Fire Following Earthquake

LA Case Study and future directions

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SPA Risk

and

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Outline

- The Problem
- Analysis
- Mitigation Options

Acknowledgments

- Seismic Safety Commission, State of California
  Richard McCarthy, Executive Director
- Pacific Earthquake Engineering Research Center
  Stephen Mahin, Director
- National Science Foundation
  Dennis Wenger, Program Officer
- U.S. Geological Survey: *The ShakeOut Scenario*
  Lucille Jones, Science Advisor for Risk Reduction
- Numerous Fire and Water Agency officials
- Others too numerous to list here

Northridge 1994

NIST-GCR-98-743

FIRE-RELATED ASPECTS OF THE NORTIIRIDGE EARTIIQUAKE

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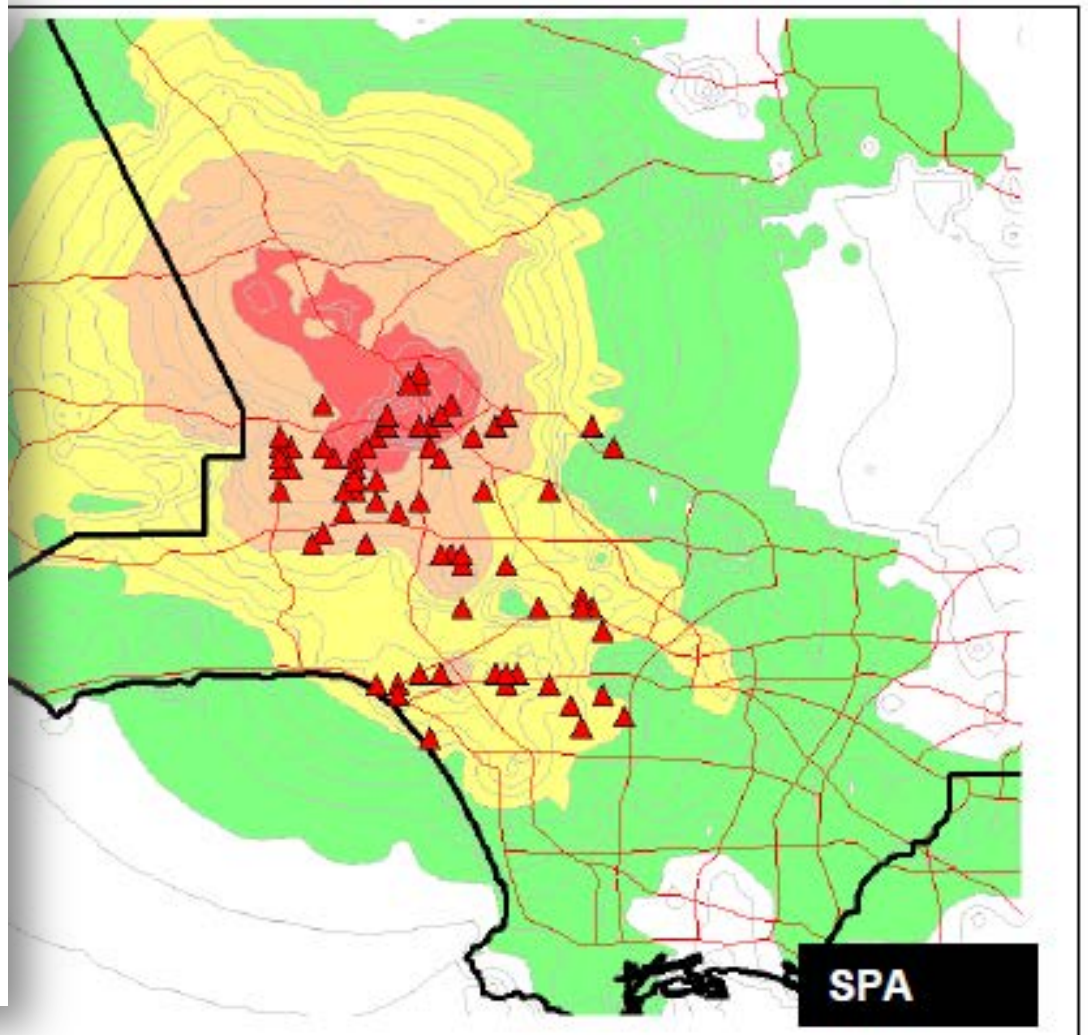
NIST
United States Department of Commerce
Technology Administration
National Institute of Standards and Technology



The Problem

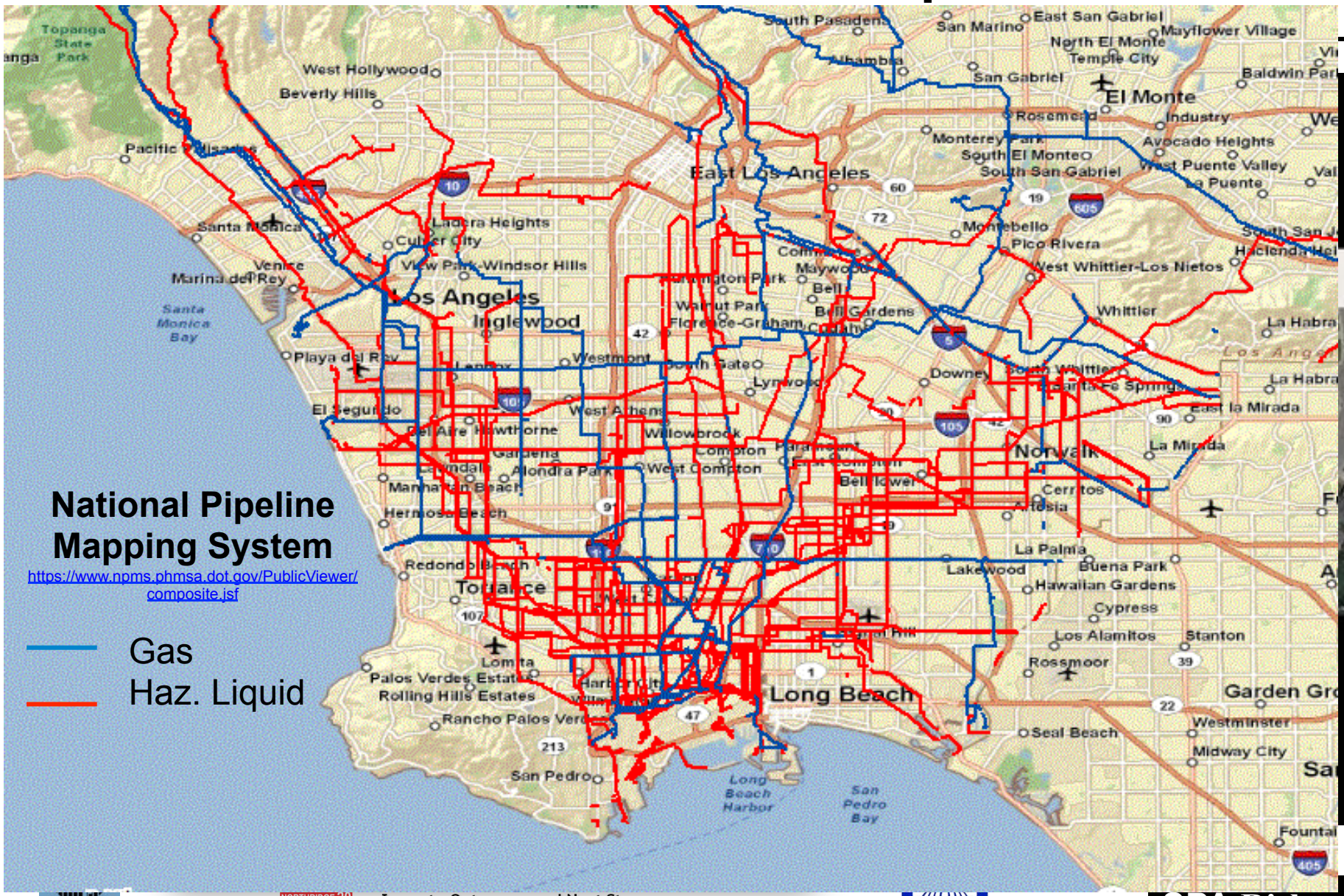
Urban Conflagration

- Northridge 1994 Earthquake
- First Interstate Bank Building fire (1988)
- East bay hills fire (1991)
- San Bruno gas explosion (2011)
- Numerous Southern California WUI fires
- ShakeOut (2008) Scenario → 1,600 ignitions

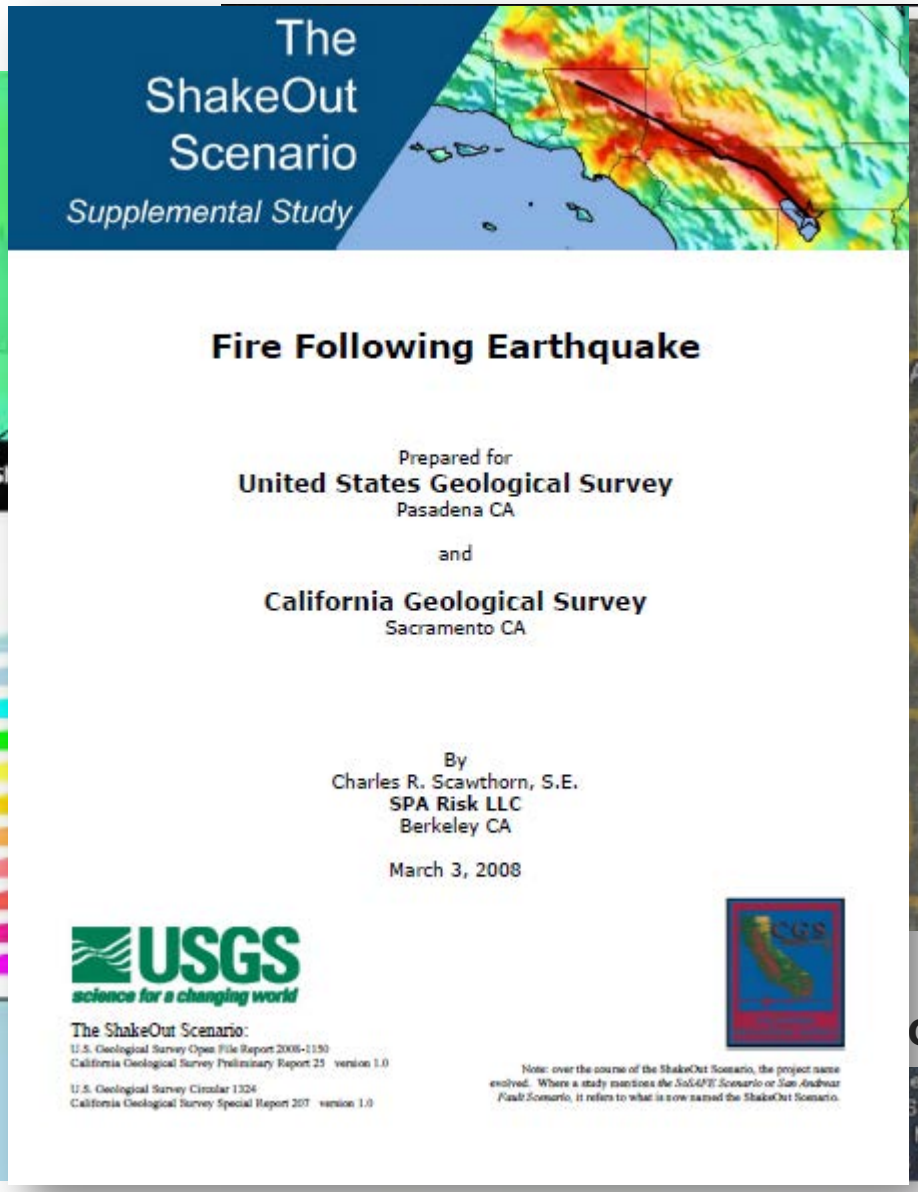
High rise building fires

- 1988 First Interstate Bank building fire
- Tallest building in California
- Required 1/3 LAFD for response

San Bruno Gas Explosion



USGS ShakeOut Exercise



($60 bn dollar) loss
owing earthquake

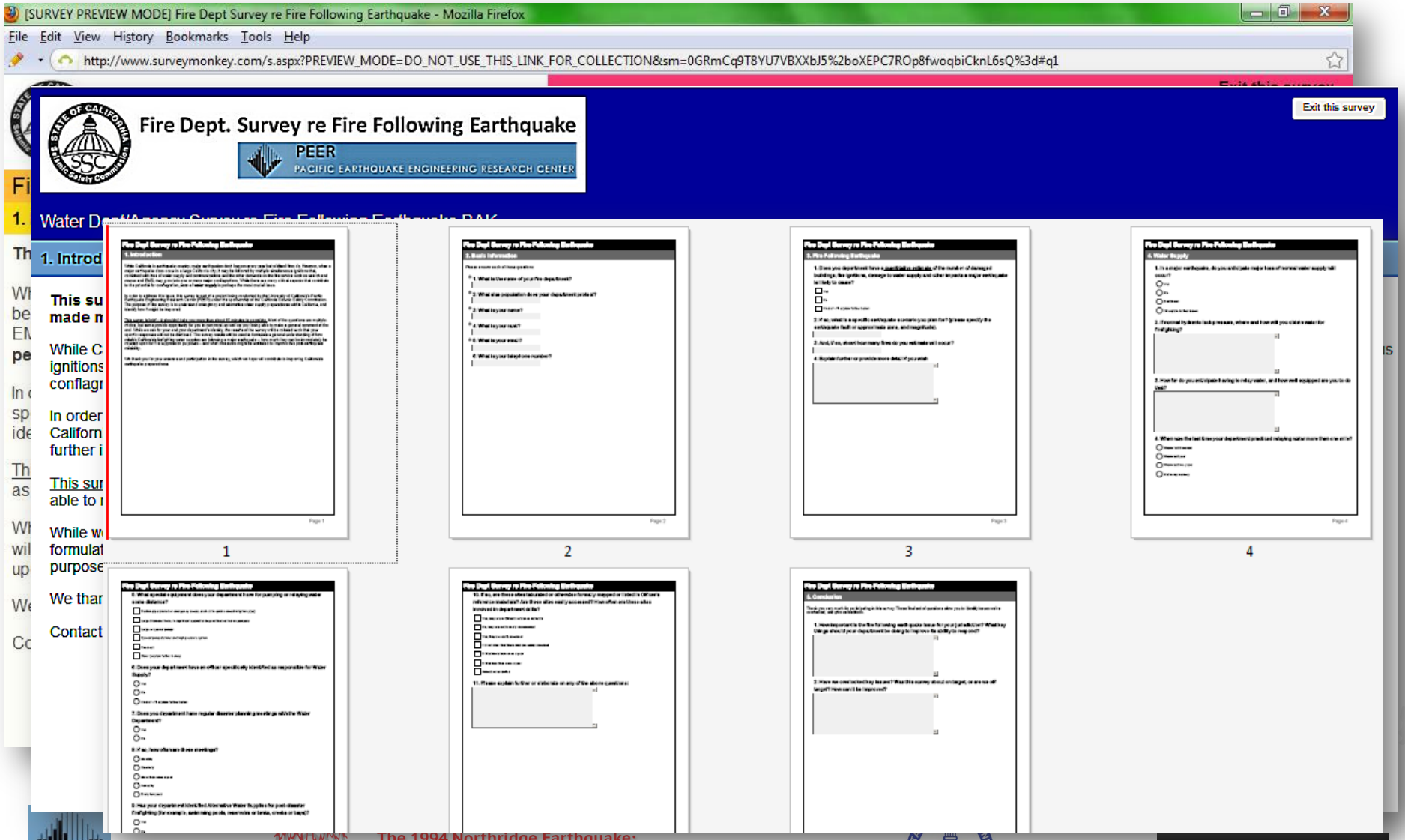
Water Supply in re FFE

Seismic Safety Commission / PEER

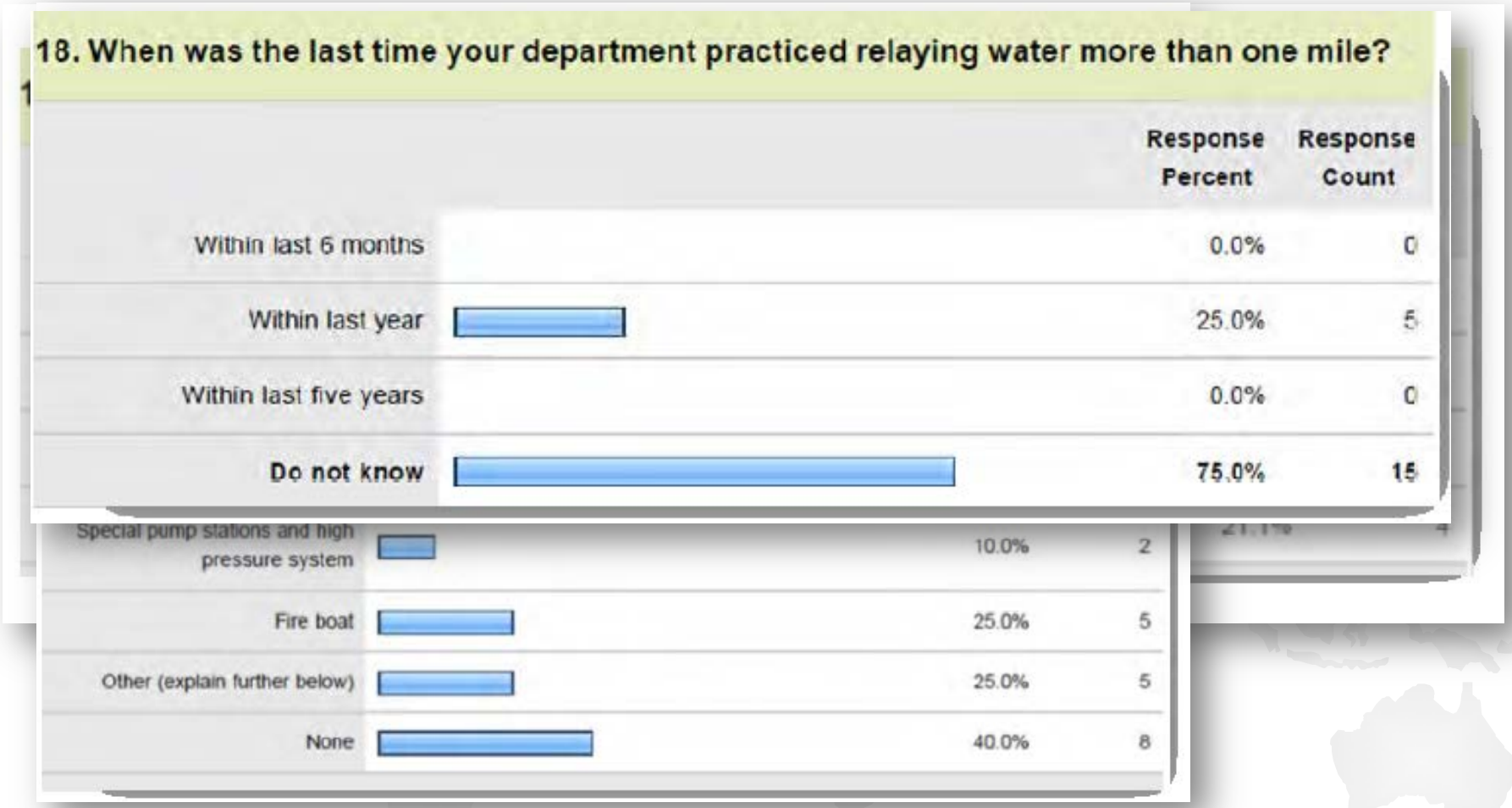
Questions:

- how well do water departments understand the potential damage to their distribution system? (focus to date has been on transmission)
- what are their current estimates of post-event firefighting water reliability?
- how well do fire departments understand this situation?
- how well are fire departments prepared for alternative water supply?
- how can this situation be improved?

Online Surveys



Findings – Fire Agencies



Key Findings from the Fire Agencies Survey

- See earthquake as a very important issue.
- But, could be better informed as to earthquake risk
- Have infrequent communication with their water departments.
- Consider their normal water supplies as seismically unreliable.
- Are improving water supply capability but efforts are piecemeal, not coordinated and often are 'reinventing the wheel'.
- Have identified alternative water sources, but These sources are often not particularly well documented, nor kept up to date nor regularly drilled.
- The very difficult task of moving water from these sources to the fire scene is in many cases not well thought out, not adequately equipped and not regularly drilled.

Findings – Water Agencies

14. If so, wl

19. In a major earthquake, do you anticipate major loss of normal water supply will occur, in a significant portion of your service area? This might include loss of distribution piping pressure in one or more neighborhoods, even if transmission integrity is preserved.

	Response Percent	Response Count
Yes	46.7%	7
No	33.3%	5
Do Not Know	6.7%	1
Sort of - I'll explain below	13.3%	2

31. If so, how often are these meetings?

	Response Percent	Response Count
Monthly	7.7%	1
Quarterly	30.8%	4
More than once a year	15.4%	2
Annually	15.4%	2
Every few years	30.8%	4

Key Findings from the Water Agencies Survey

- Most larger urban water agencies not aware of the specifics of the earthquake risk they are exposed to (i.e., two thirds had had no analysis in the last ten years).
- Earthquake is seen as a key issue by most water departments, but that provision of potable water has a higher priority in some cases than firefighting.
- Even where water departments have knowledge of the vulnerabilities of their systems, this is not often (only 22%) communicated to fire departments.
- Both water and fire departments expect major loss of water supply in a major earthquake, with the water department informing the fire department of the details of this about half the time.
- Many water departments are currently addressing their seismic vulnerabilities with significant engineering programs.
- Information on when water would be restored is sparse.
- Some water departments have alternatives given loss of normal water supply, but only a fraction (~1/3) are reasonably equipped to actually move water.
- Fire and water department liaison is not very good, and are often somewhat indirect, through larger enterprise-wide coordination meetings. Emergency water supply is not a focus.

What do we do?

Water Supply

- LADWP (1970-80s, and ongoing)
- EBMUD, Hetch Hetchy…upgrades

Special Systems

- San Francisco AWSS (1906)
- San Francisco PWSS (1986 → Loma Prieta Earthquake)
- Vancouver DFPS (1990s)
- Vallejo, Oakland, Berkeley (mini-PWSSs, 1990s)
- **Los Angeles? (ShakeOut → review of LA**

NERT / CERT citizen training programs

Gas / Electric Seismic Shutoff Valves

Portable Water Supply Systems

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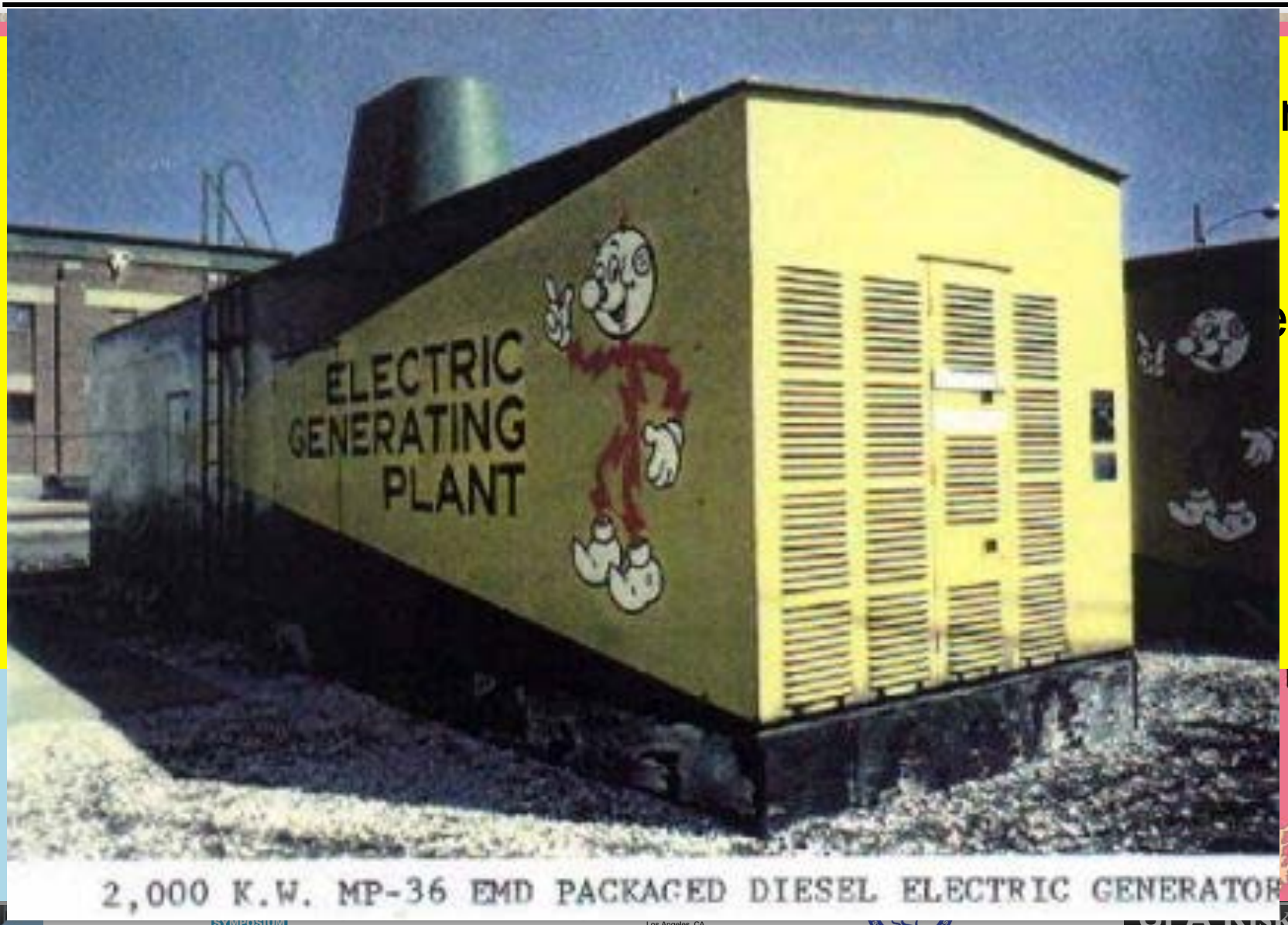
LA Basin HP system - feasibility



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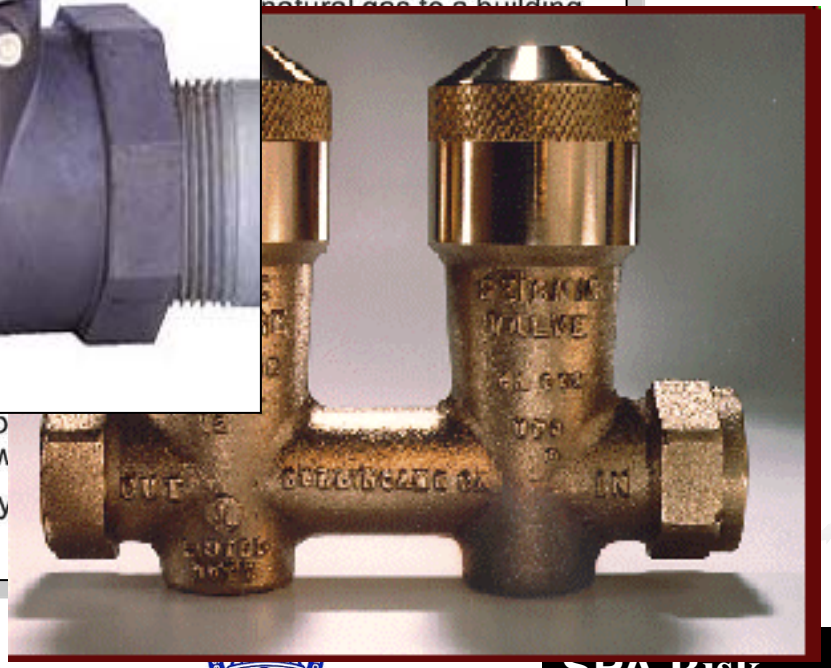
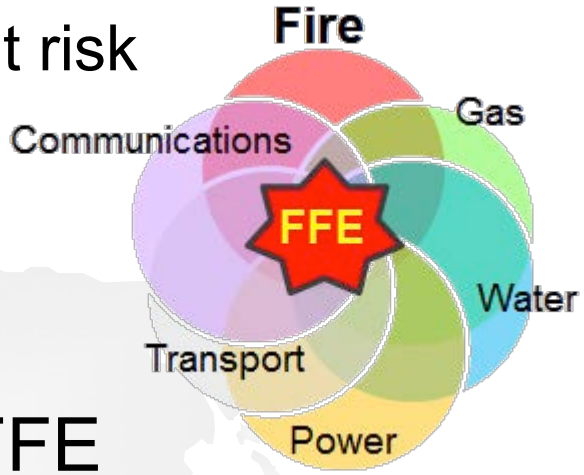


Summary / Recommendations

- Fire following earthquake a very significant risk
- FFE complex
- Limited emergency response capacity



Recommendations

- Fire and lifeline agencies focus on FFE
- Require analysis of FFE risk
- Create a state-wide PWSS
- Create an LA basin High Pressure system
- Require gas and power shut-off devices for all conflagration prone areas


PEER
2010 San Bruno Gas Pipeline Explosion; Source: National Geographic Pictures
FIRE FO
will wat
Fire following earthquak
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shows that a major earthq
PEER 2011/08
NOVEMBER 2011
2008 ShakeOut Exercise M_w 7.8 San Andreas earthquake analysis found that
APPROXIMATELY 1,600 IGNITIONS OCCUR IN SOUTHERN CALIFORNIA, WITH THE CENTRAL LA BASIN EXPERIENCING HUNDREDS OF LARGE FIRES.
Los Angeles Basin; Source: johnkand.com
MOST FIRE AND WATER DEPARTMENTS IN CALIFORNIA
could be BETTER INFORMED about the specifics of their earthquake risk
generally believe most municipal water supplies are UNRELIABLE in a major earthquake
do NOT FULLY UNDERSTAND water department system vulnerabilities
Source: Survey of fire and water agencies conducted by PEER, 2011
Tokyo oil refinery following the 2011 Mw 9.0 earthquake; Source: daehanilbo.co.kr
CALIFORNIA IS HIGHLY EXPOSED
there are about 9.5 million residential properties
1 MILLION commercial property insurance policies in CA
$4.7 trillion is the total value of insured property
guidance provided by the insurance industry for adequacy of public water supplies DOES NOT mention or consider EARTHQUAKES
Source: Statistics from the CA Department of Insurance, 2009
SALTWATER HIGH PRESSURE SYSTEMS
as alternative sources of water
San Francisco has already developed and maintains a high pressure seawater-supplied Auxiliary Water Supply System (AWSS). SF recently, in June 2010, approved a $412 million bond issue to enhance their system.
Central Los Angeles and Orange County could benefit from building a saltwater high pressure system since they are at great risk due to fire following earthquake.
This map shows Los Angeles and Orange County high pressure salt water system pipe network in storm drain channels (blue lines) with proposed connectors (black lines) overlaid on ShakeOut scenario ignitions. The pipe network is supplied from pump stations (P). Blue and yellow buffer zones around pipelines would be areas reachable by a PWSS.
GIS generated model; Source: Scawthorn
One of the larger drain channels in LA; Source: lacn.org
PEER
Pacific Earthquake Engineering Research Center
for more information, download PEER Report 2011/08
Water Supply in regard to Fire Following Earthquake
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urban areas. This PWSS would suffice for the San Francisco Bay Area.
quite feasible if existing large storm drain channels could be used for pipeline rights-of-way.
3 Develop and deploy neighborhood equipment container caches to enhance post-disaster fire-fighting capabilities. These would be used by NERT, CERT, and other volunteers.
Portable Water Supply System (PWSS), Vallejo FD; Source: Scawthorn
Berkeley FD BAWSS 12 inch Ultra LDH; Source: Berkeley FD
SYMPOSIUM
January 16-17, 2014
Los Angeles, CA
SSC
Seismic Safety Commission
SPA Risk

Thank You

Scawthorn, C., Eidinger, J. M., and Schiff, A. J. (2005). "Fire Following Earthquake." Technical Council on Lifeline Earthquake Engineering Monograph No. 26, American Society of Civil Engineers, Reston, 345pp.

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