Alabama passed a bill (Act 2010-746 Safe Space) requiring that all new K-12 school construction projects awarded after July 1, 2010, provide a storm shelter that complies with the ICC-500 storm shelter standard (Federal Emergency Management

Agency, 2011, p. 3). This action followed the destructive tornado of March 2007 that killed seven students and one teacher at Enterprise High School in southeast Alabama.

The likelihood of a tornado event in Olathe is based on risk and potential. “Tornado risk includes the potential for property damage, injury, and loss of life all of which are increased with a higher frequency of occurrence” (Federal Emergency Management Agency, 2007, p. 2).

The NWS is the only agency that issues tornado forecasts nationwide (National Oceanic and Atmospheric Administration, n.d.). Individual NWS offices issue warnings while the NWS Storm Prediction Center issues watches, severe weather outlooks and mesoscale discussions. Few countries have defined tornado watch and warning services to help provide citizen notification of severe weather (National Oceanic and Atmospheric Administration’s National Weather Service Storm Prediction Center, n.d.). Forecasting and notification systems, like the advanced, large and intricate NWS forecast network, are an integral part of reducing the risk or impact of a tornado event.

The risk versus benefit of having a shelter is also dependent upon the potential or frequency of occurrence for a tornado event. This is particularly important for those areas of the United States that may or may not be at a risk to experience a tornado. “Since the threat of tornadoes in Massachusetts has been very low, from a historical perspective, the need for ‘safe rooms’ really has not been on the table here in the Commonwealth” (P. Judge, personal communication, November 6, 2012). Due to the infrequent occurrence (low risk) of tornadoes in Massachusetts, hurricane-proof construction and flood-proofing have been considered more important mitigation items. However, states in other parts of the country have had the opposite tornado experience.



Kansas is a Midwest state located in FEMA Region VII. The other states which make up Region VII are Iowa, Missouri, and Nebraska. In the United States, Kansas ranks second, behind Texas, for having had the highest average number of tornadoes per year since 1953 (Federal Emergency Management Agency, 2011). The other Region VII states ranked fifth, sixth, and eighth for having had the highest average number of tornadoes per year. Region VII is also considered by many as part of “Tornado Alley.”

The United States is geographically separated into four wind zones. Wind Zone IV encompasses both Johnson County and Olathe. “Climatological conditions are such that warm and cold air masses meet in the center of the country to create conditions of great instability and fast moving air at high pressure that can ultimately result in the formation of tornado funnels” (Johnson County Emergency Management and Homeland Security, 2009, p. 3.65). Wind Zone IV has historically experienced the most and strongest tornado activity (Federal Emergency Management Agency, n.d., p. 6).

Johnson County has received 18 state and federal disaster declarations between the years of 1969 and 2009 (Johnson County Emergency Management and Homeland Security, 2009, table 3.2). Severe storms and tornadoes accounted for 10 of the disaster declarations. Since 1952, Johnson County has been impacted by 38 tornadoes that caused 44 fatalities and 224 injuries (The Tornado History Project, n.d.).

Johnson County, where Olathe is located, is ranked as the second most vulnerable county in Kansas to a tornado (Kansas Division of Emergency Management, 2010, p. 3.204). Johnson County and Sedgwick County are the two most populous Kansas counties and the only counties with a categorized “very high” tornado vulnerability.

In 2009 the City of Olathe adopted the JCMHMP (Olathe Fire Department, 2012, p. 134). The JCMHMP is a multijurisdictional collaboration of which over 30 organizations participated, including the OFD and City of Olathe. The purpose of the JCMHMP was to reduce or eliminate long-term risk to people and property from disaster. The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by the Disaster Mitigation Act of 2000, provided the foundation for the process.

The JCMHMP process followed a methodology prescribed by FEMA. The risk assessment identified hazards that create a risk to Johnson County. The assessment evaluated Johnson County's hazard vulnerability and related mitigation capabilities. FEMA Publication 386-2 (Understanding Your Risks: Identifying Hazards and Estimating Losses) provided the risk assessment methodology for the planning process. The methodology was a four-step process which included: identify hazards, profile hazard events, inventory assets, and estimate losses (Johnson County Emergency Management and Homeland Security, 2009, p. 3.1).

The JCMHMP Hazard Profile Summary was created with accepted methodology from the "MitigationPlan.com planning tool" to prioritize disaster potentials. The prioritization was based on a calculated priority risk index (CPRI) that considered four elements of risk: probability, magnitude/severity, warning time and duration (Johnson County Emergency Management and Homeland Security, 2009, p. 3.8). Risk level conclusions within the Hazard Profile Summary listed the tornado hazard as one with the following scores: moderate probability, high magnitude, high warning time, low duration, CPRI of 2.80, and a moderate planning significance (Johnson County Emergency Management and Homeland Security, 2009, p. 3.9). The "high warning time" score indicates a hazard with the least amount of public warning (notification) time. Terrorism is also an example of a "high warning time" hazard.

The JCMHP notes that the probability of a future occurrence of a Johnson County tornado is 49% in any given year (Johnson County Emergency Management and Homeland Security, 2009, p. 3.70). The location of Johnson County in Wind Zone IV makes the probability of a tornado in any given year “highly likely” (Johnson County Emergency Management and Homeland Security, 2009, p. 3.70). In addition, the JCMHP states that a tornado event is probable within the next three years. A powerful tornado strike in any of the densely populated and highly developed portions of Johnson County, including Olathe, would be catastrophic.

Tornado risk includes the potential for damage or destruction and an increased potential related to the frequency of occurrence. In the United States, tornadoes accounted for a record 553 fatalities in 2011 (National Oceanic and Atmospheric Administration, n.d.). Mobile home deaths accounted for 112 of those fatalities. In addition, 53% of the tornado fatalities for the years 2008-2010 were in mobile homes. Nearly 21% of Kansas tornado fatalities occurred in mobile homes from 1996-2007 (Sutter & Simmons, 2009, p. 131). “Research suggests that the likelihood of a fatality in a mobile home is 10 times or more than that in a permanent home” (Sutter & Simmons, 2009, p. 125).

Mobile homes are generally unsafe in a severe wind event (Texas Tech University Wind Science & Engineering Research Center, 2012). Because of the threat of injury from flying debris, a safe shelter should be nearby, preferably, to limit exposure to the outdoors (Texas Tech University Wind Science & Engineering Research Center, 2012). Limiting exposure to the outdoors helps reduce risk of injury and death. “If you live in a mobile home, identify a safe shelter outside of your mobile home such as a community shelter” (*Preparedness*, 2012, p. 3).

Mobile homes are not safe shelters; you should make plans before the storm arrives to get to a pre-planned shelter in order to reduce the risk of injury or death (City of Oklahoma City, n.d.). Tornadoes that are even considered “weak,” such as an EF-1, will usually cause severe damage to a mobile home and possibly “roll it over” (National Weather Service Weather Forecast Office Norman, OK, 2011, para. 19). A vehicle is one of the most dangerous places to be during a tornado (City of Oklahoma City, n.d.). Traveling to a community shelter by vehicle, especially for extended periods of time, may place an individual at greater risk during a tornado. If available, shelters should be accessible within five minutes (*Cost Benefit Analysis*, 2010, p. 33). Personal preparedness before a severe weather event helps manage risk.

The primary benefit of shelters that are constructed to industry standards is the reduction of risk to injury or death caused by tornadoes:

Shelters and safe rooms have long been thought of as a tremendous method of reducing risk from tornadoes and other high wind events. By going as low and as interior as possible, shelters and safe rooms allow the rest of the building to absorb the energy of the storm and allow the lowest and most central spots to be protected and/or preserved.

However, this clearly does not protect everyone. Direct hits to facilities -- particularly from high energy storms (ex: EF-5) -- will often impact the facility in such a way to eliminate any benefit from sheltering. Does this mean people should not use shelters -- absolutely not. The benefit of increased safety far outweighs any remote risk from the high energy storms (A. S. Crowe, personal communication, November 7, 2012).

Risk has an associated value. The value of a statistical life (VSL) is best understood not as the “valuation of life,” but as the valuation of statistical mortality risks (Executive Office of the President Office, 2011, p. 18). VSL is not a value judgment on the worth of human life, but

it is the willingness to pay for reducing the risk of death (United States Department of Transportation, n.d., slide 11). The construction of a tornado shelter would illustrate the willingness to pay for the reduction of the risk of death. The VSL varies among agencies and estimates may range from \$4 million to \$10 million (Kniesner, Viscusi, Woock, & Ziliak, 2012, p. 74). The United States Department of Transportation finds that changes in prices and incomes over the last two years imply a VSL of \$6.2 million ("Treatment of the Economic Value," 2011, para. 1). VSL has helped to create cost analyses that are specific and accurate.

An illustration of the willingness to pay for reducing the risk of death or VSL:

The average person in a population of 50,000 may value a reduction in mortality risk of 1/50,000 at \$150. The value of reducing the risk of 1 *statistical* (as opposed to known or identified) fatality in this population would be \$7.5 million, representing the aggregation of the willingness to pay values held by everyone in the population (United States Department of Transportation, n.d., p. 18).

The benefit of shelters has fiscal implications. To help reduce those implications, federal funding initiatives have been created to help reduce the cost and the risk of injuries and deaths related to tornadoes. The Housing and Community Development Act of 1974, also known as the Tornado Shelters Act, was amended in 2003 to allow for the use of community development block grant funding for the construction of tornado shelters in mobile home parks (Federal Emergency Management Agency, n.d.). Funding eligibility is based upon several factors. The factors include a minimum number of units served, income parameters of households served, and a tornado occurrence in the state where the park is located within the last three years. Eligible shelters must be built to appropriate building standards. In addition, eligible shelters must have a

capacity that will accommodate all park residents. A warning siren must also be located in the park. The Tornado Shelters Act has benefited communities with mobile home parks.

On April 27, 2011, 62 tornadoes caused almost 2,000 reported injuries and 140 deaths across the State of Alabama (National Weather Service Weather Forecast Office Birmingham, AL, 2012). About 1,500 of the nearly 2,000 injuries occurred in Tuscaloosa, Alabama and Birmingham, Alabama. Almost half of the total fatalities also occurred in these two communities. The Alabama Emergency Management Agency believes that shelters save lives:

We look at safe rooms as a way to save lives during severe weather; whether they are individual or community safe rooms, so that's the largest benefit. We also know they are built to a federal standard that is safer than the average house, so getting into a community safe room can very well mean the difference in life or death (Y. August, personal communication, November 6, 2012).

In summary, a tornado is a naturally occurring and powerful physical hazard which cannot be prevented. Residents of mobile homes are at an increased risk of injury and death during a tornado. The benefits of personal preparedness, such as having a pre-designated plan and shelter, can help reduce the risk of injury and death caused by tornadoes especially in those areas where tornadoes are considered a frequent occurrence.

### **Procedures**

After establishing a research purpose and questions, the researcher used several procedures to address the purpose and research questions for this applied research project (ARP). The researcher attended the Executive Fire Officer Program's Executive Analysis of Community Risk Reduction (EACRR) course at the National Fire Academy (NFA) from May 21 to June 1, 2012. The research started in the Learning Resource Center (LRC) on the campus of the NFA.

The researcher looked for hard copy or electronic reference materials associated to the subject matter at the LRC. The LRC research was the start of the literature review. In addition, the researcher met with Dr. Burton A. Clark at the NFA. The purpose, research questions, and research type were discussed with Dr. Clark.

The researcher used an iPad tablet computer, at the NFA, during the EACRR course to take notes, manage course tasks, create course documents, and research course topics. The researcher used Dropbox on the iPad to back-up and store all course-related electronic files, including notes. Dropbox is a free web-based file hosting service. The researcher used the CloudOn application which allowed for the use of other software such as Word® and PowerPoint® on the iPad. The cost of CloudOn was \$4.99. The researcher also used the free Adobe® Reader® application to view Portable Document Format documents on the iPad. The iPad's free Safari internet browser application was also used by the researcher.

The researcher submitted the ARP proposal by email to the evaluator on July 11, 2012. The proposal was received by email and approved by the evaluator, with comments, on July 13, 2012.

The literature review continued after leaving the NFA campus through the use of laptop internet access to the LRC and two search engines. The search engines used by the researcher were Google and Bing. The researcher used the search terms “tornado shelter use,” “tornado shelter needs assessment,” “tornado risk,” and “tornado shelter survey.”

On September 25, 2012, personal correspondence was obtained from CERT Manager and Captain John Sanches in regard to OFD CERT. As part of the correspondence, Captain Sanches explained the purpose and structure of CERT.

Personal correspondence about Santa Barbara Estates was started on September 25, 2012, from Santa Barbara Estates Co-Manager Kevin Shryock. The researcher visited the property on October 15, 2012, and gathered information from Mr. Shryock. The property was also toured during the visit by the researcher. Personal correspondence continued throughout the project with Co-Manager Shryock.

The OFD's emergency management technicians provided personal correspondence in regard to the known historical background and significance of Santa Barbara Estates mitigation on September 26, 2012. The technicians provided information to the researcher throughout the project.

An internet based instrument was created at SurveyMonkey.com on September 26, 2012. The survey was used to collect information in regard to how other communities use tornado shelters. The survey was forwarded by email to a population of emergency and non-emergency service professionals with expertise in emergency management and related functions. The survey was sent to the Training Resources and Data Exchange, Heart of America Fire Chiefs Council, Kansas Emergency Managers Association, and Kansas Association of Public Information Officers. All survey recipients were notified that the terms "shelter" and "safe room" were used as synonyms for the purpose of this applied research project. The distribution allowed for local, state and national distribution. The eight survey questions were:

1. Your area of expertise?
2. What is the population of your community?
3. Does your community have community tornado shelters?
4. If your community has community tornado shelters are they?
5. How many community tornado shelters?



6. If your community has community shelters, are their locations tracked (registration process, permit, etc.)?
7. If your community has community tornado shelters, are the structure used for any other purpose?
8. What other purpose does your community tornado shelters serve?

Personal correspondence was received on September 27, 2012, in regard to the likelihood of a tornadic event in Olathe or Johnson County. The expert correspondence, based on research question #2, was with Mark O'Malley of the National Weather Service. Mr. O'Malley is a weather expert and lead forecaster for the NWS.

Division Chief of Logistics and Support Services David Dock provided personal correspondence on September 28, 2012. The correspondence was about Olathe's outdoor warning system and its components. Division Chief Dock is responsible for the notification system.

Personal correspondence was received on October 20, 2012, also regarding the likelihood of a tornadic event in Olathe or Johnson County. The expert correspondence, based on research question #2, was with Mary Knapp. Ms. Knapp is a state climatologist and an information technology specialist. She is employed by Kansas State University and works in the Department of Agronomy.

On October 30, 2012, a personal interview by phone was conducted with Hazard Mitigation Specialist Charlie McGonigle. Mr. McGonigle is a disaster preparedness expert with the Kansas Division of Emergency Management. The interview was founded on the research questions.

Personal correspondence was received on November 6, 2012, from External Affairs Director Yasamie August of the Alabama Emergency Management Agency (AEMA). The correspondence was based on research questions #1 and #3. Mrs. August was the lead public information officer for the AEMA following the historic Alabama tornado outbreak of April 27, 2011.

Peter Judge provided personal correspondence on November 6, 2012. The expert correspondence was based on research questions #1 and #3. Mr. Judge is the public information officer for the Massachusetts Emergency Management Agency. In addition, Public Information Officer Judge worked with the Alabama Emergency Management Agency in Birmingham, Alabama, following the historic tornado outbreak of April 27, 2011.

On November 6, 2012, the researcher downloaded FEMA's Benefit-Cost Analysis (BCA) Tool Version 4.8 software program files onto the researcher's laptop. The program installation failed on two attempts and the software was not used. The BCA is usually employed to determine grant cost-effectiveness of hazard mitigation. The researcher had planned to use the tool as reference material in regard to research question #3. The BCA program is free and consists of guidelines, methodologies, and software modules for six natural hazards including tornadoes.

The researcher conducted a personal interview, on November 7, 2012, of Emergency Preparedness Director Adam Crowe of Virginia Commonwealth University. The interview was founded on the research questions. He also authored *Disasters 2.0: The Application of Social Media in Modern Emergency Management and Leadership in the Open: A New Paradigm in Emergency Management*. In addition, Mr. Crowe has been a speaker at seminars and conferences regarding emergency management topics.

Personal correspondence was received from Fire Chief and Dr. Jeff DeGraffenreid on November 14, 2012. The correspondence was based on the research questions, external community communications, and the organizational impact and implications of a tornado strike on the OFD.

A limitation of this ARP was that a singly administered survey captured only a snapshot in time. Another limitation was that the misinterpretation of a survey question could result in an inaccurate response. An added limitation was that the terms “safe rooms” and “shelters” have often been publicly used as synonyms although the terms have different meanings.

Assumptions were concluded that although differences exist between the terms “safe rooms” and “shelters,” the similarities were satisfactory and representative for this research. The procedures were sufficient for this ARP.

The completion process of the ARP occurred in November of 2012. The process entailed the collection and organization of information into a Word® 2007 document in accordance with EFO guidelines and American Psychological Association rules. The researcher submitted the completed ARP to the NFA.

## **Results**

The topic of tornado shelters is popular and abundant. This popularity and abundance of information provided for a comprehensive literature review about the topic of tornado shelters. The literature review; personal interviews and correspondence; and survey assisted the researcher with addressing the research questions.

The survey provided important and realistic information to help answer the first research question. Survey responses were honest and authentic. The Executive Fire Officer Program Tornado Shelters/Safe Rooms survey (Appendix A) was open for 12 days. The survey received

69 responses from emergency service and non-emergency service professionals. Survey questions one through seven required an answer. Survey logic was added to question #7 which immediately directed respondents, who answered “yes,” to question #8. The question #7 logic immediately directed respondents who answered “no,” “don’t know, or “doesn’t apply” to the end of the survey, which took them to [Facebook.com/OlatheFire](https://www.facebook.com/OlatheFire).

Survey question #1 asked respondents their area of expertise. Emergency service responses represented 81.2% of completed surveys. Emergency service expertise included police, fire and emergency medical service for the purpose of this survey. Non-emergency service responses represented the remaining 18.8%.

Survey question #2 asked for the population of the respondent’s community. Question #2 was broken into seven population categories. The categories mirrored the population sets of the Center for Public Safety Excellence. The population category of “10,000-49,999” received the largest representation and made up 43.5% of respondents. The population category of “0-9,999” received the second largest representation and comprised 17.4% of respondents. The least number of respondents represented the population category of “Over 1 million” with 2.9%. The population categories of “0-9,999;” “10,000-49,999;” and “50,000-99,999” combined to represent 76.8% of survey responses. The population categories of “100,000-199,999;” “200,000-499,999;” and “500,000-999,999” combined to represent approximately 20% of the respondents. When a respondent completed the survey they were automatically redirected to [Facebook.com/OlatheFire](https://www.facebook.com/OlatheFire).

The first question this research answered was how other communities were using tornado shelters. Survey question #3 determined that 52.2% of respondent communities do not have tornado shelters. Question #3 noted that 39.1% of respondent communities had tornado shelters.

Survey question #3 also identified that 8.7% of respondents did not know if their community had tornado shelters. The survey question received 69 responses.

Survey question #4 asked if respondent community tornado shelters were “public,” “private,” “don’t know,” or “doesn’t apply.” The question applied to 33 respondents. Question #4 determined that 39.1% of respondent communities had tornado shelters. Of the 39.1% of respondent communities with tornado shelters, 60.6% were public facilities; 21.2% were private facilities; and, 18.2% didn’t know whether the facilities were public or private. The question did not apply to 52.2% of survey respondents. The survey question received 69 responses.

Survey question #5 asked how many community tornado shelters were in the respondent’s community. The possible answers to question #5 were: “0,” “1-9,” “10-19,” “20 or more,” and “don’t know.” The largest response percentage was 44.9% of respondents with “0” community tornado shelters. The second largest response percentage was 31.9% with “1-9” community tornado shelters. The remaining response percentages were 1.4% (10-19 shelters); 2.9% (20 or more shelters; and, 18.8% “don’t know.” The survey question received 69 responses.

Survey question #6 inquired as to whether community tornado shelters/safe room locations were tracked. The possible answers to question #6 were: “yes,” “no,” “don’t know,” and “doesn’t apply.” The question applied to 36 respondents. The applicable response counts for “yes,” “no,” or “don’t know” were: “yes” (16.7%), “no” (47.2%), and “don’t know” (36.1%). Survey question #6 “doesn’t apply” to 47.8% of the total 69 respondents. “Doesn’t apply” indicates that the respondent community does not have a community tornado shelter/safe room.

Survey question #7 asked if respondent community tornado shelters were used for any other purpose. The possible answers to question #7 were: “yes,” “no,” “don’t know,” and

“doesn’t apply.” The question applied to 35 respondents. The largest response percentage was “yes” with 74.3% of the 35 respondents to which the question applied. Survey question #7 “doesn’t apply” to 49.3% of the total 69 respondents. “Doesn’t apply” indicates that the respondent community does not have a community tornado shelter/safe room. Survey logic was added to question #7 which immediately directed respondents, who answered “yes,” to question #8. The survey question #7 logic immediately directed respondents who answered “no,” “don’t know, or “doesn’t apply,” to the end of the survey.

Survey question #8 asked for what other purpose existing community tornado shelters serve. Question #8 was an open-ended question in a text box format and did not require a response. Of the 69 survey responses received, 23 respondents answered survey question #8. All survey responses were comprehensively analyzed by the researcher. The researcher found no unexpected findings.

The second question this research answered was the likelihood of a tornadic event in Olathe. Kansas is located in Tornado Alley and Wind Zone IV. Tornado Alley and Wind Zone IV have experienced the most tornado activity in United States history (Federal Emergency Management Agency, n.d.). This geographical area has also experienced the strongest tornado activity. Kansas ranks only second to Texas for the annual average of tornado events.

The climatological conditions in and around Olathe are favorable for tornado activity. Johnson County, where Olathe is located, is ranked as the second most vulnerable county in Kansas to a tornado (Kansas Division of Emergency Management, 2010). Only two Kansas counties have been categorized with the “very high” tornado vulnerability designation. A tornadic occurrence is considered probable in Johnson County within the next three years (Johnson County Emergency Management and Homeland Security, 2009). Tornadoes are

considered as having a “high warning time.” “High warning time” hazards occur rapidly and have the least amount of community warning time. Tornadoes are also a “high magnitude” hazard.

The probability of a future tornado occurrence in Johnson County is nearly 50% in any given year (Johnson County Emergency Management and Homeland Security, 2009, p. 3.70). The probability of a tornadic event in Johnson County, including Olathe, is “highly likely” (Johnson County Emergency Management and Homeland Security, 2009). The researcher found no unexpected findings.

The third question this research answered was the risk-benefit of tornado shelters. The VSL is the valuation of statistical mortality risk (Executive Office of the President, 2011, p. 18). VSL is essentially the accepted willingness to pay for reducing the risk of death (United States Department of Transportation, n.d., slide 11). VSL has been considered an industry best practice that is used by government agencies. The valuation of a mortality risk may or may not outweigh the benefit provided by the protection of a tornado shelter if the willingness to pay for the risk reduction is exceeded.

Research indicated that a tornado-related fatality was at least 10 times more likely to occur in a mobile home than a permanent home (Sutter & Simmons, 2009). Even a weak tornado will typically cause severe destruction to a mobile home (National Weather Service Weather Forecast Office Norman, OK, 2011). People located inside a mobile home are at greater risk and are therefore vulnerable to injury or death during a tornado.

Shelters and safe rooms have long been thought of as a tremendous method of reducing risk from tornadoes and other high wind events (A. S. Crowe, personal communication, November 7, 2012). Shelters, constructed to industry standards, benefit the community by

helping to reduce the risk of injury or death related to tornadoes. A shelter can very well mean the difference between life or death (Y. August, personal communication, November 6, 2012).

Santa Barbara Estates does not have a shelter(s) within FEMA's recommended one-half of a mile, or within five minutes walking distance (M. Shryock, personal communication, October 15, 2012). The researcher found no unexpected findings.

### **Discussion**

The relationship, of the study results, was consistent with industry best practices and local findings. The shelter construction action for Santa Barbara Estates, which was identified in 2008 and 2009 by the STAPLEE (Appendix D) and Hazard Mitigation Action Implementation Worksheet (Appendix E), remains relevant and is recommended today.

“Tornado risk includes the potential for property damage, injury, and loss of life all of which are increased with a higher frequency of occurrence” (Federal Emergency Management Agency, 2007, p. 2). The potential for property damage, injury and loss of life for residents of a mobile home is significant. The likelihood of a tornado-related fatality to occur in a mobile home is at least 10 times greater than that of a permanent home (Sutter & Simmons, 2009). In addition, the risk of injury or death is increased with a higher frequency of tornado occurrences. The risk for people living in a mobile home in Johnson County, including Olathe, is compounded since the probability of a future tornado occurrence each year is almost 50%; a tornado occurrence is considered “highly likely” in any given year; and a tornado event is probable within the next three years (Johnson County Emergency Management and Homeland Security, 2009). In addition, Santa Barbara Estates is located in ESZ 202, which has a metropolitan population density (Appendix C) and a “high” comprehensive risk level classification (Olathe Fire Department, 2012).



The researcher's interpretation of the results found that more than half of survey respondent communities did not have tornado shelters. Of those respondent communities with tornado shelters, six in 10 shelters were public facilities (property). The researcher's conclusion is that most community tornado shelters are public.

The researcher discovered that of those respondent communities with tornado shelters, most communities have less than 10 such facilities. The researcher was surprised to learn that nearly 20% of respondents did not know if their community had a tornado shelter(s). In addition, the researcher found it interesting that more than 80% of respondent communities said that shelter locations were either not tracked, or that they "don't know" where these facilities are to be found.

The research indicated that most community tornado shelters are multi-use. Almost three-quarters of all respondent communities (public and private) use shelters for other purposes. Other "public" purposes included, but were not limited to meeting rooms, community center rooms, assemblies, and library rooms. "Private" facilities purposed their multi-use rooms as part of hospitals and churches. A single notable response stated that one community shelter was also used for "storage." The researcher believes that storage in a multi-use community shelter may infringe upon the shelter's occupant capacity, which is based upon the minimum usable square floor area per person (Federal Emergency Management Agency, 2008, table 3-1). Consequently, storage may decrease the shelter's occupant capacity and reduce the number of people who could safely shelter in the structure.

A tornado strike in ESZ 202, where Santa Barbara Estates is located, would have an overwhelming organizational implication to the OFD's emergency service resources (J. G. DeGraffenreid, personal communication, November 14, 2012). This tornado strike would have

the potential to significantly affect a community population of approximately 5,000 people (Olathe Fire Department, 2012), including up to 1,500 residents of Santa Barbara Estates (M. Shryock, personal communication, October 15, 2012). The service demand created by a tornado strike in ESZ 202, including Santa Barbara Estates, would immediately exceed the organizational capabilities of the OFD's daily minimum staffing of 28 firefighters (J. G. DeGraffenreid, personal communication, November 14, 2012).

The researcher determined that the severe weather notification mediums, which provide early warning, are established in Olathe. The residents of Santa Barbara Estates are sufficiently protected by Olathe's state-of-the-art outdoor warning system. The closest siren location of Olathe's system, which is made up of 37 devices, is .3 miles from Santa Barbara Estates devices (D. Dock, personal communication, September 28, 2012). For at least a decade, the OFD has publicly and actively encouraged the use of NOAA weather radio as the best way to receive weather watches and warnings (J. G. DeGraffenreid, personal communication, November 14, 2012). Personal preparedness of residents combined with adequate shelter for residents - meeting FEMA criteria - would reduce the risk of injury and death in the event of even a weak tornado (Appendix F). The concentrated risk reduction effort of personal preparedness, to include shelter, would not only help to diminish the organizational impact of a tornado strike on the OFD, but the community as a whole.

### **Recommendations**

Following considerable research and study to address the problem, purpose and research questions of this project, the researcher created these recommendations:

1. The OFD should collaborate with Santa Barbara Estates management to help create a formal severe weather plan.

2. Santa Barbara Estates management should formally provide a new resident guide to those who have recently located on the property. The guide should include, but not be limited to personal preparedness information (get a kit, make a plan, be informed).
3. The OFD and Santa Barbara Estates management should encourage the use of NOAA weather radio by residents of Santa Barbara Estates.
4. A CERT class should be offered to Santa Barbara Estates staff and residents.
5. Shelter should be constructed on the property of Santa Barbara Estates to accommodate its residents per applicable standards and best practices.

Future readers should conduct a shelter needs assessment for communities and target populations, such as mobile home residents, that are at greater risk for injury or death related to tornado events.

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## Appendix A

**Executive Fire Officer Program Tornado Shelters/Safe Rooms<br>****\* 1. Your area of expertise:**

- Emergency service (police, fire and emergency medical service)
- Non-emergency service

**\* 2. What is the population of your community?**

- 0-9,999
- 10,000-49,999
- 50,000-99,999
- 100,000-199,999
- 200,000-499,999
- 500,000-999,999
- Over 1 million

**\* 3. Does your community have community tornado shelters/safe rooms?**

- Yes
- No
- I don't know

**\* 4. If your community has community tornado shelters, are they:**

- Public
- Private
- Don't know
- Doesn't apply

**\* 5. How many community tornado shelters/safe rooms are in your community?**

- 0
- 1-9
- 10-19
- 20 or more
- Don't know



**Executive Fire Officer Program Tornado Shelters/Safe Rooms<br>**

**\*6. If you're community has community shelters/safe rooms, are their locations tracked (registration process, permit, etc.)?**

- Yes
- No
- Don't know
- Doesn't apply

**\*7. If your community has community tornado shelters/safe rooms, are the structures used for any other purpose?**

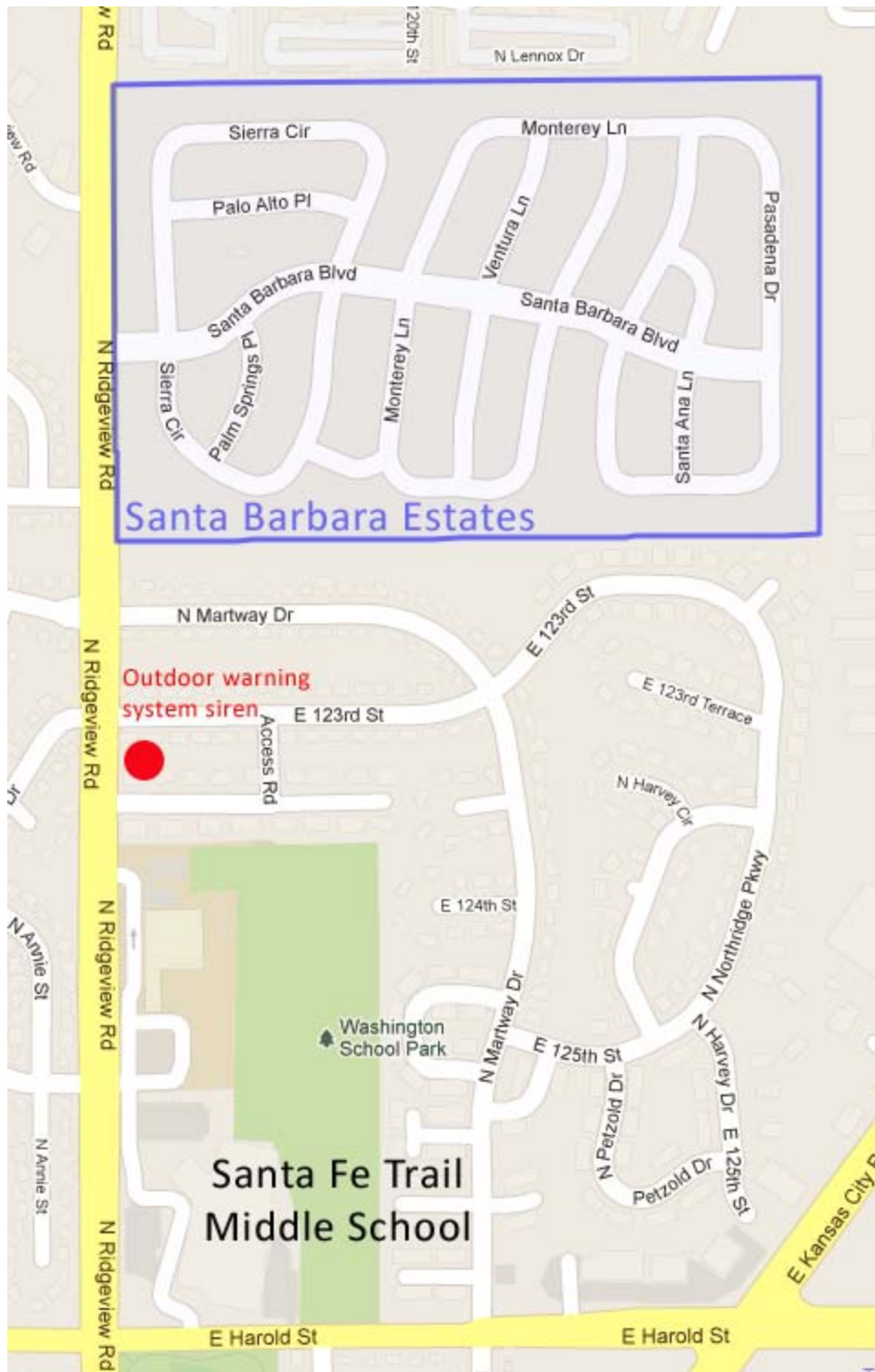
- Yes
- No
- Don't know
- Doesn't apply

**Executive Fire Officer Program Tornado Shelters/Safe Rooms<br>**

**8. What other purpose does your community tornado shelters/safe rooms serve?**

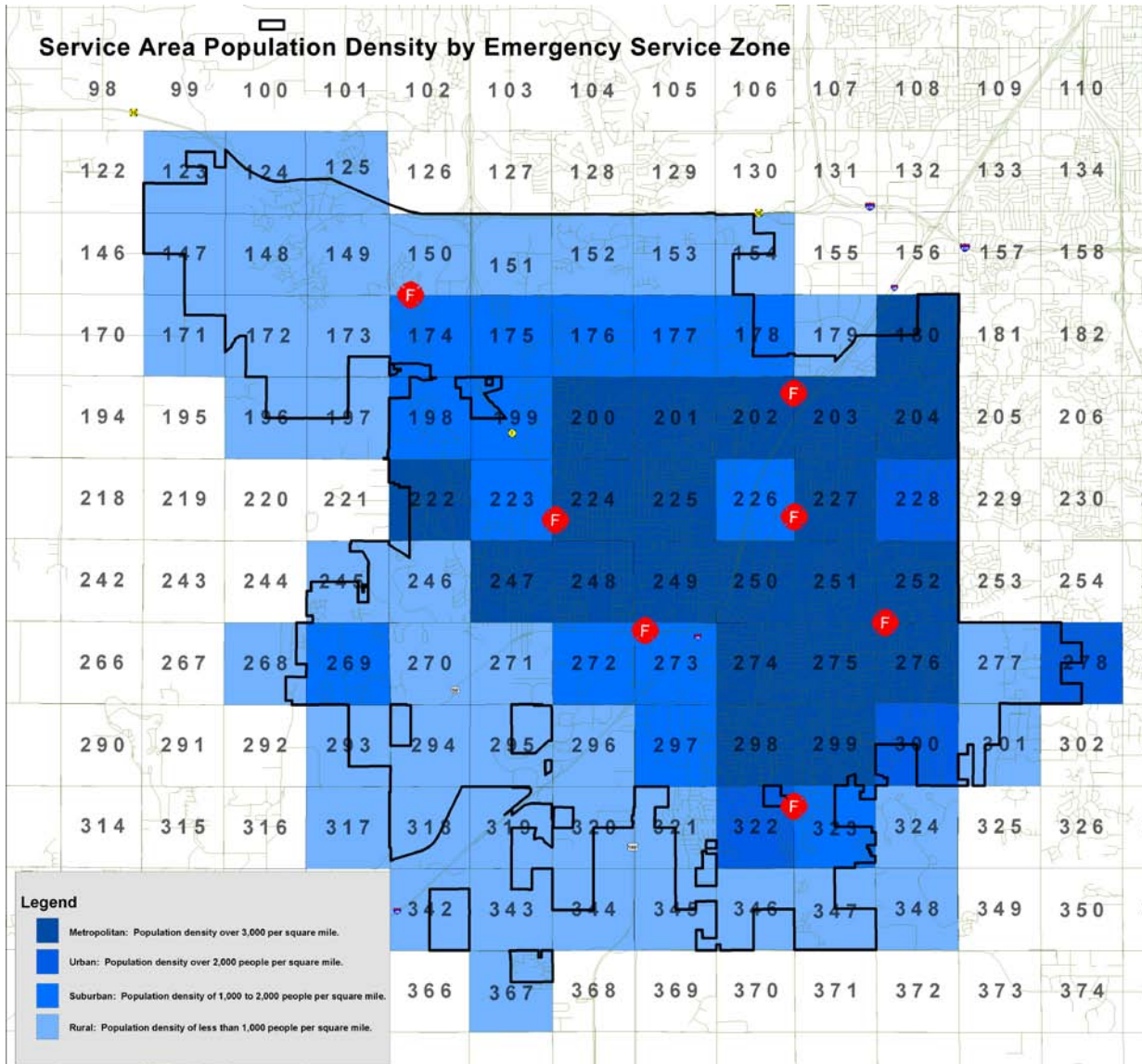
Appendix B

Santa Barbara Estates Map



Appendix C

Service Area Population Density



Appendix D

**STAPLEE Multi-Jurisdictional Hazard Mitigation Project**

Jurisdiction(s): City of Olathe


Proposed Mitigation Action Suggestion:

New construction of free-standing safe rooms at Santa Barbara Mobile Home Estates.

<b>Criteria</b>	<b>Evaluation Rating</b> Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0	<b>Score</b>
Does it reduce disaster damage?		0
Does it contribute to other goals?		2
Does it benefit the environment?		0
Does it meet regulations?		3
Will historic structures be saved or protected?		0
Does it help achieve other community goals?		3
Could it be implemented quickly?		2
<b>S:</b> Is it Socially acceptable?		2
<b>T:</b> Is it Technically feasible and potentially successful?		2
<b>A:</b> Does the jurisdiction have the administrative capacity to executive this project.		2
<b>P:</b> Is it Politically acceptable?		2
<b>L:</b> Is there Legal authority to implement?		2
<b>E:</b> Is it Economically beneficial?		2
<b>E:</b> No special Environmental approvals required?		1
<b>Total Score</b>		23

Appendix E

Mitigation Action Implementation Worksheet

<b>Jurisdiction:</b>	<b>City of Olathe</b>	<b>Priority: High</b>	(High, Medium, Low)
<b>Action Title:</b>	New construction of safe rooms for Home Town Santa Barbra Mobile Home Park		
<b>Issue/Background:</b>	<p>The Home Town Santa Barbara sub-division is a mobile home park with a total land area of 82.57 acres. The total number of housing units on the site is 487 with 100% of the units built at grade. The average census/populating in the complex is 1600 people.</p> <p>The original construction date is 1972 and offers no protection from high-wind and tornado events.</p> <p>This mobile home complex has no existing structures on the property for residents to seek shelter and safety from tornado or high wind events.</p>		
<b>Ideas for Implementation:</b>	<p>Seek grant funding to construct two free-standing community shelter areas within the sub-division with capacity of 800 people each.</p> <p>Optional implementation ideas: Complete this project in two phases over a two-year period. The result will increase the life safety to the residents by 50% over a two-year period.</p>		
<b>Responsible Office:</b>	To be determined		
<b>Partners:</b>	None		
<b>Potential Funding:</b>	KS State Mitigation grant funds only		
<b>Cost Estimate:</b>	\$800,000.00		
<b>Benefits: (Losses Avoided)</b>	<p>1 – Increase the life safety to the residents from high wind and tornado events.</p> <p>2 – Reduce the vulnerability of loss of life situations due to high wind and tornado events.</p>		
<b>Timeline:</b>	Complete the initial structure 2010		
<b>Completed by:</b>		Emergency Management Technician	

## Appendix F

## Enhanced Fujita Scale

EF-Scale Categories	Wind Speed Ranges
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	>200