

UNITED STATES SENATE

Subcommittee on Disaster Prevention and Prediction
Senate Committee on Commerce, Science and Transportation

PREPARATION FOR MAJOR EARTHQUAKE OF THE SAN FRANCISCO FIRE DEPARTMENT – THEN & NOW

By: James M. Vannucchi, Captain, SFFD, April 18, 2006

OPENING REMARKS

The mission of the of the San Francisco Fire Department is to protect the lives and property of the people of San Francisco from fires, natural disasters and hazardous material incidents; to save lives by providing emergency medical services; and to prevent fires through prevention and education programs.

As I come before this body to address a call to preparation and community I am haunted by our greatest enemy and that is complacency. History has taught us that we cannot ignore history.

In 1906, hell was unleashed upon this majesty that we embrace as San Francisco, all but destroying what we have come to love. Again in 1989, nature provided us with a courtesy call sharing with us that the devastation of 1906 again was not only possible, but inevitable.

I would be naïve to say the San Francisco, unlike other cities, possess an unlimited budget. We do not. Our resources are stretched beyond limits, held together solely by the originality of our administration, but more importantly, the unwavering dedication of our members. But a storm still rages.

As aggressive as we are in our training, as fiscally conscious as our management is, as prepared as we are for disaster, we are still without.

Preparedness, the crucial element that is now known as “mitigation”, cries out for equality. For the San Francisco Fire Department to turn the defensive into the offensive, the most fundamental of equipment and management is needed:

- **EQUIPMENT** – Due to budgetary restraints, should a recall of off-duty firefighters occur, we are still without sufficient apparatus (engine and aerial trucks), self-contained breathing apparatus and hand-held radios.

- **WATER SUPPLY** – The entire water system is vulnerable due to the proximity of faults and infirmed soil. The fireboats that augment the water system and protect the port are over 50 years old and are in need of replacement. The inventory of portable hydrants, large-diameter hose (5 inch) and associated valves needs to be increased dramatically.
- **FACILITIES** – Disaster supplies need to be stocked at all SFFD sites (water, food, and medicines) to support SFFD personnel and citizens during long-term campaigns. In the event of a major disaster, help is at least 72 hours away.
- **COMMUNICATIONS** – Although the Emergency Communications Department boasts state-of-the-art technology, the San Francisco Fire Department still does not possess the ability to communicate with the San Francisco Police Department or outside agencies with the exception of one channel.
- **MEDICAL** – Within 3 hours of a major disaster, hospitals and ancillary medical vehicles will be overwhelmed.
- **GRANTS** – Funds need to be quickly, easily and directly accessible for Fire Agencies. They should not be channeled through State, Regional or Local offices.
- **LEADERSHIP** – Disasters require a visible commander at all levels who is a career professional in emergency services, molded by an experience of success. Not a political appointment that lacks the synergistic balance of education and experience.

TESTIMONY

April 3, 2006 marked the 140th anniversary of the San Francisco Fire Department. The Fire Department's century and a quarter plus of heroic dedication to the citizens of San Francisco began in the cauldron of the California Gold Rush and was further personified as the Fire & Earthquake of 1906 became a watershed in the history of San Francisco. An event that would shadow the rebirth and vitality of this great city to this very day; the 100 year anniversary of the Great Fire & Earthquake of 1906.

The San Francisco Fire Department (SFFD) provides protection to approximately 750,000 citizens residing in the 47.5 square miles of San Francisco.

During the business day, this number increases to approximately 1.2 million people. The SFFD Suppression forces consist of approximately 1700 firefighting and emergency medical field personnel, 42 engine companies, 19 aerial truck companies, 18 ambulances, 2 rescue squads, 2 fireboats and assorted specialized units. These companies are deployed into 2 divisions, which are further divided into 9 battalions. Fire Stations are strategically and

geographically located throughout the City of San Francisco (CCSF). A separate division of the SFFD is comprised of 3 firefighting companies located at the San Francisco International Airport.

Since the 1907 report on the Great Earthquake & Fire of 1906, the next major report on suppression operations of the San Francisco Fire Department was not authored until October 17, 1990 following the 1989 Loma Prieta Earthquake. The following reviews and recommendations that will be addressed later in this document were compiled by David Fowler and brought forward by then Chief of Department Frederick Postel.

Some of the changes made in the Department's structure as a result of the 1906 disaster are still with us, including the current battalion system, the design and use of an Auxiliary Water Supply System, the continued use of street water cisterns and certain Charter requirements which guide the operations of the San Francisco Fire Department.

Although the SFFD was far better prepared for disaster in 1989 than the SFFD of 1906, we still need to move forward with recommendations, technology and implementation of same.

1989 LOMA PRIETA EARTHQUAKE

- The earthquake shook for 15 seconds and resulted in at least 67 deaths from direct earthquake causes, 3,757 injuries, more than 12,000 left homeless and property damage in excess of \$10 billion 1989 dollars throughout the affected zone according to the State of California OES.
- In San Francisco, 11 people died as a direct result of the earthquake and hundreds were injured. Thirty buildings either collapsed or were immediately demolished and 91 others were condemned.
- From 5:04 p.m. October 17 to midnight October 19, 36 fires involving structures were reported to the San Francisco Fire Department. Of these, 34 fires were directly or indirectly attributable to the earthquake and subsequent aftershocks.
- When the earthquake struck, the electric supply was lost to most of San Francisco.
- Initially, failure of electric service may have been beneficial in reducing the number of potential fires because of the loss of an ignition source for hundreds of PG&E gas leaks. As anticipated, natural gas was responsible for some of the fires following this earthquake.
- An estimated 500 dispatches were transmitted by midnight of October 17 of which 80 percent were investigations of natural gas odors.
- Damage to private and public property in San Francisco is in excess of \$3.2 billion 1989 dollars.

- The SFFD suffered \$327,000 damage to facilities, \$80,000 to equipment that was either damaged or lost during the earthquake emergency. Almost \$1 million was expended for earthquake-related labor and overtime.
- The Loma Prieta Earthquake of 1989 measured 7.1 on the Richter magnitude scale (6.9 on the Moment magnitude scale).

Of both immediate and long-range concern to the SFFD as a result of the 1989 Loma Prieta Earthquake is the excessive damage from earth shaking in the Marina District, South of Market area and portions of the Inner Mission District where, in places, severe liquefaction occurred which damaged water mains and structures. There was also liquefaction on Treasure Island which is within the city limits of San Francisco. Further, in addition to the collapse of two decks of the San Francisco-Oakland Bay Bridge, there was near-failure of a westerly portion of the structure which also lies within the jurisdiction of the SFFD.

The U.S. Geological Survey wrote “Areas underlain by thick deposits of water-saturated unconsolidated sand and mud were not only strongly shaken but were also affected by compaction and loss of strength in sediment that liquefied the shaking; many of these same areas experienced similar processes in the 1906 earthquake.”

The USGS also reported “Events of magnitude 7 or larger, each with a probability of 20 to 30 percent...are expected... at three locations in Northern California. (The locations in Northern California are the San Francisco segments of the San Andreas fault and the northern and southern segments of the Hayward fault in the East Bay.) A magnitude of 7 shock on any of these fault segments will probably cause considerably more damage than the recent Loma Prieta event because of their proximity to larger population centers.”

On July 20, 1990 the USCS revised upward probability factor for a Richter-magnitude 7 event to 67 percent by the year 2020 (Magnitude 6 event 80 percent by the year 2030) inevitable.

Of significant concern to the SFFD is the large number of freeway viaducts which transverse San Francisco and were damaged during the earthquake.

SFFD PLANNING REVIEW

This earthquake required a city-wide multi agency response. In this case, the SFFD’s day-to-day experience in handling large-scale emergencies was of value in the initial response to the disaster. On-duty and recalled personnel were able to expand normal operations to effectively deal with the disaster, despite numerous obstacles. However, planning must be strengthened before a larger earthquake strikes San Francisco.

The major areas of concern are:

- Familiarity and understanding of the SFFD Disaster Operations Plan and the CCSF Emergency Operations Plan.
- The SFFD's current procedures for coordinating response of the command staff, companies, bureaus, reserve personnel and recalled personnel.

SFFD PLANNING RECOMMENDATIONS

- The SFFD Disaster Plan should be revised and expanded to allow for the best coordination in large-scale disasters. (Revised 1999 and currently under revision).
- The SFFD Disaster Plan should cover all possible contingencies and have accompanying checklists for practical and efficient application.
- The SFFD annexes in the CCSF Emergency Operations Plan should be reviewed and updated.
- Mutual Aid agreements and plans should be reviewed and updated. These plans should reflect the concern that mutual aid during and earthquake disaster may not reach San Francisco for up to 72 hours. (It should be noted the in its' 140 year history, the SFFD has never utilized mutual aid from an outside fire agency.)
- Exercises and orientation sessions based upon the SFFD Disaster Operations Plan should be part of an on-going training program.

SFFD APPARATUS AND EQUIPMENT REVIEW

The majority of the apparatus that responded to emergency calls during the earthquake period performed well. Very little difficulty was noted with first-line apparatus, and the Bureau of Equipment made necessary repairs to keep apparatus in running condition. However, deficiencies were noted with reserve equipment.

- Reserve engine, trucks and some specialized apparatus are old and are no longer reliable. This condition still exists today.
- There was an insufficient number of relief or reserve apparatus. This condition still exists today.

- There is insufficient five-inch hose. This condition exists today. Currently there are 3 miles of five-inch hose available. 100 miles are required.
- There is an insufficient amount of Heavy Rescue and Urban Search and Rescue equipment.
- Apparatus from the SFFD Museum was placed in-service to transport firefighters.
- There was an insufficient number of self-contained breathing apparatus and hand-held radios.

SFFD APARATUS AND EQUIPMENT RECOMMENDATIONS

- The reserve fleet of engines, trucks and rescue units should be expanded.
- A transportable cache of Search and Rescue equipment should be acquired for both SFFD and volunteer use.
- The inventory of equipment for in-service apparatus should be expanded to allow for the influx of recalled personnel to effectively operate.

SFFD WATER SUPPLY REVIEW

The Auxiliary Water Supply System (AWSS) was designed to protect San Francisco from fires following the 1906 earthquake beginning in 1908, and expansion continues at this time.

The lower zone, which supplies water by gravity to hydrants from sea level to 150 feet elevation, suffered five breaks in the South-of-Market area because of liquefaction and lateral earth spread.

The upper zone of the AWSS, however, functioned normally through the earthquake period, and was used to suppress earthquake-caused fires.

Two pump stations associated with the AWSS functioned as designed and were additionally prepared to pump saltwater into the system. Further, as envisioned, the SFFD Fireboat Phoenix supplied saltwater to large-diameter hose and associated valves at the Marina District fire.

- Breaks in the domestic mains in the Marina District severely hampered fire suppression operations.

- One 75,000-gallon cistern at Fifth and Harrison streets developed a leak at the cold joint between roof and sidewall due to earthquake damage and lost 20 percent of its water.
- Falling structures destroyed one High Pressure hydrant and damaged another.
- Placing the Utility and Valve Units out-of-service hampered the SFFD's ability to quickly close off leaks in the High Pressure System.

SFFD WATER SUPPLY SYSTEM RECOMMENDATIONS

- Damage assessment of the High Pressure system must be accomplished quickly to allow restoration of water service for fire suppression purposes. Technical improvements such as seismic valves to be installed as required by the 1986 bond issue may improve the system's survivability during major earthquakes.
- The use of large-diameter hose and associated valves should be expanded, with a commensurate increase in the number of hose tenders and the amount of five-inch hose and associated valves.
- Status of the SFFD Fireboat Phoenix should be clarified. Both the Phoenix and its' sister ship, the Guardian, are over 50 years old and only one vessel is staffed at any given time.
- In-service firefighters should be trained in the emergency operation of the High Pressure System valves to be able to quickly isolate breaks.

SFFD FACILITIES REVIEW

The majority of SFFD buildings sustained only minor damage during the earthquake, and none collapsed or were condemned. All facilities were fit for use immediately after the earthquake. SFFD facilities have been undergoing seismic upgrading since the 1950's and the survivability of these structures can be credited to many years of earthquake planning.

The October 1989 earthquake did, however, expose weaknesses in planning for the long-term use of these structures following a major disaster.

- There are no formal procedures in the SFFD Disaster Operations Plan to determine when a fire station can or should be reoccupied following an earthquake.

- Some stations still have no generators for long-term operations during disasters.
- There are no supplies for supporting personnel during long-term disasters. There is no food, water, or Search and Rescue equipment within the stations to support major operations.
- A plan to notify on-duty personnel of family status following an earthquake should be formalized.

SFFD FACILITIES RECOMMENDATIONS

- The existing earthquake repair and retrofitting projects should be accelerated.
- Installation of generators at all SFFD facilities should be accelerated.
- Plans should be developed to provide disaster supplies to all SFFD facilities for the support of personnel during long-term emergencies.

SFFD EMERGENCY RECALL SIGNAL REVIEW

Imaginative use of the television and radio broadcast media and the Emergency Broadcast System (EBS) in transmitting the Emergency Duty Recall Signal and the ingenuity displayed by recalled personnel returning to San Francisco despite damaged freeways and fallen bridges, was outstanding. However, the disaster did highlight weaknesses in recall procedures.

- The Emergency Duty Recall Signal is dependent upon the telephone system and staff to make the calls.
- Transportation alternatives for recalled personnel were not sufficient given the size of the disaster.
- Plans which called for helicopter transportation from Marin County (Hamilton AFB) did not work.
- Plans for use of the telephone system for personnel recall should be examined.

SFFD EMERGENCY RECALL SIGNAL RECOMMENDATIONS

- Plans for emergency transportation of recalled personnel into San Francisco should be revised.
- Agreements should be drawn up with available carriers such as ferry boat operators and helicopter services.
- The current Emergency Duty Recall Signal notification system should be reviewed and updated in its' entirety.
- A new Emergency Duty Recall notification plan should become part of on-going in-service training.

SFFD TRAINING REVIEW

- This disaster exposed the need for better disaster training. Cross-training with CCSF employees, the public and SFFD personnel in individual, group or cooperative disaster operations was lacking.
- Those firefighters with formal Rescue Systems training were few in numbers.
- The psychological effects of a disaster upon the public and emergency workers left many persons feeling they had not been prepared for this disaster.

SFFD TRAINING RECOMMENDATIONS

- Urban Search and Rescue and Heavy Search and Rescue training should be obtained for all field personnel and training staff. Currently, over 300 members have received this exposure.
- Members of the SFFD should receive training in the psychological effects of disasters upon the public, other emergency workers and themselves.

SFFD VOLUNTEER OPERATIONS REVIEW

Hundreds of citizen volunteers assisted the SFFD at the Marina District fire and the collapse of a building at Sixth and Bluxome streets. Some, acting under the direction of SFFD members, were instrumental in rescue and fire suppression operations. Clearly, the organization and direction of volunteers must be addressed.

- Some citizens, at their own initiative, assisted in search and rescue operations, fire suppression and traffic control. Many others stood by, ready to help, but were not used.
- 15 of 40 members of the SFFD Reserves reported for duty at various locations.

SFFD VOLUNTEER OPERATIONS RECOMMENDATIONS

- The SFFD Reserve should be expanded and its mission redirected away from purely suppression-oriented activities. The Charter authorizes the SFFD 800 sworn Reserve positions.
- THE SFFD Reserve should be become Emergency Response Teams and trained in emergency first-aid, light rescue, limited suppression activities and community organizing (Neighborhood Emergency Response Teams, aka NERT, which is a FEMA Compliant Emergency Response Team).
- All firefighters should be trained in the direction and supervision of citizen volunteers during disasters.

SFFD COMMUNICATIONS REVIEW

Central Fire Alarm Station (CFAS) suffered minimal damage during the earthquake because the building had been seismically strengthened and dispatch consoles, status boards and other equipment were anchored as a precaution against earthquake damage. Similarly, components of the SFFD telephone, street telegraph and radio systems had also been seismically strengthened by the CCSF Department of Electricity during the past 10 years.

Even with the overwhelming call volume and the drastically increased dispatch load, SFFD dispatchers were able to fulfill almost all calls for service, including Special-Call assistance to the Division of Airports, initiation and transmission of

the Modified Assignment Response and Emergency Duty Recall signals, coordination of ambulance responses as well as the handling of emergency service requests from other CCSF agencies.

At the same time, Central Fire Alarm Station began to serve as the Emergency Operations Center, with a commensurate increase of staffing from other CCSF agencies.

There were however, still several problem areas that are to be examined:

- The rising demand for fire service caused the Computer Aided Dispatch (CAD) to overload and it became necessary for supervisory personnel to shut down a portion of the computer system to maintain other functions of the communication system.
- The radio system became overloaded because of the excessive number of dispatches, calls for assistance and excessive narrative messages. As a result, delays occurred in the dispatch of calls and handling of field request for assistance.
- Inadequate facilities for the Emergency Operations Center located within CFAS

SFFD COMMUNICATIONS RECOMMENDATIONS

- Replace the CAD system that was installed in 1974 (1994 Voter approved 911Capital Improvements created the Emergency Communications Department which consolidates all Fire/Police Medical dispatch functions).
- Expand the number of emergency radio frequencies for use during disasters.
- Update communications procedures manual to impose better procedures upon dispatchers and field units.
- Clearly separate the EOC functions from the SFFD communications (now the Emergency Communications Department) functions so personnel working within EOC will not impact SFFD operations.
- Develop procedures and protocols for disaster response to include
 1. Establishment of a system to prioritize response to incidents.
 2. Implement the Incident Command System (ICS).
 3. Predetermined personnel assignments for disaster response.
 4. Expanded exercises and training at the Emergency Communications Department to include scheduled and unscheduled drills.

5. Enhance the ability to communicate with the San Francisco Police Department as well as other agencies.

RESOURCES:

City and County of San Francisco
San Francisco Fire Department
San Francisco Fire Commission
San Francisco Historical Society
Chief Frederick Postel
David Fowler
Dennis Smith
International Association of Firefighters
San Francisco Firefighters Local 798
United States Geological Survey