In fact, a string of more than 50 California Division of Mines and Geology and U.S. Geological Survey stations —emplaced seismological instruments—were set up in the Imperial Valley years ago; the array runs at right angles across the Imperial Fault like the cross bar of the letter "T." It was this network which provided reams of measurements for scientists like Brune.

Object of Analysis

Brune's continuing analysis of these measurements led him to hypothesize that there was a pocket, perhaps no more than a few miles long and a mile or so from top to bottom, in the Imperial Fault where there was a considerably higher-than-average amount ot stress stored.

In his scenario, Brune conceives of the 1979 earthquake starting just below the U.S.-Mexico border and propagating toward the northwest along the Imperial Fault. When the fracture reached this pocked of anomalously high stress, the energy that was released may have been as much as five times more than that released, on average, along the 18-mile length of surface rupture.

Brune believes that that concentrated energy zone may have released as much as 500 bars—a mechanical engineering term, with 1 bar about equal to a pressure of 14.7 pounds per square inch—while the average energy liberated along the length of the Imperial Fault may have been only around 100 bars.

(Other scientists, contacted by The Times, feel that Brune may be over-estimating the energies released during that 1979 quake).

A Burst of Energy

It was this little burst of above-average energy, according to Burne, that caused some of the stations near to the pocket where it was stored to register surprisingly high vertical and horizontal accelerations.

At Bonds Corner, for example, which is about as far from the Imperial Fault as the Diablo Canyon facility is from the Hosgri Fault, the peak acceleration scored 0.8g —"g" is the term used by scientists to describe acceleration due to gravity and is equal to 32.1 feet per second per second.

A value of 0.8 g—80% of gravity —is 25 to 26 feet per second per second and is quite high. If a race car could sustain this acceleration for just five seconds, it would at the end of the time be zipping along at 85 m.p.h.

In an earthquake, the ground actually jumps forward like a sportscar making a jack-rabbit start, but it also jumps backward and sidewards in a complex manner, and each acceleration pulse is not usually sustained for more than a fraction of a second. Moreover, these pulses die out after a span of several to 10 seconds or more.

Still, peak accelerations are one of several factors that must be included in the design of a building, whether it be a private home, a high-rise office building or a nuclear power plant. Engineers will specify that a structure can take up to a particular "g" level without suffering any damage.

Diablo Canyon has been considerably reinforced, following the discovery of the Hosgri fault's 3½-mile-proximity. Massive steel girders have been "backfit" on many critical pieces of equipment and huge shock absorbers have been clamped around to vital steam and water lines.

John Hoch, a PG&E official, said that some lines inside the plant are secured every three feet—compared to 10 to 15-foot tiedown lengths at plants elsewhere in the U.S. Hoch said it was the rare visitor to Diablo Canyon who is not impressed with the $110 million efforts made by the utility to make the plant earthquake-safe.

Values like these are entered into computerized equations and used to calculate a range of frequency responses in the structure.

To get some concept of what this all means, imagine a

If you wanted to make sure that a certain range of shaking would not cause the trunk to break, branches to snap off or ornaments to swing against one another and shatter, you would brace, stiffen or tie down each to resist the worrisome vibrations.

Application of Theroy

Transfer this image now to a nuclear power plant, with its reactor and miles of plumbing lines, pumps and other critical equipment, and you have some generalized idea of what engineers call the "design spectra."

Brune contended before the Appeal Board that the accelerations that occurred close-in to the Imperial Valley earthquake may very well be typical of the conditions that prevail very near to the maximum energy release zone of all large earthquakes. Since the Hosgri has been estimated to be capable of unleashing a magnitude 7.5 earthquake, almost 10 times greater than that of the Imperial Valley quake, the UC San Diego professor urgued that the design spectra for the Diablo Canyon plant was not "conservative"—not equal to the seismic challenge.

The PG&E and Nuclear Regulatory Commission witnesses differed sharply with Brune. Nathan N. Newmark, 70, a University of Illinois professor of civil engineering and a widely respected engineer who has helped design a great many large structures around the world, including nuclear power plants, chided Brune for being so obsessed with peak acceleration levels.

"There was an earthquake in Italy several years ago that had a magnitude on the Richter Scale of only 4, Newmark said, and yet one station recorded a peak "g" of 0.7.

"That's only one-tenth less than what was seen in the Imperial Valley," he said, "and there was no damage to buildings near the fault."

Newmark said that his own analysis of the data from the Imperial Valley earthquake did not shake his confidence in the adequacy of the Diablo Canyon planet's seismic criteria. "If anything," he said, "the data would warrant a decrease in my numbers (for Diablo Canyon's "g" loads), certainly not an increase."

Other witnesses, like Gerald Frazier, the engineer-president of the San Diego-based firm Del Mar Technical Associates Corp., presented analytical evidence from the Imperial Valley that showed Diablo Canyon holding its own, structurally, even during a magnitude of 7.5 earthquake.

Frazier's firm built a computer model of an earthquake, based on the accurate seismographic records of five real tremors, to test the response spectra which Newmark had worked out for the Diablo Canyon plant. The computer model projected shaking intensities lower than what the plant can withstand structurally and functionally, Frazier said.

Time for a Decision

Brune and other anti-Diablo witnesses attacked Frazier's model, of course, just as pro-Diablo witnesses defended it. And so it went through the week.

The Appeal Board now will retire with a mass of documents that, piled all together, would probably withstand a moderate earthquake and try to make sense of the various arguments. No matter how the Appeal Board rules after the first of next year—that Diablo Canyon is seismically safe or unsafe—the decision is likely to be appealed to the five commissioners of the Nuclear Regulatory Commission, the next jurisdiction above the board.

And the Commission's ruling could well be appealed to a federal court. The battle may go on yet for several more years and Fleischaker's fantasy may eventually acquire some degree of reality.