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## Earthquakes and One-dimensional Planning

### *Thinking beyond single events*

Shortly after 5 AM on the morning of April 18, 1906 San Francisco was struck by a major earthquake estimated to have been between magnitude 7.7 and 8.3. The series of shocks lasted between 45-60 seconds and produced considerable structural damage.

Small fires broke out immediately after the event but since the temblor had destroyed the central fire dispatch station ruptured water mains, there was little that firefighters could do. The many small blazes coalesced into a series of larger fires that would burn for three days and destroy much of the city.

The San Francisco earthquake is an extreme example of a cascading event. This is where an initial triggering event serves as the catalyst for a series of often unforeseen events. In this case, an earthquake on the San Andreas Fault created the conditions for a second catastrophe – the series of firestorms that followed.

Had the earthquake occurred in isolation it would have been remembered as one of the worst

disasters in US history. However, the subsequent fires abetted by the heavy damage to the City's infrastructure created a second event that exceeded the first in catastrophic consequences.

### **Cascade Events**

However, there was also a human element involved. San Francisco for years had neglected its firefighting infrastructure, allowing cisterns to fill with debris, neglecting water line improvements, and refusing training for firefighters. San Francisco was a city of densely packed wooden structures, ripe for conflagration and, indeed, had experienced several major fires in its history that destroyed much of the City.

Human involvement was not limited to neglect prior to the disaster. One of the most destructive of the series of fires in the disaster was caused by a woman cooking breakfast for her family. The use of low explosives by inexperienced soldiers helped spread the fires and even caused a major fire that destroyed a section of the City that might have survived the conflagration.

We need look no further than the recent earthquake in Japan to see another example of a cascading event. The earthquake was larger than anything predicted by geologist and spawned a tsunami that exceeded the planning parameters used by the local communities in constructing seawalls.

Added to the earthquake and tsunami was the failure of the protective systems at the Fukushima nuclear power plants. One can argue that such a failure was foreseeable. The tsunami on March 11<sup>th</sup> was estimated as high as 70 feet. However, the tsunami generated by the Meiji-Sanriku earthquake in 1876 of the northeast coast of Japan was estimated at 125 feet. The Sanriku earthquake in 1933 generated a tsunami of 94 feet.

## One-dimensional Planning

Despite the evidence to the contrary, we still tend to think in one-dimensional terms when we prepare emergency plans. We define plans on the basis of the event itself rather than in terms of potential impacts.

Despite historical events like the 1906 earthquake, many fire districts still think in terms of fighting individual fires. The San Francisco Earthquake Annex assumes that as many as 130 fires could break out following an earthquake. However, the plan does not seem to consider that these fires could unite to form a conflagration as happened in 1906. A fire of this type is fought very differently from a series of structural fires.

Where does this type of one-dimensional thinking come from? It comes from an over-reliance on scenarios developed by experts. Don't misunderstand me – basing planning on

credible evidence and sound scientific studies is absolutely essential. However, one has to understand that these scenarios are at best educated guesses based on the best available evidence. This does not mean that an event will unfold exactly as predicted. We are constantly learning from new events and rethinking previous conclusions.

## Avoiding One-dimensional Planning

Planning for disasters, particularly in terms of mitigation, is always a tradeoff between available resources and risk. We can never make our critical infrastructure safe from all events nor can we provide training to our responders for every eventuality. However, we do need to take our heads out of the sand and consider the lessons of history: if it's happened once, it can happen again.

First, we need to stop using expert predictions as a means to limit costs and instead treat them as the valuable planning tools they are. We need to understand that these do not really represent the "maximum credible threat". Instead, they are what we *think* might be the maximum credible threat and as such represent a minimum planning threshold.

Secondly, we need to consider our infrastructure and ask some of those embarrassing "what if?" questions. Not all mitigation proposals lend themselves to a cost-benefit analysis. There are some things, like oil wells and nuclear power plants that, to borrow and overworked phrase for the financial industry, are just big to fail. 