

Weekend
Edition

Saturday
May 24, 2003

Lake County
RECORD-BEE

Earthquakes' cause: A matter of interpretation

Matter debated at BOS meeting

Margaret Gan-Garrison
Record-Bee staff

LAKE COUNTY — Is wastewater injection in the Southeast Geysers causing earthquakes to occur in the area?

A debate concerning that issue took place at the Seismic Monitoring Advisory Committee meeting May 19 at the Board of Supervisors chambers.

The committee, which meets twice a year, was formed in 1996 as a required mitigation for the Southeast Geysers Effluent Pipeline Project. It is comprised of representatives from Lake County Special Districts; California Division of Oil,

Gas, and Geothermal Resources (DOGGR); Geysers Power Co. (Calpine); Northern California Power Agency (NCPA); Friends of Cobb Mountain; and Anderson Springs Community Alliance.

Independent seismic experts were also present at the last meeting, including U.S. Geological Survey (USGS) Geophysicist David Oppenheimer and Seismo-Watch Inc. Chief Geologist Charles Watson.

Both Calpine and NCPA presented data that included earthquakes that were below magnitude of 1.2, which Oppenheimer said skewed the data. "We cannot be sure that every earthquake below 1.2 was recorded," he said.

Oppenheimer felt that the data presented by Anderson Springs Community Alliance President Jeff Gospe — who used data showing earthquakes above 1.2 magnitude

See **EARTHQUAKES**,
Page A8

Earthquakes

From Page A1

— was properly analyzed and concluded with the conclusion that injection was one of the reasons for more seismic activity.

Gospe's presentation showed the correlation between the cumulative effect of wastewater injection and the increasing number of earthquakes that have occurred in the Geysers over the past four years. Affluent injection started in October 1997.

The number of earthquakes of magnitude 1.2 and above has been climbing, from 321 in 1998 to 1,738 in 2002, while affluent injection increased from 3.3 billion gallons to 14.2 billion gallons during the same period. At that same time, steam production was up 75 to 285 billion pounds.

Oppenheimer said the number of earthquakes of magnitude 3 is about 1/10 of those of magnitude 4. With small earthquakes increasing, the number of bigger earthquakes will increase as well, he said.

Earthquakes of magnitude 3 and above averaged about two events annually from 1999 to 1995. Since 2000, they have averaged three events a year.

"We know that (water) injection causes earthquakes," said Oppenheimer, adding that these have

been documented. "But not all earthquakes are caused by injections. It is a complex situation in the Geysers."

Volumetric contraction — withdrawal of steam or water from the earth and not injecting it back — causes rocks to contract and causes stress on the area. That, said Oppenheimer, triggers earthquakes.

That probably explains why Calpine has not found conclusive evidence that by moving injectors away from Anderson Springs it has reduced smaller earthquakes.

Mitch Stark of Calpine said the company had closed two injection wells near Anderson Springs, finding that there were no significant changes in the earthquake frequency patterns.

Stark said Calpine is also trying to move the injections away from the Calistoga wells, which are located in an area west of Anderson Springs. He told the meeting there was a cluster of earthquake activities in that area and the company is going to move the injection further north.

There are about 100 production wells

in the Southeast Geysers. "If we want to make earthquakes stop, we need to see what is causing it to occur," said Oppenheimer.

One option that the industry is working on is to try to balance the fluid taken out with water being put back into the reservoir.

"If you inject more fluid into the reservoir, there will be more steam being produced and that means more withdrawal and more heat being taken out," Oppenheimer explained.

He believes that injection activities are the catalyst for the earthquakes, but that they are not the most significant cause. Earthquakes at the Geysers are more shallow than typical ones experienced in other parts of California.

A "typical" earthquake, said Oppenheimer, is five to seven miles in depth, while those happening at the geysers are three miles or less in depth.

That explains why the residents at Anderson Springs can feel the tremors of even the smaller earthquakes.

"... not all earthquakes are caused by injections."

David Oppenheimer