What to Make of the Recent Hayward Fault Jiggles?

Albany resident and seismic expert Dr. Robert Uhrhammer sheds some light on last week's Berkeley-centric Hayward Fault earthquakes.

Catherine Rauch, Albany Patch, 10-25-11

Every time there's an earthquake, let alone a bunch in a row, seismic legends and lore fly. This means the Big One will hit soon. This means the Big One won't hit soon. Highly unusual. No biggie – enjoy the ride.

Help us put this string of shakers in perspective, people asked last week.

We phoned retired UC Berkeley seismologist Robert Uhrhammer, who happens to live in Albany, to help put last week's eight local quakes in context. Uhrhammer, a seismic researcher and instrumentalist, still works in Cal's Seismology Lab.

How many earthquakes were recorded in the Berkeley area last week? There have been 10 events since Oct. 20, all on the Hayward Fault. The first quake, of magnitude 3.9, occurred at 2:41 p.m., epicentered just southeast of the UC campus between the Clark Kerr campus and the Claremont Hotel. It had a depth of eight kilometers, or 20 miles.

The rest were all aftershocks. All of these events occurred in a 2.6-kilometer radius of the first quake -- Berkeley's own cluster.

How do you distinguish aftershocks? Basically, the timing. In California, two thirds of the time, when we look at a grouping of earthquakes, the biggest is the first. About one third of the time, we see one or more earthquakes preceding the main one, those are foreshocks.

Where are foreshocks most common? In volcanic regions, such as along the Pacific Rim.

When do people start feeling quakes? At a threshold of magnitude 2. That's when people start reporting them.

Was the recent Hayward Fault quake sequence rare? No. Since 1970, there have been about 1,200 earthquakes in a 10-kilometer radius of last week's 3.9 quake. Most of them are quite small; much smaller than what people would feel.

If you look at the seismic patterns, the cluster we've had in the past week doesn't look anomalous or unusual when compared to other clusters that occur along the Hayward Fault.

The Hayward Fault behaves quite differently than other fault systems in the Bay Area. On the Hayward, earthquakes all occur in clusters or pockets, not along a continuum, which is more common. These little patches cover only 2 to 5 percent of the whole Fault.

Locally, there are pockets in Berkeley, Oakland, El Cerrito, Richmond and Pinole. They tend to occur where the Fault has bends or steps on it. The Fault isn't a nice straight line.

Does the recent sequence give a read on the future? Not really. Whenever there is a cluster of little earthquakes like this on this section of Hayward Fault, statistically and mathematically the probability of getting a big earthquake within a few days increases a little, by about 1 to 2 percent. More probable minutes to hours after the first shock.

Every day that passes, this drops off. The most likely scenario is that a big quake would occur soon, within a few days of the biggest quake. (This is on the rare foreshock occasion.)

What about further in the future - The Big One? I can never say that we're due; I can only say what the probability is. Using our best evidence at this time, in the next 30 years, there's a 65 percent chance that we'll get a magnitude-6.7 or larger on one or more of the seven Bay Area fault systems capable of producing quakes of this size.

If we go specifically to the Hayward, there's a 28 percent chance of getting a magnitude-6.7 or larger in the next 30 years. This is the greatest "hazard probability" of all the seven fault systems.

The Hayward also has a great risk probability. There are 3.5 million people living in the Hayward, extending out 15 miles.

Every year, there's approximately a 1 percent chance of a magnitude-7 earthquake or greater occurring along this section of the Hayward Fault. That means a 99 percent chance it won't.

I've heard that small quakes relieve stress, lessening the chance of future major earthquakes? That is wrong. There just aren't enough small quakes to significantly impact the "strain release," or to mitigate the possibility of a large earthquake occurring.

The Hayward Fault zone is accumulating what's called elastic strain energy at the rate of about four-tenths of an inch a year. This is from the collision of the Pacific Plate and the North American Plate. The Farallon Islands are moving northwest about two inches a year. Those two inches are distorting the earth's crust or creating strain energy. The crust will break where the strain is the weakest, namely the preexisting fault zones.

It's like pulling a rubber sheet tighter and tighter. As time goes on, you're storing more and more strained energy.

Earthquakes do release this energy, but only very slightly. The largest, and usually the first quake in a sequence, releases the most energy. Smaller aftershocks release much less as they drop in magnitude. (For every magnitude increase in a quake, the strain energy release goes up by a factor of 32.)

In fact, if a series of small quakes occurs in a stress pocket (asperity) on a fault, it can redistribute the pressure, increasing the chance of a larger quake.

You live near the Hayward Fault. Do you fear quakes? I live on the west side of Albany Hill, which is pretty solid ground. If you have a house that's retrofitted to modern codes, and you're sitting on fairly firm material, the severity of the ground shaking is less than if you're sitting on loose fill like bay muds.

Wherever you live, always be aware of the potential of a large earthquake to occur and take appropriate precautions.