Hayward Fault Tiny explosions to simulate earthquakes along dangerous East Bay fault

Lisa M. Krieger, Santa Cruz Sentinel, 9-9-16

CASTRO VALLEY -- No one knows exactly how the dangerous Hayward Fault will behave when it next ruptures. Like a silently seething person, its volatility is extremely difficult to predict.

But a new network of sensitive and submerged tools installed in the East Bay will soon help reveal the geology of the vast fault zone, providing information about its violent outbursts.

On Friday morning, geologists prepared to install 500 small portable seismographs along a 10-mile line that crosses the fault through the cities of San Leandro and Castro Valley.

The experiment — a partnership between the Menlo Park-based U.S. Geological Survey, Cal State East Bay and community volunteers — will create a three-dimensional image, like a medical MRI, which helps predict how the region will respond to shaking.

This can be used to help the communities prepare for future earthquakes — so the millions of East Bay residents aren't so violently surprised.

"Understanding that fault structure — and how the energy will move along that fault — is important," said Rufus Catchings, USGS geophysicist and co-chief of the project.

"We can improve our 'Shake Maps,' which helps first responders. It helps homeowners, who may want to retrofit their houses," Catchings said.

Through the weathered sandstone and shale of Lake Chabot Regional Park, an auger drilled a slender 30-foot deep hole. Geologists will bury a small explosive at the bottom.

Some time over the next several weeks, around 1 in the morning, they will detonate it by sending down an electrical charge.

If standing nearby, "you might feel a little thump," Catchings said. But nearby residents won't feel a thing.

The long line of seismographs — each with exquisitely accurate clocks — will measure waves of sound energy.

The patterns of this traveling energy will help identify underlying faults — and will show scientists how that region will behave in an earthquake.

There are two kinds of seismic waves, which are radiated from the focus of every earthquake, said Luther Strayer, Cal State East Bay professor of geology and a co-chief of the project.

One type is called a compressional (or "p") wave, because the seismic energy compresses and releases the ground as it is passed through. The other type is called a shear (or "s") wave, because it makes the ground move perpendicular to the wave direction.

The “p” and “s” waves respond differently, depending on the characteristics of the rock or nearby water, Strayer said. The team will take the ratio of “p” and “s” waves to identify the structure of the ground under our feet. A high ratio is considered an anomaly — or damaged rock.

“It will pick up damaged rock — and damaged rock is faulted rock,” he said.

Of particular interest is the little-understood Chabot Fault, which would likely rupture if there is a major earthquake along the Hayward Fault.

Similar investigations have been performed in the south Santa Clara Valley, the Peninsula and Napa.

But the missing link has been the Hayward fault, which is full of pent-up energy and is more than twice as likely to rupture — with a 14 percent risk of a 6.7 quake over the next 30 years — as the northern San Andreas (6.4 percent), which exploded in 1906, devastating much of the Bay Area.

California earthquakes are triggered by the sideways motion of the Pacific Ocean’s crustal plate moving to the northwest under North America’s continental crust.

The most famous example of our lateral “strike-slip” faults is the San Andreas Fault, a many-branched system stretching about 600 miles from Southern California to the Point Reyes Peninsula and then out to sea.

But the Hayward Fault — parallel to the San Andreas Fault — is even more restless.

“We’re trying to keep people alive,” Strayer said. “We’re trying to assess the hazard so we understand what’s going on underground — and then inform people what to do about it.”