Seismic safety discussion at Diablo provides cold comfort

Erik B. Layman, San Luis Obispo Tribune, 1-30-12

Layman received Bachelor of Science and Master of Science degrees in geology from Stanford University. He has been in the geothermal energy business for more than 30 years.

In late November 2011, PG&E sponsored a three-day public workshop on seismic safety issues for the Diablo Canyon nuclear power plant. The workshop brought together PG&E technical staff, their paid consultants and government earth scientists, all of whom are working on various aspects of PG&E's ongoing seismic hazard assessment of Diablo Canyon, to share their research results.

As a concerned San Luis Obispo resident with a geologic background, I attended a portion of the conference to get an overview of what has been accomplished to date. My goal was to distill down the diverse technical information presented into a few main takeaway points from the conference, and share these with the local community. I left the conference feeling less secure about living within 10 miles of Diablo Canyon than I did beforehand.

The conference was divided into two sections: the seismic source section, which focused on locating active faults near Diablo Canyon and the type of earthquake they may produce; and the ground motion section, which focused on determining how the ground will shake below the plant under various earthquake scenarios. The latter ties in to the key question: Will the resulting ground motion exceed the design capacity of Diablo Canyon and potentially damage the plant to the extent that radiation is released into the environment?

Work to date on seismic sources indicates that the web of seismically active faults around Diablo appears to be denser and more interlinked than previously thought. High-tech bathymetry studies and shallow marine seismic surveys have confirmed linkage between the Hosgri and San Simeon faults, effectively increasing the length of the Hosgri and thus its rupture length and destructive potential. A newly identified seismicity lineament in Estero Bay may link to the Los Osos and San Simeon faults. Several lines of evidence show the Shoreline Fault, located only 600 yards from the plant, and the Los Osos Fault is clearly linked with the Hosgri fault.

Furthermore, a general consensus has emerged that fault ruptures will jump across junction points between fault segments, creating longer ruptures and more energetic, dangerous quakes. PG&E's previous effort to treat each fault segment near Diablo Canyon as separate and thereby minimize the apparent seismic risk (short fault equals lower risk) is simply no longer defensible.

The seismic source group does not seem to be focusing at all on the worst case scenario of linkage between the Hosgri, San Simeon and San Gregorio fault systems. Should the entire 450-kilometer length of this zone rupture at once, USGS scientists have indicated this would produce a quake with magnitude in the range of 7.8-8.2. A magnitude-8.2 event would be about 11.2 times more powerful than the design capacity of the plant for a magnitude-7.5 event on the Hosgri fault, and could be expected to lead to plant failure and radiation release.

A key research objective of the highly technical ground motion studies is to simulate with computers the effects of a given earthquake on ground vibration at Diablo Canyon to infer the potential for damage to the plant. It is clear that a huge number of variables need to be taken into account in running these computer models to achieve a realistic result. These include the ground characteristics at the plant site and the potential for amplification of ground motion; the degree of attenuation of motion away from the fault rupture; the direction of travel of seismic waves to the plant; the rupture zone shape and how it propagates along the fault plane during a quake; and fault dip angles.

Unfortunately, many of these parameters are either unknown or not fully defined for the fault network near Diablo Canyon. It is not yet clear if further work will be able to provide sufficient certainty to improve the confidence levels of computer simulations.

Most worrisome was the fact that these current state-of-the-art computer simulations are designed to model the effects of ruptures only along a single fault plane. These are not now capable of modeling combined ruptures along branching and linked faults, which are characteristics of the dangerous web of active faults that surrounds Diablo Canyon. This disconnect between the current modeling capability and the actual known fault network in the area is indeed disturbing.

PG&E's ongoing seismic source studies highlight the following worrisome conclusions: 1) with each new study new hazards are identified as the web of dangerous, active faults surrounding Diablo Canyon becomes ever more complex; 2) PG&E is ignoring a realistic worstcase scenario of a combined Hosgri-San Simeon-San Gregorio fault rupture; and 3) the ability of computer simulations to predict the effects of various earthquake scenarios on the plant integrity is compromised by uncertainties and limitations of the method. The science of ground motion modeling is evolving and appears not yet sophisticated enough to handle the real world complexities of a system of interlinked faults such as occurs very near to Diablo Canyon.

PG&E's seismic assessment is still a work in progress. However, PG&E's continued assertions that Diablo Canyon is safe and that the seismic risks are acceptably low seem absurd in light of the study results presented to date. Given their massive vested interest in keeping the plant operating, it is hard to imagine that PG&E would ever reach the conclusion that the seismic risks at Diablo Canyon are unacceptable and thus recommend that the plant be closed. The temptation to minimize the public perception of risk to justify continued plant operation is simply too great.