

OPTIONS FOR DEVELOPING AN EARTHQUAKE PREPAREDNESS PLAN

Options for Developing an Earthquake Preparedness Plan within the

Santa Rosa Fire Department

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CERTIFICATION STATEMENT

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

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Abstract

The problem is that Santa Rosa Fire Department (SRFD) does not have a comprehensive earthquake preparedness plan, thus leading to the possibility of discontinuity of the department's mission. The purpose of this research was to identify ways to increase knowledge within SRFD in order to develop an earthquake preparedness plan.

Through descriptive research, earthquake standards and guidelines were identified, other fire departments were surveyed about this issue, and essential components SRFD should consider were identified, along with the internal earthquake preparedness knowledge of company officers.

The research was accomplished through literature review and surveys. The results showed the importance of developing a comprehensive earthquake preparedness plan. Recommendations included the design, implementation and evaluation process for an earthquake preparedness plan.

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Introduction

For many Californians, earthquakes have become an accepted part of life. The San Francisco Bay Area is often referred to as “earthquake country”. Beneath the counties surrounding the Bay Area lie the San Andreas, Hayward, Calaveras, San Gregorio, Rogers Creek and Greenville fault lines. Bamattre (2007) discusses how emergency preparedness must become second nature for all residents living in the Bay Area. In the event of a major earthquake, many freeways and surface streets will likely be impassable and public services could be interrupted or taxed beyond their limits. It is therefore imperative that everyone learn to provide for their own needs at work, home and on the road.

Earthquakes in the San Francisco Bay Area can happen at any time and the extent of damage is unpredictable. There are normally long periods between earthquakes which make it essential to keep emergency supplies fresh. Rotating older supplies into daily use is a practical way to keep disposable and perishable goods fresh. It is recommended that drinkable water stored by the public be exchanged every six months, Miner (2009). Commercially bottled drinking water will have a label with an expiration date like food products.

The Loma Prieta earthquake on October 17, 1989 was the last major earthquake to hit the Bay Area. It measured a 7.1 on the Richter scale. This earthquake was large but nowhere near as large as the great San Francisco earthquake of 1906 which was estimated at a magnitude 7.8. For each whole number on the Richter scale you go up, the amplitude of the ground motion recorded by a seismograph goes up ten times. United States Geological Survey (USGS, 2003) states there is a 62% chance of a magnitude 6.7

or greater earthquake will strike again within the next 30 years. Scientists believe a 6.7 or greater earthquake is nearly twice as likely to happen as not to happen. They predict the location of the next major earthquake to further north of San Francisco, between Oakland and Santa Rosa.

The problem is that Santa Rosa Fire Department (SRFD) does not have a comprehensive earthquake preparedness plan, thereby leading to the possible discontinuity of the department's mission: to save life and property.

The purpose of this research is to identify how SRFD can best develop an earthquake preparedness plan. Descriptive methodology will be utilized to answer the following questions: a) what components are needed for an earthquake preparedness plan? b) what are other communities doing to protect their citizens and workforce from the effects of a major earthquake? c) what are the essential components SRFD should consider when developing an earthquake preparedness plan?, and d) what is SRFD doing to develop an earthquake preparedness plan?

Background and Significance

The City of Santa Rosa Fire Department is located approximately 40 miles north of San Francisco in middle of the Sonoma County wine country. It is an all-risk fire department with a total population of approximately 163,095 within 43 square miles. SRFD has an annual budget \$26.2 million and is the largest fire department between San Francisco and Portland, Oregon. In 2008, SRFD responded to 19,137 requests for service.

Unfortunately, the City of Santa Rosa resides on top of the Rogers Creek earthquake fault line which on April 18, 1906 caused over 100 deaths and the highest structural damage per capita for any city in California, including San Francisco.

City limits for Santa Rosa were established in 1884. Soon after, City Ordinance #115 was passed creating the City's first paid fire department. By 1900, SRFD was serving a population of 5,500 out of one fire station with only one officer, the fire chief. Today SRFD is staffed with 140 sworn and twelve non-sworn personnel. The organization structure operates within three bureaus: Administration, Operation and Prevention. The Administration bureau consists of the fire chief and nine non-sworn administrative personnel.

The Operation Bureau has 140 sworn personnel managed by one deputy chief, one division chief, three battalion chiefs and 37 captains. It provides all-risk service to the citizens of Santa Rosa with the delivery of emergency medical services, fire prevention and suppression, hazardous material mitigation, public education and technical rescue. These services are provided out of ten fire stations staffed with one battalion, ten advance life support fire engines and two basic life support truck companies. Also included is a hazardous material unit, technical rescue unit, water tender and two wildland patrol units which are cross-staffed at various stations.

The Prevention Bureau operates with ten sworn and three non-sworn personnel who perform building plan checks, code enforcement, fire prevention activities, as well as hazardous material compliance, neighborhood rehabilitation and public education programs.

The City of Santa Rosa is located directly over the Rogers Creek fault. This fault is an off shoot of the Hayward fault which is located on the eastside of the San Francisco Bay extending from San Jose to Richmond. Many predictions point to Santa Rosa being the next epicenter for a major earthquake. Currently there are few guidelines within

SRFD to prepare firefighters to handle a significant seismic event, thus leading to the possibility of discontinuity of the department's mission which reads: The mission of the Santa Rosa Fire Department is to minimize the loss of life and damage to property and the environment resulting from fires, medical emergencies, complex rescues, and disasters through prevention, education, fire suppression, medical services, and other related emergency and non-emergency activities, Varner (2007).

Varner states, "We will actively participate in our community, serve as role models, and strive to effectively and efficiently utilize all of the resources at our command to provide a service deemed excellent by our citizens" (SRFD Strategic Plan, 2005, p. 6).

The significance of this applied research project (ARP) relates to the organizational culture and change curriculum discussed in the Executive Analysis of Fire Service Operations in Emergency Management (NFA 2007). This ARP relates to the United States Fire Administration (USFA) Operational Objectives: a) to promote within communities a comprehensive, multi-hazard risk-reduction plan led by the fire service organization and b) to respond appropriately in a time manner to emerging issues (USFA 2008). This ARP will examine ways emergency personnel can expand their knowledge of earthquake preparedness, thereby increasing their ability to mitigate emergencies associated with significant seismic activity.

Literature Review

The purpose of this literature review is to research components which help identify how SRFD can best develop an earthquake preparedness plan. The literature review collected data from both private and public sectors relative to the topic. Research

primarily consisted of gathering information at: a) Learning Resource Center (LRC), b) Sonoma County, California public library system, c) California State Office of Emergency Services, d) Sonoma County, Department of Emergency Services, and e) Santa Rosa Fire Department Training Division. The Internet was also used to gather pertinent subject matter.

Santa Rosa, California resides just east of the Northern San Andres earthquake fault, the northern tip of the Hayward fault and directly over the Rogers Creek fault. All three of Santa Rosa's hospitals are susceptible to sustaining catastrophic structural damage and have the potential for a large number of casualties. Scientists at the United States Geological Survey (USGS) have now 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%. Such quakes can be deadly, as shown by the 1989 magnitude 6.9 Loma Prieta and the 1994 magnitude 6.7 Northridge earthquakes, USGS (2008). The likelihood of at least one more powerful quake of magnitude 7.5 or greater in the next 30 years is 46%.

Although most earthquake damage is caused by shaking, other damaging effects of quakes can be just as devastating. USGS (2005) predict other damaging effects to be: a) fires from natural gas or electrical hazards, b) dam failures which produce downstream flooding and reduced water supplies, c) infrastructure damage such as bridges, pipelines, powerlines and roads, d) hazardous material releases from refineries and railroad tank cars to laboratories and households, e) landslides which easily damage everything in their path, f) tsunamis, although the tsunami hazard in most of the Bay Area is low, coastal areas are still at risk, g) liquefaction or allowing the soils to behave like liquid and lose

their ability to support structures, and h) surface rupture, where the fault actually breaks the ground surface.

The role of state and local government for earthquake preparedness resides with several different entities, Yates (2001). It starts with the Governor's Office of Emergency Services (OES) which is the state's counterpart of the Federal Emergency Management Agency (FEMA), b) the Seismic Safety Commission which advises the governor, the legislature, and the public on ways to reduce earthquake risk, c) the Uniform Building Code (UBC) which is one of the most important steps a community can take, d) grading ordinances and regulation of building sites, e) State Department of Insurance, f) California Earthquake Authority, g) CalTrans, h) universities, and i) regional organizations.

Preparing for earthquakes should be thought of as earthquake risk reduction. Countries are seldom hit by a major disaster more than once in a generation, Orey (2006). That is why people forget. Developing countries place daily problems like hunger, poverty and illness higher on their list for preparedness. Elected officials serve limited terms and often figure that an earthquake is a low probability on their watch. Emergency preparedness is a top priority of today's fire service. Fire management has an obligation to prepare not only their department, but the citizens they serve for any natural disaster.

Earthquake risk reduction can be achieved by educating people in what to do when an earthquake happens and how to make their home less deadly by simple means. Orey (2006) suggest five ways to plan ahead for an earthquake which are: a) make sure each member of your family knows what to do no matter where they are when an earthquake strikes, b) know where your gas, electric, and water main valves are and how

to shut them off, c) locate you nearest fire, medical and police stations, d) talk with your neighbors about helping one another, and e) take a Red Cross first-aid and cardiopulmonary resuscitation training course (CPR).

The answer to minimizing injury, loss of life, and property damage during an earthquake is to focus our efforts on mitigating their destruction through a combination of appropriate building construction, enforcement of building codes and community preparedness, McGuire (2002). The 1989 Loma Prieta and 1994 Northridge earthquakes in California clearly demonstrate how well-constructed buildings and strictly enforced building standards can dramatically reduce the impact and casualty figures of even large quakes.

On October 30, 2000, the President of the United States signed into law the Disaster Mitigation Act of 2000 (Public Law 106-390) to amend the Robert T. Stafford Disaster Relief Act of 1988. Among other things, this legislation reinforces the importance of pre-disaster infrastructure mitigation planning to reduce disaster losses nationwide, and is aimed primarily at the control and streamlining of the administration of federal disaster relief and programs to promote mitigation activities. Under this Act, counties and cities are required to have a FEMA approved Local Hazard Mitigation Plan (LHMP) in order to be eligible for certain pre and post disaster mitigation funds.

Assembly Bill 2140 (AB 2140), adopted by California legislature in the fall of 2006, provides financial incentives for local jurisdictions adopting their LHMP as part of their general plans.

The State Hazard Mitigation Plan (SHMP) is the official statement of California's statewide hazard mitigation goals, strategies and priorities. Schwarzenegger, A. &

Renteria, H. (2007), describes the overall purpose as of this plan is to facilitate mitigation planning and actions by state agencies, local governments, business and industry, and citizens. The SHMP is broken down into the following sections: a) planning process, b) legal, institutional and policy framework, c) state mitigation strategy, d) profile of state assets, e) assessing hazards, vulnerability and risk, f) local hazard mitigation planning, g) funding sources and capability, h) enhanced plan criteria achievements program, and i) plan updates.

If you live or work in the region (San Francisco Bay Area), you need to know why you should be concerned with earthquakes, what you can expect during and after a quake, and what you need to do beforehand to be safe and reduce damage, USGS (2006). USGS states that everyone in the region should “START PREPARING NOW!” They provide these seven steps to earthquake safety: a) identify potential hazards in your home and begin to fix them, b) create a disaster preparedness plan, c) create disaster kits, d) identify your building’s potential weaknesses and begin to fix them, e) protect yourself during earthquake shaking, and f) when safe, continue to follow your disaster preparedness plan.

The Association of Bay Area Governments (ABAG) is made up of the following counties: San Francisco, Alameda, Contra Costa, San Mateo, Santa Clara, Solano, Napa, Sonoma and Marin. This multi-jurisdictional association has developed a LHMP, Taming Natural Disasters (2005). This organization encourages each of the ABAG cities and counties to find ways in which to address these major commitments by reducing identified risks in the following: a) infrastructure with regards to Bay Area transportation, b) health facilities throughout the Bay Area that provide care to the sick, injured and

those with special needs, c) housing for Bay Area residents to have safe and disaster-resistant housing, d) thriving economy that is safe and disaster-resilient, e) government services to provide essential services during and immediately following disasters, f) education facilities to be safe and disaster resistant, g) environment needs to prevent sustainability, reduce pollution, strengthen agriculture resiliency and avoid hazardous material releases, and h) land use change needs to be accompanied by a respect for hazardous areas and facilities, as well as recognize the interconnected nature of the Bay Area.

The County of Sonoma between 1991 and 2006 has declared twelve EOC activations, fifteen local emergencies, ten gubernatorial declarations and nine presidential declarations due to floods, extreme freeze, landslides, wildfires and even emergency fishing which received a local emergency, and gubernatorial and presidential declarations, (Sonoma County LHMP 2006, p.15).

Sonoma County is most recent LHMP was adopted on September 19, 2006. The plan analyzes the risk posed to people and property in Sonoma County by earthquakes, landslides, floods and wildland fires. It represents the County's commitment to pre-disaster mitigation, prevention and preparation. This plan focuses on: a) hazardous events from 1991-2006, b) comparison of Modified Mercalli Intensity (MMI) and Peak Ground Acceleration (PGA), c) building exposures in hazard zones, d) dates of key changes to seismic resistant design in UBC, e) use of unreinforced masonry buildings, f) historically significant structures located in the Alquist-Priolo Zone, g) summary of exposure of key county buildings, h) county building that may pose seismic risk due to age/construction

type, i) seismic safety of hospitals, j) exposure to Veteran's building, k) roads and highways, and l) a summary of estimated losses in Sonoma County.

Recent earthquakes did not decrease the risk of future earthquakes. We cannot prevent an earthquake but being prepared for one can significantly lessen the impact it has on our family, our homes and our community, Pryor (2009). Earthquake preparedness should include the following: a) what to do during an earthquake, b) what to do immediately after the earthquake, c) what to do before the earthquake, d) home retrofits, e) supplies, supplies, supplies, f) disaster recovery, g) neighborhood organizations, h) organizing to respond to a disaster, i) disaster task, j) recovery, k) disaster mental health, l) disaster first aid, m) search and rescue, and n) fire suppression.

The City of Santa Rosa adopted the ABAG Report "Taming Natural Disasters" as their LHMP (2006). The city is committed to maintain and enhance both a disaster-resistant City of Santa Rosa and region by reducing the potential loss of life, property damage and environmental degradation from natural disasters, while accelerating economic recovery from those disasters.

The Santa Rosa Emergency Operations Plan (EOP) identifies city emergency planning, organization and response policies and procedures. The plan also addresses the integration and coordination with other governmental levels and special districts as required (EOP, 2008, p.4). This plan is based on the principles and functions of the California required Standardized Emergency Management System (SEMS), which is based on the FIRESCOPE Incident Command System (ICS), and identifies how the City of Santa Rosa fits in the overall state SEMS structure. Furthermore, the plan incorporates

the additional required elements of the National Incident Management System (NIMS) as directed by Homeland Security Presidential Directive 5, issued February 29, 2003.

The City of Santa Rosa's Part II, Emergency Operations Center (EOC) Plan (2005) operates under SEMS/NIMS/ICS structures which include the following command and general staff positions: a) EOC Manager, b) public information officer, c) safety officer, d) liaison officer, e) operations, f) planning, g) logistics, and h) finance. The EOC can be activated for disasters such as: a) earthquakes, b) landslides, c) tsunamis, d) wildfires and e) floods. These disciplines are routinely exercised by city management, fire, police, medical, public works, utilities, and health departments.

A Citizens Organized to Prepare for Emergencies (COPE) program was started by residents of the Santa Rosa community of Oakmont, in cooperation with SRFD and the American Red Cross. Hattendorf, S. & Thomas, A. (2009) state that the COPE program now have over 70% of their 2,800 households in the COPE Neighborhood Preparedness Program. Bouonaccorsi (2009) is now trying to repeat their success by recruiting leaders in all parts of the city to help train and prepare their neighbors in order to "COPE a little better with disasters that may disrupt our lives, such as earthquake, fire, flood and landslide". The mission of COPE is for the citizens of Santa Rosa to become and remain better prepared to respond to and recover from emergency situations.

The Santa Rosa EOP states that each section branch must develop Standard Operating Procedures (SOPs) for their respective element of the City Emergency Management Organization (EOP, 2008, p. 23). These SOPs should contain in detail: a) actions necessary to fulfill the SEMS functional responsibilities, b) generic information

on preparedness, and c) pre-incident phase activities, procedures for recalling department personnel, disaster assignments and resource lists.

In 1989 SRFD developed three SOPs to address these EOP directives: a) criteria for notification of the duty chief, b) communication techniques and procedures, and c) fire department emergency response. The very next year SOP emergency callback in the event of an earthquake or other disaster was developed. These SOPs have not been revised since they were originally developed.

Varner (2007) states, as with all public services, citizens' expectations and outside influences require anticipating future needs, as well as developing a plan and identifying the funding for programs to meet these expectations. Natural disasters such as earthquakes, floods and landslides require necessary training in the disciplines of a) rescue systems, b) swift water rescue, c) confined space rescue, d) trench rescue, and e) hazardous materials operations. In addition, SRFD remains committed to supporting COPE programs throughout the City of Santa Rosa which requires a commitment of time and resources as well.

County of Sonoma, Department of Emergency Services (2009) reminds citizens that emergency responders may be unable to reach all citizens for various reasons and therefore, it is essential that individuals and neighborhoods be prepared to be on their own for a minimum of three to five days. They provide suggestions for disaster preparedness kits for personal, home and auto use. The suggested home use kits should include: a) drinking water, b) first aid supplies, c) medications, d) hygiene items, e) emergency lighting, f) battery operated radio, g) canned and packaged foods, h) items to protect you from the elements, i) heavy duty plastic waste bags, j) work gloves and

protective goggles, k) pet food, and l) copies of vital documents. Most online emergency preparedness kits, including the City of Santa Rosa COPE program, mirror what the County of Sonoma suggests.

Procedures

The purpose of this research project was to gather and analyze information to assist SRFD with developing an earthquake preparedness plan. The author started obtaining information through the LRC at the National Fire Academy in Emmitsburg, Maryland. Periodicals, journals and published books on emergency preparedness for natural and manmade disaster were obtained with regards to developing an earthquake preparedness plan. Also included were applied researched projects that were completed by other EFO candidates.

A descriptive research methodology was utilized to answer the following questions: a) what components are needed for an earthquake preparedness plan? b) what are other communities doing to protect their citizens and workforce from the effects of a major earthquake? c) what are the essential components SRFD should consider when developing an earthquake preparedness plan? and d) what is SRFD doing to develop an earthquake preparedness plan? This Applied Research Project (ARP) was formatted through the guidelines published in the American Psychological Association (APA) manual.

Two survey instruments were developed to gather specific information regarding the development of an earthquake emergency preparedness plan within the SRFD (See Appendixes A, B, D and E). The Intra-Departmental Earthquake Preparedness survey is found in Appendix A and B and was distributed by way of www.surveymonkey.com to 37

fire captains within the SRFD. Appendix A is a memorandum preceding the survey that states the purpose of the Intra-Departmental Earthquake Preparedness survey, gives instructions and provides a reasonable completion due date. The survey itself is found in Appendix B. This was developed to discover the knowledge of fire captains with regards to earthquake preparedness and to gather their views on what requirements might be needed for an earthquake emergency preparedness plan within SRFD. Upon expiration of the survey return date, a total of 29 surveys were completed which equaled a return rate of 78.3%.

The second survey was an Earthquake Preparedness Ten Comparable Cities survey. Appendix D states a clear purpose for the survey and gives instructions on how to take the survey and again provides a reasonable due date for its completion. Appendix E was the Earthquake Preparedness Ten Comparable Cities survey. This survey gathers input from like cities with regards to emergency preparedness pertaining to developing an earthquake preparedness plan. These cities were selected from the Memorandum of Understanding (MOU) between the City of Santa Rosa and the Santa Rosa Firefighters, Local 1401. These ten comparable cities (See Appendix G) were used during the contract negotiations. Upon expiration of the survey return date, a total of seven surveys were completed which equaled a return rate of 70%.

Assumptions and limitations

It was assumed that the intra-departmental survey participants had some knowledge in emergency preparedness with regards to natural disasters such as earthquakes, and that they would answer the questions objectively. Responses from the ten comparable cities survey were assumed to be from chief officers who had experience

in emergency planning and would answer the questions through the knowledge of past experiences. It was also assumed that both surveys would have an element of subjectivity from the participants. Some limitations identified were the number of survey cities for this topic and the results should be viewed with that in mind. The questions contained in both surveys were developed by the author based on the literature review and were not validated by outside means, thus this can be viewed as a limitation to this research. The research was also limited to the amount of time the author had available.

Definitions of terms

EFO – Executive fire officer

LRC – Learning resource center

MOU – Memorandum of Understanding

SRFD - Santa Rosa Fire Department

Chief Officer – Both middle and executive level positions in the fire department

Captain – 36 field suppression fire captains and one forty hour training captain

Emergency Planning – Development and maintenance of agreed procedures to prevent, reduce, control, mitigate and take other actions in the event of an emergency.

Results

The results of this applied research project were obtained from the literature review and through two surveys. The results of the survey can be review in Appendixes C and F.

Research question 1: What components are needed for an earthquake preparedness plan?

Research has identified the following as the most common areas to acquire standards or guidelines for establishing an earthquake preparedness plan: a) United States

Geological Survey, b) Federal Emergency Management Agency, c) California Governor's Office of Emergency Services d) Seismic Safety Commission, e) Uniform Building Code, State Department of Insurance, f) California Earthquake Authority, g) Assembly Bill 2140, h) State Hazard Mitigation Plan, i) Local Hazard Mitigation Plan, and j) SEMS/NIMS/ICS.

Research question 2: What are other communities doing to protect their citizens and workforce from the effects of a major earthquake?

A survey instrument was used to gather the information needed in order to ascertain how other departments are preparing for the catastrophic effects of a major earthquake.

Survey participants were asked their rank. There was one fire chief, one acting deputy chief, four battalion chiefs and one fire captain. Three of the ten cities did not respond to this survey.

Participants were then asked what they thought what would be the likelihood of an earthquake impacting their jurisdiction. Six (85.7%) indicated very likely, one (14.3%) viewed it as likely and zero (0%) stated unlikely.

The participants were then asked if their department had an emergency response plan for earthquakes. All (100%) of the San Francisco Bay fire departments stated yes.

The follow-up question was how familiar are operational personnel with their earthquake response plan. There was one (14.3%) who responded very familiar, five (71.4%) stated somewhat familiar, and one (14.3%) felt there that operational personnel were not at all familiar with the current response plan.

The next question asked of the participants was if their jurisdiction had a designated Emergency Operation Center (EOC). All seven (100%) departments reported having a designated EOC.

As a follow up question, participants were asked how often their EOC conducted exercises. Three (42.9%) replied once a year, three (42.9%) stated twice a year and one (14.3%) reported that their EOC conducted exercises three times a year.

The participants were asked if their department had a Citizens Organized to Prepare for Emergencies, Community Emergency Response Teams or Neighborhood Emergency Response Teams within their jurisdictions. Five (71.4%) stated they did have one or more of these programs in their jurisdiction and two (28.6%) did not.

Those participants who responded “yes” to the previous question were then asked how often they trained with their citizen’s response groups. One (20%) replied once a month, two (40%) were quarterly and two (40%) stated annually.

Participants were asked if their department provided three to five days of disaster supplies for personnel at each fire station. Five (71.4%) did provide emergency disaster supplies and two (28.6%) did not

The final question posed to the participants was how well prepared did they feel their department was to deal with a major earthquake. Out of all the participants only one (14.3%) felt they were very well prepared. Five 71.4% stated they were somewhat prepared and one (14.3%) replied they were not prepared.

Research question 3: What are the essential components SRFD should consider when developing an earthquake preparedness plan?

Most earthquake damage is caused by shaking, but other damaging effects of an earthquake can be just as devastating. The USGS suggests that communities should prepare for fires from natural gas or electrical hazards, possible dam failures which produce downstream flooding and reduced water supplies, and infrastructure damage such as bridges, pipelines, powerlines and roads. They also warn of hazardous material releases from refineries and railroad tank cars to laboratories and households. They point out how landslides quickly damage everything in their path as soils to become like liquid and instantly lose their ability to support structures, as well as, surface rupture where the fault actually break the ground surface.

There are many ways to prepare for the next earthquake. Reducing earthquake risk through public education is our best defense against the next major earthquake. One way to plan for such a disaster is to insure the public knows what to do no matter where they are when an earthquake strikes. They should know where the gas, electric and water main shutoffs are and how to shut them off. Be able to locate the nearest fire, medical and police stations. It is essential to have them talk to their neighbors about helping each other, and to take a first aid and CPR course.

Mitigating the awful impact of an earthquake should begin well before one happens. California has clearly demonstrated how well-constructed buildings and strictly enforced building standards can dramatically reduce the impact and casualty figures of even large earthquakes. We must continue to focus on mitigating the impact of earthquakes through a combination of appropriate building construction, enforcement of building codes and community preparedness.

The Disaster Mitigation Act of 2000 (Public Law 106-390) is aimed primarily at the control and streamlining of the administration of federal disaster relief and programs to promote mitigation activities and reinforces the importance of pre-disaster infrastructure mitigation planning to reduce disaster losses nationwide. This act requires counties and cities to have a FEMA approved LHMP in order to be eligible for certain pre and post disaster mitigation funds. In 2006, the City of Santa Rosa adopted a LHMP which was developed by the Association of Bay Area Governments.

The Association of Bay Area Governments encourages each of the Bay Area cities and counties to reduce identified risks with regards to Bay Area transportation, health facilities that provide for the sick, injured and those with special needs, to provide safe disaster resistant building construction. Government services should provide essential services during and immediately following disasters. The government needs to ensure environmental sustainability, reduce pollution, strengthen agriculture resiliency and avoid hazardous material releases. ABAG also suggest that land use change be accompanied by a respect for hazardous areas and facilities, as well as recognize the interconnect nature of the Bay Area.

It is essential that your community members are prepared to provide with food, water and supplies to last up to three days after a major earthquake. Community groups such as COPE are outstanding. These groups deal with neighborhood issues and help free up emergency resources so they can deal with prioritized emergencies throughout the community.

Research question 4: What is SRFD doing to develop an earthquake preparedness plan?

Another survey instrument was used to gather the information needed in order to ascertain the level of knowledge within SRFD fire captains regarding earthquake preparedness. The survey was sent via email to 37 fire captains, 29 (78.3%) of whom answered the survey questions.

Each participant was asked how long they have been a fire captain with SRFD. Ten (34.5%) replied they had 1-5 years, eleven (37.9%) had 6-10 years, two (6.9%) with 11-15 years, four (13.8%) had 16-20 years and two (6.9%) were over 21-25 years of service as a fire captain.

The participants were then asked what they believed is the likelihood of an earthquake impacting the community of Santa Rosa. Twenty-two (75.9%) felt it was very likely and seven (24.1%) stated that it seemed likely. No one chose not very likely.

Participants were asked if they were familiar with the City of Santa Rosa's LHMP for natural disasters. Eighteen (62.1%) stated they were while eleven (37.9%) were replied they were not.

They were then asked if they were familiar with the Sonoma County Department of Emergency Services LHMP for natural disasters. Eleven (37.9%) replied they were and 18 (62.1%) stated they were not.

The survey went on to ask the participants if they are an active participant in the City of Santa Rosa's EOC. Six (20.7%) were and twenty-three (79.3%) were not.

The follow-up question was how often should Santa Rosa's EOC conduct exercises. Zero (0.0%) stated once a month, seven (24.1%) replied once a quarter, fourteen (48.3%) felt it should be semi-annually and eight (27.6%) said annually.

Participants were then asked if they have a personal, home or auto emergency preparedness kit. Twenty-three (79.3%) did and six (20.7%) did not.

The next question asked is whether your fire station equipped with three to five days of emergency supplies for all personnel. Three (10.3%) stated yes and twenty-six (89.7%) replied no.

The follow-up question asked if they were interested in helping prepare an earthquake preparedness plan of the Santa Rosa Fire Department. Six (20.7%) were very interested, eleven (37.9%) expressed some interest and twelve (41.4%) were not.

The final question of the survey was whether the participant believes the Santa Rosa Fire Department is ready for the next major earthquake. Zero (0.0%) stated very prepared, fifteen (51.7%) believed SRFD was somewhat prepared and fourteen (48.3%), nearly half, replied that SRFD is not prepared for the next major earthquake.

Discussion

When comparing the literature review with the results of the intra-departmental and external fire department surveys for this applied research project, similar patterns were identified to provide SRFD with information to assist in developing an earthquake preparedness plan. The 1989 magnitude 7.1 Loma Prieta in Northern California and 1994 magnitude 6.7 Northridge in Southern California earthquakes have proven how devastating and deadly earthquakes can be. Scientists at the USGS (2008) have given a 99% probability of one or more magnitude 6.7 or greater earthquake occurring in California within the next 30 years. The likelihood of a magnitude 7.5 or greater earthquake during the same timeframe is 46%.

Santa Rosa resides directly over the active Rogers Creek fault line, at the tip of the Bay Area Hayward fault and just east of the northern San Andres fault line. This active seismic activity creates many challenges for the citizens, as well as the SRFD, with regards to earthquake preparedness. It is impossible to predict the magnitude of the next big earthquake to strike Santa Rosa. There is great potential for a large loss of life due to catastrophic damage to residential and commercial buildings if an earthquake of 6.7 or greater hits the region.

Emergency preparedness is a top priority in today's fire service. Preparing for earthquakes should be thought of as earthquake risk reduction, Orey (2006). Fire management must be obligated to prepare for the safety of the citizens and their personnel by preplanning, developing policy and conducting training exercises for the next earthquake. Often elected officials hold limited terms and do not place a high priority on earthquake preparedness because they feel it will not happen on their watch. The author discovered that 48.3% of fire captains surveyed did not feel that SRFD was prepared to handle the next major earthquake. Not one of the 37 fire captains surveyed believes that SRFD is well prepared.

We must focus our efforts on mitigating the awful impact of earthquakes through a combination of appropriate building construction, enforcement of building codes and community preparedness, McGuire (2002). Over time, this has proven to be an excellent way to minimize injury, loss of life and property damage. Loma Prieta and Northridge are two strong examples where the communities were prepared to handle an earthquake and where proper building construction saved lives throughout the communities affected.

If you live and work in the San Francisco Bay Area you need to know about earthquakes, what to expect before and after one occurs, and what you need to do in order to be safe and reduce damage, USGS (2006). The external survey revealed that 100% of the fire departments surveyed had an emergency preparedness response plan for their jurisdictions and all operated under an EOC during a major earthquake. Schwarzenegger, A. & Renteria, H. (2007) describes the overall purpose of California's hazard mitigation plan is to facilitate mitigation planning and actions by state agencies, local governments, business and industry, and citizens.

USGS (2006) further states that everyone in the region should not wait to begin earthquake preparation. They suggest that property owners should create a disaster preparedness plan, create disaster kits and identify your building's potential weaknesses and begin to fix them. Make sure to protect yourself during and after an earthquake, and when safe, follow your disaster preparedness plan.

In order to be eligible for state and federal disaster funding each community must have a Local Hazard Mitigation Plan. The internal survey revealed that 37.0% of fire captains were familiar with the Santa Rosa adopted LHMP, ABAG Report "Taming Natural Disasters", (2006). The City of Santa Rosa is committed to maintain and enhance both a disaster-resistant city and region by reducing the potential loss of life, property damage and environmental degradation from natural disasters, while accelerating economic recovery from those disasters.

Most cities in California have established their own emergency operations plan. The City of Santa Rosa developed an Emergency Operation Plan which identifies city emergency planning, organization and response policies and procedures. This plan is

based on the principles and functions of the California required SEMS which is based on the FIRESCOPE ICS system, and identifies how the City of Santa Rosa fits into the overall state SEMS structure. The plan also incorporates NIMS, per Homeland Security Presidential Directive 5, issued February 29, 2003. It incorporates integration and coordination with other governmental levels and special districts as required (EOP, 2008, p.4).

The City of Santa Rosa's EOP requires that each branch must develop SOP's for their respective element of the City's Emergency Management Organization (EOP, 2008, p. 23). These SOP's are to contain detailed actions necessary to fulfill the SEMS functional responsibilities, generic information on preparedness and pre-incident phase activities, procedures for recalling department personnel, disaster assignments and resource lists. In 1989, SRFD developed the following SOP's to address the stated directives: a) criteria for notification of the duty chief, b) communications techniques and procedures, and c) fire department emergency response.

There are many different citizen groups that do a great job preparing for natural disasters. Most commonly are Citizens Organized to Prepare for Emergencies, Community Emergency Response Teams and Neighborhood Emergency Response Teams. COPE teams are slowly being developed throughout the City of Santa Rosa. Community leaders are being recruited through the city in order to "COPE a little better with disasters that may disrupt our lives, such as earthquakes, fire, flood and landslides", Bouonaccorsi (2009). The external survey discovered that 71.4% of the fire departments had established citizen response groups. These groups trained on a quarterly, semi-annual and annual basis. It is extremely important that the City of Santa Rosa does not lose sight

of their goal of having over 70% of households in the COPE Neighborhood Preparedness Program.

SRFD is committed to supporting COPE programs throughout the City of Santa Rosa, Varner (2007). As with all public services, outside influences and citizens expectations require anticipating future needs, developing a plan and identifying the funding for programs to meet these expectations. Varner goes on to state that earthquakes, floods and landslides require training disciplines such as rescue systems, swift water rescue, confined space rescue, trench rescue, and hazardous material operations.

It is important to be able to remain self sufficient for three to five days after a major earthquake. During the internal survey, the author asked if SRFD was equipped with three to five days of emergency supplies for all personnel at each of the ten fire stations. Out of the twenty-nine respondents, twenty-six (89.7%) replied no and only three (10.3%) stated yes. The survey also revealed that twenty-three (79.3%) had either a personal, home or automobile emergency preparedness kits. Sonoma, Department of Emergency Services (2009) suggest home kits to include a minimum of drinking water, first aid supplies, medications, hygiene items, emergency lighting, battery operated radio, canned and packaged foods, items to protect you from the elements, heavy duty plastic bags, work gloves with protective goggles, pet food and copies of vital documents. They also remind citizens that these three to five days of supplies are essential for survival because emergency responders may not be available to reach all citizens for various reasons.

Through research and surveys the author has discovered that SRFD is slightly behind where it should be with having an operational earthquake preparedness plan.

The intra-departmental survey was sent to all thirty-seven fire captains, twenty-nine of whom participated. The survey revealed that eighteen (62.1%) were not familiar with the Sonoma County LHMP and eighteen (62.1%) stated they were familiar with the City of Santa Rosa's LHMP. With only 60% of the twenty-nine fire captains knowing the city's LHMP, it appears to be the right time to initiate more training with regards to earthquake preparedness.

There would be a cost with associated training and developing preparedness programs for SRFD. The City of Santa Rosa is currently under budgetary restraints due to the housing market and sales tax shortfalls. Many programs would not be feasible at this time due to the current budgetary restraints. One might argue that there is also a cost associated with not implementing training and emergency preparedness programs.

The author found through the literature review and surveys that there are better ways to develop earthquake preparedness programs within SRFD than what is currently taking place. Although there is not a standardized approach for earthquake preparedness, there are many components and characteristics that should be considered when developing these programs. The information gathered will assist the author and SRFD with developing an operational earthquake preparedness plan.

The SRFD has a unique opportunity to create exceptional programs and procedures in order to avoid the possibility of not being prepared for the next major earthquake which is expected to occur within the next thirty years. While timing of such programs is of the utmost importance, it will also provide guidance and a standardized approach for future leaders of SRFD to follow when disaster strikes.

Recommendations

The problem, as previously stated, was that SRFD does not have a comprehensive earthquake preparedness plan, thereby leading to the possible discontinuity of the department's mission; to save life and property. The purpose of this research is to identify how SRFD can increase their knowledge to the development of an earthquake preparedness plan.

The findings in this study demonstrate the need for a comprehensive earthquake preparedness plan for SRFD. If this comprehensive plan is not developed to assist the department with preparing for the next major earthquake, the personnel and citizens they serve and protect may be ill prepared to deal with devastating effects that a major earthquake would have on the City of Santa Rosa and neighboring jurisdictions.

Based on information gathered in the literature review and the analysis of the results the following recommendations are suggested to assist SRFD with the development of an earthquake preparedness plan: a) obtain support from labor, management and city manager, b) form a committee to develop an earthquake plan, c) develop short term and long term goals of the plan, d) review SRFD's mission statement for alignment with the plan, e) develop an evaluation tool to gauge the efficiency of the plan, f) implement the plan as soon as possible, and g) conduct on-going evaluations of the plan in order to ensure it stays on track with the department's mission.

Development of a comprehensive earthquake preparedness plan should become a high priority of today's managers. Orey (2006), preparing for earthquakes should be thought of as earthquake risk reduction. Emergency preparedness is a top priority of

today's fire service. Fire management has an obligation to prepare not only their department, but the citizens they serve for any natural disaster.

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Appendix A

MEMORANDUM

DATE: March 1, 2009
TO: Fire Department Captains
FROM: Bill Shubin, Fire Captain
SUBJECT: Earthquake Preparedness

Last winter I completed the Executive Analysis of Fire Service Operations in Emergency Management class at the National Fire Academy in Emmitsburg, Maryland. This is the third of four classes of the Executive Fire Officer Program. As part of this course, I am required to complete a research paper that pertains to the course work. I have chosen to research ways to develop an earthquake preparedness plan for the Santa Rosa Fire Department.

This type of planning is a systematic approach to assist our department with developing an operational response plan to a earthquakes within our community. It will ensure that personnel are educated, prepared and willing to fulfill their duties during this type of event.

As part of this research I am asking each of you to fill out the attached survey by April 6, 2009.

Please click on the link below for a 10 question multiple choice survey.

http://www.surveymonkey.com/s.aspx?sm=S5K1f_2fp7pC146WaO1ox2w_3d_3d

All survey results are confidential.

Thank you for your cooperation.

Appendix B

**Developing Chief Officers
Intra-Departmental
Survey**

This survey was sent via surveymonkey.com to 37 fire captains within the Santa Rosa Fire Department.

1. How long have you been a Fire Captain?
 - a) 1-5 years
 - b) 6-10 years
 - c) 11-15 years
 - d) 16-20 years
 - e) 21-25 years

2. What do you feel is the likelihood of an earthquake impacting the community of Santa Rosa?
 - a) Very likely
 - b) Somewhat likely
 - c) Not very likely

3. Are you familiar with the Santa Rosa Fire Department Local Hazard Mitigation Plan (LHMP) for natural disasters?
 - a) Yes
 - b) No

4. Are you familiar with the Sonoma County Department of Emergency Services Local Hazard Mitigation Plan (LHMP) for natural disasters?
 - a) Yes
 - b) No

5. Are you currently an active participant in Santa Rosa's Emergency Operation Center (EOC)?
 - a) Yes
 - b) No

6. How often do you feel the EOC should conduct exercises?
 - a) Once a month
 - b) Once a quarter
 - c) Semi-annually
 - d) Annually

7. Do you have a personal, home or auto emergency preparedness kit?
 - a) Yes
 - b) No

8. Is your fire station equipped with three to five days of emergency supplies for all personnel?
 - a) Yes
 - b) No

9. Are you interested in helping prepare an earthquake preparedness plan for our department?
 - a) Very interested
 - b) Some interested
 - c) Not interested

10. Is the Santa Rosa Fire Department prepared for a major earthquake?
 - a) Very prepared
 - b) Somewhat prepared
 - c) Not prepared

Appendix C

Developing Chief Officers Intra-Departmental Survey Results

This survey was sent via surveymonkey.com to 37 fire captains within the Santa Rosa Fire Department.

1. How long have you been a Fire Captain?

a) 1-5 years	(10)	34.5%
b) 6-10 years	(11)	37.9%
c) 11-15 years	(2)	6.9%
d) 16-20 years	(4)	13.8%
e) 21-25 years	(2)	6.9%

2. What do you feel is the likelihood of an earthquake impacting the community of Santa Rosa?

a) Very likely	(22)	75.9%
b) Somewhat likely	(7)	24.1%
c) Not very likely	(0)	0.0%

3. Are you familiar with the Santa Rosa Fire Department Local Hazard Mitigation Plan (LHMP) for natural disasters?

a) Yes	(18)	62.1%
b) No	(11)	37.9%

4. Are you familiar with the Sonoma County Department of Emergency Services Local Hazard Mitigation Plan (LHMP) for natural disasters?

a) Yes	(11)	37.9%
b) No	(18)	62.1%

5. Are you currently an active participant in Santa Rosa's Emergency Operation Center (EOC)?

a) Yes	(6)	20.7%
b) No	(23)	79.3%

6. How often do you feel the EOC should conduct exercises?

- a) Once a month (0) 0.0%
- b) Once a quarter (7) 24.1%
- c) Semi-annually (14) 48.3%
- d) Annually (8) 27.6%

7. Do you have a personal, home or auto emergency preparedness kit?

- a) Yes (23) 79.3%
- b) No (6) 20.7%

8. Is your fire station equipped with three to five days of emergency supplies for all personnel?

- a) Yes (3) 10.3%
- b) No (26) 89.7%

9. Are you interested in helping prepare an earthquake preparedness plan for our department?

- a) Very interested (6) 20.7%
- b) Some interested (11) 37.9%
- c) Not interested (12) 41.4%

10. Is the Santa Rosa Fire Department prepared for a major earthquake?

- a) Very (0) 0.0%
- b) Somewhat prepared (15) 51.7%
- c) Not prepared (14) 48.3%

Appendix D

MEMORANDUM

DATE: March 1, 2009
TO: Bay Area Comparable Cities
FROM: Bill Shubin, Fire Captain
SUBJECT: Earthquake Preparedness

Last winter I completed the Executive Analysis of Fire Service Operations in Emergency Management class at the National Fire Academy in Emmitsburg, Maryland. This is the third of four classes of the Executive Fire Officer Program. As part of this course, I am required to complete a research paper that pertains to the course work. I have chosen to research ways to develop an earthquake preparedness plan for the Santa Rosa Fire Department.

This type of planning is a systematic approach to assist our department with developing an operational response plan to earthquakes within our community. It will ensure that personnel are educated, prepared and willing to fulfill their duties during this type of event.

As part of this research I am asking each of you to fill out the attached survey by April 6, 2009.

Please click on the link below for a 10 question multiple choice survey.

http://www.surveymonkey.com/s.aspx?sm=JHW215tpMxDVLDtKmZ0Gpg_3d_3d

All survey results are confidential.

Thank you for your cooperation.

Appendix E

**Chief Officer Development
10 Comparable Cities
Survey**

This survey was sent via surveymonkey.com to the 10 City of Santa Rosa comparable cities.

1. What is the respondent's rank in the organization?

2. What is the likelihood of an earthquake impacting your jurisdiction?
 - a) Very likely
 - b) Somewhat likely
 - c) Not very likely
3. Does your department have an emergency response plan for earthquakes?
 - a) Yes
 - b) No
4. If you have an emergency response plan in place how familiar are operation personnel with this plan?
 - a) Very familiar
 - b) Somewhat familiar
 - c) Not familiar
5. Does your jurisdiction have a designated Emergency Operation Center (EOC)?
 - a) Yes
 - b) No
6. If you have an EOC, how often does your EOC conduct exercises?
 - a) Once a year
 - b) Twice a year
 - c) Three times a year

7. Do you have a COPE, CERT or NERT program?
 - a) Yes
 - b) No

8. If you have a citizen's response group, how often do you conduct training with them?
 - a) Once a month
 - b) Quarterly
 - c) Semi-annually
 - d) Annually

9. Does your department provide three to five days of disaster supplies for personnel at each fire station?
 - a) Yes
 - b) No

10. How well prepared do you think your department is to deal with a major earthquake?
 - a) Very prepared
 - b) Somewhat prepared
 - c) Not prepared

Appendix F

Chief Officer Development 10 Comparable Cities Survey Results

This survey was sent via surveymonkey.com to the 10 City of Santa Rosa comparable cities.

1. What is the respondent's rank in the organization?

Fire Chief	(1)
Acting Deputy Chief	(1)
Battalion Chiefs	(4)
Fire Captain	(1)

2. What is the likelihood of an earthquake impacting your jurisdiction?

a) Very likely	(6)	85.7%
b) Somewhat likely	(1)	14.3%
c) Not very likely	(0)	0.0%

3. Does your department have an emergency response plan for earthquakes?

a) Yes	(7)	100%
b) No	(0)	0.0%

4. If you have an emergency response plan in place how familiar are operation personnel with this plan?

a) Very familiar	(1)	14.3%
b) Somewhat familiar	(5)	71.4%
c) Not familiar	(1)	14.3%

5. Does your jurisdiction have a designated Emergency Operation Center (EOC)?

a) Yes	(7)	100%
b) No	(0)	0.0%

6. If you have an EOC, how often does your EOC conduct exercises?

- a) Once a year (3) 42.9%
- b) Twice a year (3) 42.9%
- c) Three times a year (1) 14.3%

7. Do you have a COPE, CERT or NERT program?

- a) Yes (5) 71.4%
- b) No (2) 28.6%

8. If you have a citizen's response group, how often do you conduct training with them?

- a) Once a month (1) 20.0%
- b) Quarterly (2) 40.0%
- c) Semi-annually (0) 0.0%
- d) Annually (2) 40.0%

9. Does your department provide three to five days of disaster supplies for personnel at each fire station?

- a) Yes (5) 71.4%
- b) No (2) 28.6%

10. How well prepared do you think your department is to deal with a major earthquake?

- a) Very prepared (1) 14.3%
- b) Somewhat prepared (5) 71.4%
- c) Not prepared (1) 14.3%

Appendix G

**Chief Officer Development
10 Comparable Cities**

The 10 City of Santa Rosa comparable cities were gathered from the memorandum of understanding (MOU) between the City of Santa Rosa and the Santa Rosa Firefighters, Local 1401. These cities were used as comparable cities for the purpose of contract negotiations.

Below are the 10 comparable cities:

Novato Fire Protection District

Hayward Fire Department

Salinas Fire Department

Petaluma Fire Department

San Mateo Fire Department

Richmond Fire Department

Vallejo Fire Department

Santa Clara Fire Department

Modesto Fire Department

Fremont Fire Department