Times-Standard
Times-Standard / Humboldt Beacon

# Not My Fault: Humboldt Bay Nuclear Power Plant: a geologic saga

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Posted November 7, 2021
https://www.times-standard.com/2021/11/06/lori-dengler-humboldt-bay-nuclear-power-plant-a-geologic-saga/

The Nuclear Regulatory Commission (NRC) is about to accept PG&E's application to terminate the license for Humboldt Bay Power Plant nuclear facility, Unit #3. It's been a long time coming.

The nuclear facility ceased operations in 1976 for maintenance and refueling. It never produced power again and PG&E decided to permanently shut down the reactor in 1983. Dismantling began in 2009 and unused fuel rods, spent fuel, and contaminated parts of the facility were put into casks and buried on the site.

Here's the Unit #3 bare bones history: planning in the late 1950s, groundbreaking January 1961, commissioned August 1963, shut down July 1976, PG&E notice of permanent closure 1983, a license for storage of waste on site 1988, and active decommissioning and waste storage 2009 - 2018. But between those points there are many stories, and the geologic one traverses some of the biggest milestones in Earth Sciences.

Nuclear power was considered a solution to energy needs in the 1950s. PG&E was looking at three potential sites: Pt. Arena, Bodega Bay, and Humboldt. Proximity to the San Andreas fault and local activist outcry at the time took the first two off the list and they moved forward on the Humboldt Bay site.

How could they build a reactor in one of the most seismically active areas of the contiguous forty-eight states and only a few miles above the only US fault outside of Alaska capable of producing a M9 earthquake? The simple answer is what they didn't know; they had no clue that such a large earthquake could occur.

Turn the clock back to 1958. No global seismic network. There is a patchwork of regional seismic networks all over the world, but it will take the underground nuclear test ban treaty to spur the creation of a global network and another five years before the ring of fire and global earthquake concentrations become clear.

1958 is before plate tectonics. Many geologists still think of the planet's surface as relatively static. They understand much about geologic processes, but few accept the dynamic planet surface that is now common knowledge. Wegener proposed continental drift in 1912 but focused only on spreading and rifting of continents and not earthquake potential. Few scientists accepted it in the 1950s. The term 'subduction zone' won't emerge for another five years and the Cascadia subduction zone won't be fully recognized for another thirty.

In 1958, there are only two seismic stations on the North Coast – one at HSU and one a few miles away on Fickle Hill – not adequate to detect small earthquakes regionally or accurately locate larger ones. Berkeley's seismic catalog showed no significant earthquake activity near the powerplant site. Large earthquakes in 1932 and 1954 are known but the epicenters were poorly located and were not thought a risk to the site.

The discipline of paleoseismology does not exist in 1958. There is only half century of recorded seismic data and older written accounts to base an earthquake catalog on. Techniques to identify and date prehistoric earthquakes and potentially active earthquake faults are still a decade off. Environmental impact studies don't exist either.

In 1958, earthquake engineering is a young discipline. There is no strong motion program and almost no buildings are instrumented in a way to understand how buildings respond to strong shaking.

In the first few years after Unit #3 goes online, dozens of papers were published on the new theory of plate tectonics and seafloor spreading. Magnetic mapping off the Northern California to British Columbia coast reveal the characteristic fingerprint of a spreading center and a subduction zone. There isn't much concern about the subduction zone at first – it's small and there were no known earthquakes along it.

In 1971, the M6.6 San Fernando earthquake changes the earthquake hazard landscape. The earthquake killed 64 and the largest failure was the Veterans Hospital in Sylmar where two buildings collapsed and 49 people died. The failures were caused in part by proximity to surface fault rupture and in 1973, California passed legislation restricting construction in fault zones.

The Atomic Energy Commission took notice too and required that all operating nuclear power plants examine the shaking potential of their sites and identify possible sources of surface fault rupture. PG&E brought on TERA

Corporation to establish the first network of seismic stations in the Humboldt Bay region.

In 1974, the Humboldt Bay Seismic Network was operational and, for the next 12 years, would provide the first detailed look at earthquake activity on the North Coast. Bob McPherson, who would become my first grad student years later, helped to build the network and ran it from 1975 until it closed. It didn't take long to catch a significant quake. On June 7, 1975, a M5.6 eq occurred near Fortuna. The earthquake was strong enough to topple items from shelves and produce cracks in pavement. It gave added urgency to concerns about the powerplant 16 miles to the north.

Thus began the geologic scrutiny of the North Coast. For geologists, Unit #3 was an unexpected boon. The seismic network was only the first step. A few years later, PG&E brought on Woodward Clyde consultants (now URS) to study surface faulting potential and do the detailed analysis that an environmental impact study should routinely uncover today. Even after the decision was made to permanently close the reactor, studies continued on the storage site and the tsunami potential.

The saga of #3 reminds me of what Donald Rumsfeld (DOD Secretary) said in 2002 "…But there are also unknown unknowns—the ones we don't know we don't know." Ah yes, those unknown unknowns. So much that we didn't know when the plant was designed and constructed, and, in hindsight, were important to know. I'm only just beginning to scratch the surface on the geologic story of nuclear power on the North Coast. More next week.----------

Lori Dengler is an emeritus professor of geology at Humboldt State University, an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times-Standard's. All Not My Fault columns are archived online at https://kamome.humboldt.edu/resources and may be reused for educational purposes. Leave a message at (707) 826-6019 or email rctwg@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."