

Not My Fault: Two strong earthquakes give California a wakeup call

Lori Dengler/For the Times-Standard
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The June 23rd magnitude 5.6 in the Mendocino triple junction area maintained its spot as the largest quake of the year in the lower 48 for all of 11 days. It became a minor footnote on the 4th of July. The developing sequence in California's Mojave Desert quickly moved the topic of earthquakes to the front page of newspapers nationwide and has caused concern, a field day for geologists and a plethora of rumors.

The sequence began with a magnitude 4 earthquake on the morning of July 4th. Geologists are calling it the Searles Valley earthquake sequence, named after the dry lakebed and valley near the southern end of the Owens Valley. It is, by California standards, sparsely populated. About 45,000 people live in the area, 28,000 in the only incorporated city in the region and the rest spread out in the small towns of Trona, and Searles Lake and on the Navy's China Lake Air Weapons research base.

The M4 earthquake was felt by many but not out of the ordinary. Ridgecrest was given the nickname "Earthquake City" in the mid 1990s after a vigorous sequence of earthquakes that began in August of 1995 and continued for several years. It produced more than a thousand small quakes and a number of widely felt ones including three in the M5 range and 15 M4s. The July 4th M4 was nothing to be very concerned about.

A half hour later, a M6.4 centered 11 miles NE of Ridgecrest and 6 miles beneath the surface got everyone's attention. It was somewhat unusual in that two perpendicularly oriented fault strands ruptured, a nine-mile long fault trending NE and a seven-mile long section oriented to the NW. From a geologists' perspective, this isn't so odd. These faults are conjugates, both accommodating the regional stress field. We've become aware of a single earthquake rupturing multiple fault strands in the past several decades. The 1992 Landers earthquake centered 120 miles to the south of Searles Valley, involved displacement on at least six different faults. The 2016 M7.8 New Zealand earthquake is now thought to have ruptured no fewer than 25 different faults.

The July 4th M6.4 caused damage in Searles Valley area. The shaking triggered several fires in Ridgecrest, caused some foundation damage, disrupted gas, water and power lines and triggered numerous rockslides, blocking many roads in the region. Trona was effectively cut off. Twenty injuries were reported, most attributed to broken glass and falling debris. The earthquake was felt by an estimated twenty million people from the greater Los Angeles area to some people in Sacramento and as far away as SW Utah and NW Arizona.

And of course there were aftershocks. At least 1,400 were detected by the USGS networks in the next 30 hours. Most were very small but 16 made it into the M4 range and the largest was a magnitude 5.4, about 18 hours after the 6.4. This was all within the "normal" range for SoCal earthquakes. The USGS routinely publishes aftershock probabilities after strong earthquakes and had forecast a 50-50 chance of an aftershock in the M5 range. But the aftershock forecast also noted a 1 in 20 chance that the 6.4 could be followed by an earthquake of similar or even larger size, based on statistical analyses of past sequences in the region.

At 8:19 pm on July 5th, that small probability turned true. A M7.1 earthquake ruptured the NW trending strand of the M6.4, extending it another 15 miles to the north and 12 miles to south. It was the largest earthquake in California since the June 1992 M7.3 Landers earthquake. The earthquakes caused more damage in the Searles Valley region – more fires were reported and a number of structures in Trona suffered foundation damage. Rockslides again cut off access to roads that were just beginning to be cleared. Five additional injuries were reported. A 7.1 releases about 11 times the energy of a 6.4 and. Not surprisingly, this earthquake was felt over a wider area – from Baja to Redding, W Utah and as far away as Phoenix Arizona.

All earthquakes bring lessons and Searles Valley is no exception. It is still early in the response and scientific investigation phase, and much is still to be analyzed and assessed. But there are a couple of points that already jump out and are relevant to us on the North Coast.

- Complex sequences: The terms foreshock, mainshock, and aftershock can be confusing. They are all earthquakes and, depending on size, quite capable of doing damage on their own. The label is a human construct that places the event within a sequence. The M4 Thursday morning became a foreshock when the 6.4 occurred and the 6.4 became a foreshock when the 7.1

earthquake happened. Whenever a felt earthquake occurs, there is always a small but real chance that a bigger quake may follow. It is even possible (though unlikely) that an even larger quake could still happen and the 7.1 would be relegated to “foreshock” status.

- Multiple faults: We used to estimate seismic risk in terms of the largest fault in the region. Now it has become apparent that fault ruptures can jump from one fault and continue rupturing onto another, making it possible for larger magnitude events to occur.

- Rumors and misinformation: Every time an earthquake happens, I can bank on rumors flying.

Social media memes have attributed the cause to fracking, weapons testing and gas pipe ruptures. There are no oil reserves in Searles Valley – the closest drilling operations are about 80 miles away. These earthquakes were centered at depths of five to eight miles deep and are completely unaffected by human activities near the earth’s surface. While the exact faults involved have yet to be completely determined, they are part of the Eastern California shear zone, a well known system of faults that accommodates part of the Pacific-North American plate motion and has produced even larger earthquakes in the past. Give Mother Nature her due – these are natural “tectonic” earthquakes.

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