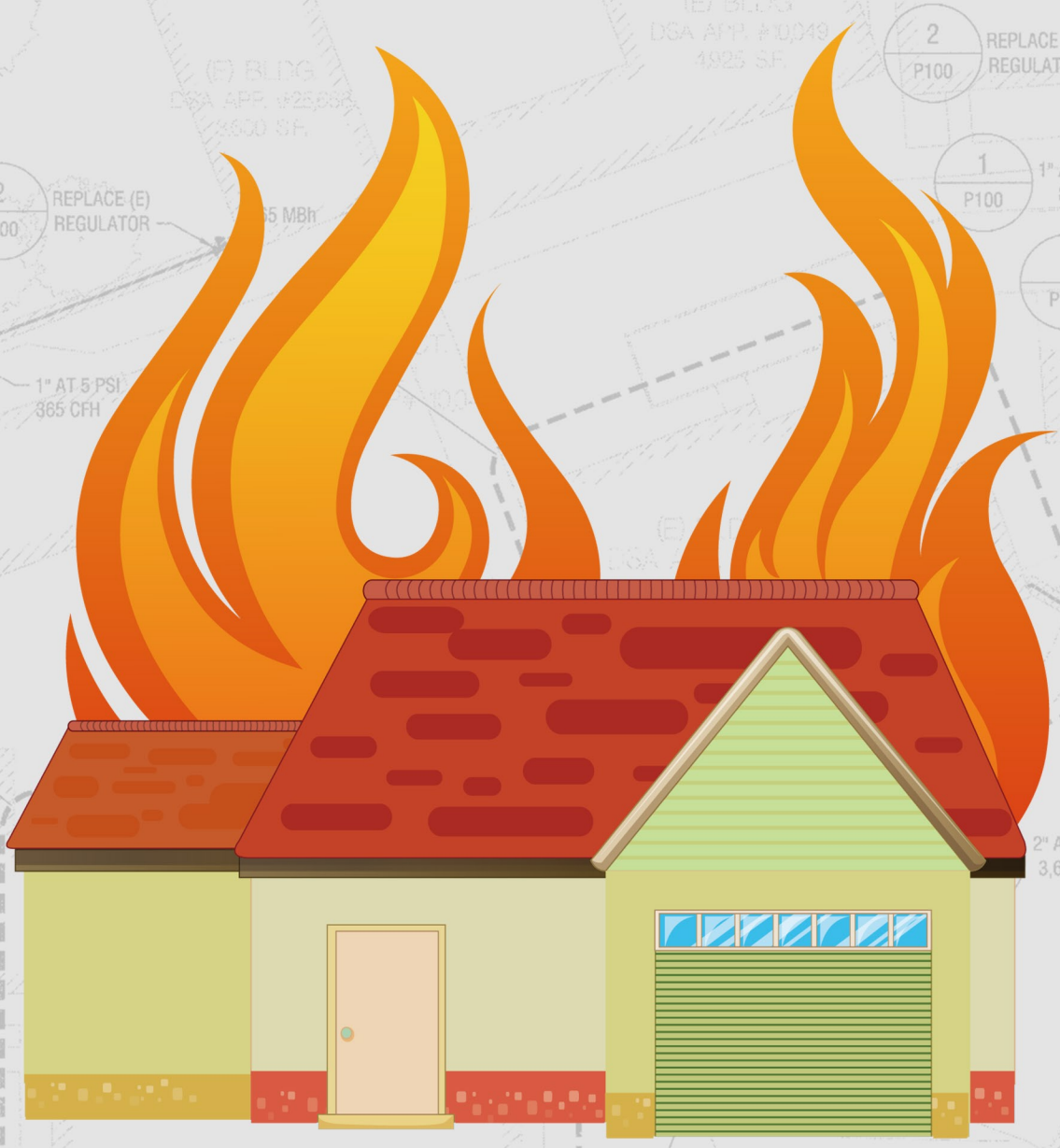

Earthquakes And Natural Gas Fires

MBS Engineering

Earthquakes Cause Less Damage Than The Fires That Follow Them

According to a 2008 USGS Hypothetical Study, a 7.8 Richter Scale earthquake in California would cause approximately 1,600 fires, burn out the equivalent of 200 million square feet of single-family dwellings, and cost more than $40BN.

What Happens To Natural Gas Lines In An Earthquake?

The USGS does not pretend California is not overdue for a large quake. Neither does UC Berkeley, UCLA, Cal Tech, or Stanford. Since utilities are mission-critical, there will be expenses associated with natural gas lines and earthquakes; the difference is that prevention can cost in the thousands of dollars, while damage repairs – which can include legal liability – can amount to millions or even billions of dollars.

Again, not from the quake – which was nobody's fault. But from failure to take due care to protect natural gas lines.

Connection between Earthquakes and Natural Gas

Because most gas and water lines are rigid, they can be torn from the connection points during an earthquake. Results can include not only serious damage to your property, but also damage to you and others. A broken gas line is particularly serious due to the potential for a fire or even an explosion.

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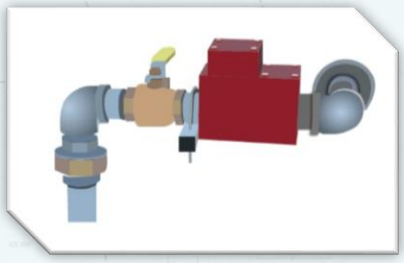

By far the most cost-effective means to mitigate or prevent a damage from a natural gas accident is installing seismic shut-off valves. In the event of an earthquake, these will stop gas flow on a premises and preclude a fire from igniting – from any number of ignition sources (electrical lines, sparks, open flames, pilot lights, etc.) downstream on the gas line. Typically, a seismic shut-off valve can be installed in a day. They cost less than installing flexible piping, are installed on open piping, near a meter or regulator, and can be easily reset. Seismic shut-off valves are a proven method to stop gas flow during a seismic event, eliminating the source of damage related to gas-fed fires and explosions.

An alternate safety precaution against natural gas fires following an earthquake, is to place flexible connectors or fittings between pipes. The same method can be used for other devices, such as a hot water heater, clothes dryer, stove or gas oven. A licensed contractor can usually do this for you.

Benefits of using this mitigation strategy:

- Helps to prevent gas and water lines from tapping their connections
- Helps to prevent serious damage to a structure
- Helps to prevent fires or explosions
- Helps to prevent damage to residents

Keep these points in mind when installing flexible connections:

- Changes to the gas lines and plumbing in your property must be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.
- A flexible connection will help to protect against a small amount of motion, but is not designed to function if the device to which it is connected is largely moved or dropped. So you also need to anchor the device to the floor or wall.

Below are a few of the larger California earthquakes from the last 150 years or so.

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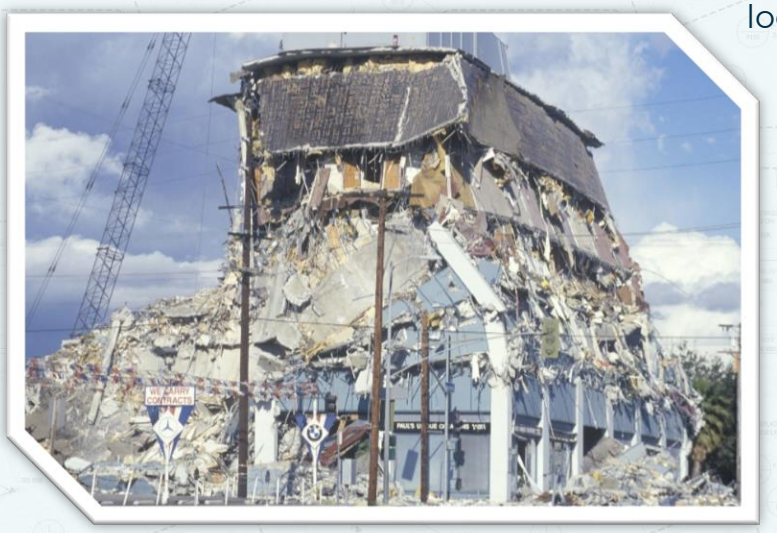
Northridge Earthquake, 1994[i]

The LAFD reported 158 structure fires during the first 27.5 hours. However, fires at several mobile home parks were reported on one incident report at the same address, even though there were multiple ignitions and numerous dwellings burned 58 mobile homes burned at one park, 54 at a second, and 22 at a third. In areas where the firefighting water supply failed, there were numerous backyard pools from which the LAFD was able to draft water. The LAFD used helicopters to drop water (over 15,000 gal) on some burning structures (Borden 1996). Within two weeks, the Southern California Gas Company (SoCalGas) restored 119,600 of the 151,000 gas-service outages; 9100 could not be restored due to structural damage, and 22,300 were waiting for the customer to return or for a determination that the building was structurally safe. SoCalGas found leaks in ≈ 20% (162 of 841) of the customer gas piping systems for which it was requested to reset a SGSV (SoCalGas 1994). SoCalGas also found 144 strapped water heaters that were damaged or leaking. SoCalGas testified that restoring gas is labor intensive because "you have to look and make sure that the appliances haven't shifted..." (Assembly Committee on Utilities and Commerce 1994). If the Northridge earthquake had occurred during the middle of a business day, there would have been many more fires. Fortunately, most residents were home to shut off the gas, traffic was light, humidity was not low, winds were light, the electricity system went down for six hours, the epicenter was near the outskirts of the urbanized area, the fire department was well prepared, and the aftershocks were not strong. SGSVs performed well during this earthquake (Strand 1998). LAFD Fire Marshall Davis Parsons testified that the LAFD supported the mandate of SGSVs in Los Angeles:



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"....[T]he most devastating earthquake aftereffects have been due to fire....The bottom line for those who deal with the aftereffects of a major disaster is elimination of the sources of fire."

Loma Prieta Earthquake, 1989[ii]

The Loma Prieta earthquake of October 17, 1989, had a significant regional impact and will provide some insight into the effects of a great earthquake in an urban setting. Unlike other very damaging California earthquakes, such as the San Fernando, Coalinga, and Whit tier events, this earthquake distributed damage widely throughout many counties. For example, light damage was reported as far north as the Sonoma County area and in downtown Sacramento. It is from this perspective that the following preliminary observations are offered.

As of October 27, 1989, the California Governor's Office of Emergency Services reported that ten counties and three cities in other councils had declared local emergencies. The governor proclaimed a State of Emergency on October 17, and the President declared the earthquake as a major disaster on, October 18. Total fatalities numbered 67, injuries amounted to 2,435, and total estimated damage was $5.6 billion. As of October 30, some 76,000 requests had been received for various forms of disaster assistance. This earthquake is the most expensive in United States history.

Local emergency response resources generally were adequate, but in several cases were stretched to the limit of their capacity. Some mutual aid was activated, and the state and federal governments supplemented local resources in specific instances. For the first time, the state's plan for mobilizing engineers to inspect buildings was formally implemented. Emergency communications and the gathering and disseminating of disaster intelligence generally were a problem, as they have been historically, especially between levels of government. There were no significant losses to emergency

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response resources. It appears also that recent planning and preparedness efforts contributed to the effective response efforts. Except at Oakland's collapsed Cypress overpass, immediate lifesaving activities were over in a few hours. The number of people made homeless by the earthquake exceeded 10,000.

Responding to this need is especially difficult in the smaller rural communities, such as Watsonville and larger cities such as Oakland that suffered damage to several old, high-occupancy residential hotels. The ability of victims to deal with this problem seems directly related to their physical mobility and economic capabilities. Some dislocated upper-income Marina District residents relocated to places such as Marin County using their own resources while many dislocated lower-income people remain in emergency shelters and are looking to government for housing assistance.

San Francisco Earthquake, 1906[iii]

In 1906, the Great San Francisco Earthquake changed history and began a series of scientific studies that have had a tremendous impact on pre-earthquake preparation, building construction, and general scientific knowledge about earthquakes. The Great San Francisco Earthquake was deadly and destructive. We all know that. But one thing not commonly known about that famous earthquake, was that most of the people who died and most of the buildings that were destroyed, weren't a direct result of the ground shaking. Most of the death and destruction was because of the enormous fire that followed the earthquake.

At 5:12 AM, a foreshock hit hard enough to be felt widely throughout the San Francisco Bay area. About a half minute later, the primary earthquake ripped through the city, with the epicenter near San Francisco. Violent shocks and strong shaking lasted nearly a full minute.

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It was after the shaking stopped that some of the worst destruction occurred, including:

Fires destroyed about 28,000 buildings and 500 blocks – ¼ of San Francisco.

A San Francisco resident cooking breakfast on a stove that's chimney was damaged during the quake, started the 24-hour-long "ham and eggs fire" which destroyed a 30-block area, including parts of City Hall and Market Street.

Fires burned for three days and three nights; some were as hot as 2,700°F.

The Navy contributed to putting out fires by running water lines and providing water to the city's fire department for their steam engines.

As a result of the fire, more than 250,000 of the city's 400,000 residents were left homeless.

Hayward Earthquake, 1868[iv]

Occurring at approximately 8:00 a.m. local time on October 21, 1868, the Hayward Earthquake was felt throughout the entire San Francisco Bay Area, with strong shaking lasting more than 40 seconds. The most recent studies of the earthquake have placed the moment magnitude between 6.8 and 7.0, with the earthquake creating up to 6 ft (1.8 m) of horizontal offset along a 28 to 37 mile (45 to 60 km) section of the Hayward Fault. Historical records indicate that strong aftershocks were felt throughout the region in the weeks following the main shock.

According to U.S. census records, at the time of the 1868 earthquake, the total population of the Bay Area was about 260,000, with approximately 10% of the population living along the Hayward Fault. Casualties from the earthquake totaled thirty people and most loss of life was a direct result of building collapse. The most severe damage was in small farming communities along the Hayward Fault, with nearly every building in the town of Hayward, with a population of 500 people, wrecked or severely damaged. In 2013, Hayward's population is 149,000 – almost 300 times the population of 1868.

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In the city of San Francisco, the shaking and accompanying liquefaction severely damaged and destroyed unreinforced masonry buildings in the business district, and caused the ground to “open up” in many places. With approximately 150,000 individuals living in San Francisco, the city was the largest one on the U.S. West Coast at the time, and thus, the earthquake’s damage to San Francisco was well-documented in the newspapers. Accounts of damage ranged widely—for example, the San Francisco Bulletin reported that:

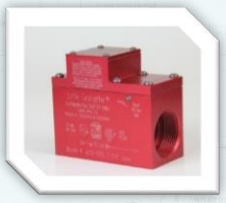
> *“Upon Russian and Telegraph Hills, the shock was not very damaging. In some houses on the latter, ornaments were not displaced from the mantel.”*

In the Alta California, it was written that:

> *“At the junction of Market and Front Streets, the ground sank for a foot or two, and there was evidence that the tide had risen in the adjoining lot at the same time, for a pond of water collected and remained until low tide.”*

MBS Engineering is exclusively a natural gas safety company. Whether you retain us for your natural gas safety needs, or a non-dedicated service provider, we encourage review of your natural gas piping and infrastructure as part of your disaster response, mitigation, and prevention plan.

What is A Seismic Shut-Off Valve?



A seismic shut-off valve is just what it sounds like: in the event of a seismic event, they stop gas flowing to a property. Seismic valves will stop gas flow when an earthquake of significant magnitude occurs and decrease the chances of a fire or explosion. Installing seismic valves will greatly reduce the risk of an explosion if a gas line is broken or damaged after a major seismic event.

Can’t I Simply Manually Turn Off My Gas?

In most cases. earthquakes happen suddenly, and people simply don’t have time or the clarity of mind to turn off the natural gas line.

Isn’t the Utility Company Responsible For Gas Accidents?

No. Not on your property.

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Can I Be Sued For A Natural Gas Accident On My Property?

The short answer is: yes, and – if gross negligence can be shown – even on public property.

Why Do I Need An SSOV?

In high-risk earthquake zones like California, seismic shut-off valves are not a luxury, they are a necessity. Most of the damage that comes from earthquakes are from secondary sources such as fires caused by a gas leak. These gas line explosions are so prevalent that natural gas contributes to one of every four fires after an earthquake.

How Expensive Is A Seismic Shut-Off Valve

A seismic shut-off valve for a school with, say, 1,000 people, would have 4" piping, and might cost $5,000 to $10,000. On a ¾" inch system (that you might find at a house), the cost could be as low as $500.

Who Can Install Seismic Valves?

Contractors must have a C36-Plumbing license to install these valves, because the danger from gas lines during earthquakes is so considerable. Seismic Gas Shut-Off Valves are usually installed on the exterior of your facility.

Every Californian knows that earthquakes are possible and have maintenance plans in place in the event an earthquake, yet many business owners don't account for how sudden earthquakes occur. In many cases, manual shut-off valves often can't be reached in time by your staff. Even small earthquakes nearly undetectable by us can result in a natural gas leak—which can create problems for your facility.

Why Should I Call MBS?

MBS Engineering has installed over 100,000 seismic gas valves in countless facilities throughout Northern and Southern California. We focus only on gas line safety, and have a stellar reputation for safety, quality, and value.

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[i] One Hundred Years Of Experience With Gas Systems And Fires Following Earthquakes, CL Strand & Associates, earthquake consultants, 2019, http://www.strandearthquake.com/
[ii] Ibid;
[iii] Ibid;
[iv] Ibid;

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