

Diablo Canyon Fact Sheet

Seismic and Tsunami Issues

Diablo Canyon Power Plant (Diablo Canyon) is built to withstand environmental hazards including the largest earthquakes that could potentially result from nearby faults. The Nuclear Regulatory Commission (NRC) requires that structures, systems and components (SSCs) important to safety be designed to withstand the effects of natural phenomena such as earthquakes and tsunamis without loss of capability to perform their safety functions. The design bases for these SSCs includes appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and the surrounding area. The NRC also requires nuclear operators to have in place robust emergency preparedness and response plans. Diablo Canyon is in full compliance with these NRC requirements and works to continuously improve our operations, safety and emergency preparedness activities.

Seismic Design

Diablo Canyon was designed and constructed with seismic safety in mind and components of the plant were evaluated against potential ground motions resulting from nearby faults.

The dominant seismic feature in the vicinity of Diablo Canyon is the Hosgri Fault. In 1975 the NRC, in collaboration with the USGS, concluded that the maximum earthquake on the Hosgri fault could be as high as M 7.5 - resulting in ground motions of 0.75 g at DCP. In 1978 PG&E seismically retrofitted all structures, systems, and components at DCP to withstand the 0.75 g ground motion. In 1985, with advice from the Advisory Committee on Reactor Safeguards (ACRS), the NRC required four licensing conditions to be resolved to approve the final operating license. This seismic safety reevaluation was named the Long Term Seismic Program (LTSP). During the program, improved earthquake models showed that the maximum earthquake on the Hosgri fault was M 7.2 and improved ground motion models gave a ground motion of up to 0.83 g. The plant structures, systems, and components were shown to have adequate seismic safety margin to withstand ground motions of 0.83 g. The LTSP report and conclusions were approved by the NRC in 1991 (NRC-SSER-34). PG&E and the NRC agreed to make the LTSP a permanent Program as part of the operating license which continually evaluates seismic issues, and applies new information to assure that the plant is seismically safe.

We are partnering with the United States Geological Survey (USGS) to update the earthquake hazards along the Central Coast and throughout our service territory. We also study significant global seismic events and apply those lessons learned against the design criteria of Diablo Canyon to verify the basis of its design.

Those efforts resulted in the discovery of the Shoreline Fault in 2008. Using updated models of the ground motions gives a ground motion of 0.56 g from the Shoreline fault. PG&E's evaluation concluded that the existing plant design is adequate to accommodate Shoreline Fault ground motion. PG&E continues to study the fault and submitted an evaluation of it to the NRC in January 2011. The NRC is currently reviewing this evaluation. Furthermore, PG&E is currently collecting additional data using 3D imagery (low energy) to better constrain the shallow fault geometries and activity rates. The company is preparing applications required by the state of California to implement high energy 3D imagery that would help better define the deep fault geometries at depths of up to 10 km.

Tsunami Preparedness

Diablo Canyon is designed to exceed a maximum oceanic flood level (combined tsunami, storm wave, high tide, and storm surge) of 32.0 feet above mean sea level (MSL) / 34.6 feet mean lower-low water (MLLW).

The intake structure is designed with an elevated air intake so that the Design Class I auxiliary saltwater (ASW) pumps can operate during the design combination tsunami-storm wave runup to elevation +48 feet MLLW (+45.4 feet MSL). The ASW pump motors are housed in watertight compartments within the intake structure.

The combined wave runup for near-shore tsunamis, 34.6 feet (MLLW), is based on results from scale model testing. This runup value represents the maximum runup observed at the location of the ventilation shafts in the test model, excluding wave spray.

Diablo Canyon recently conducted a trial application of a Probabilistic Tsunami Hazard Assessment (PTHA) to evaluate lessons learned from the 2004 Sumatra Tsunami as part of the LTSP. This study shows that the hazard for tsunami waves of up to 3 meters (approximately 10 ft) is dominated by distant earthquakes around the circum-Pacific region, and is consistent with the historic record. The tsunami wave heights observed in San Luis Obispo County from the March 2011 Japanese tsunami were consistent with these results. For wave heights up to 5 meters (approximately 16 ½ ft), the hazard from tsunamis is much smaller than the hazard from storms and tides. Wave heights between 7 meters (approximately 23 ft) and 10 meters (approximately 33 ft) appear to be dominated by very rare submarine landslides. A copy of this Assessment is available at the UC Berkeley PEER website:
<http://peer.berkeley.edu/tsunami/tasks/task-1-tsunami-hazard-analysis/>

Various buildings and system components at Diablo Canyon are situated at the following levels:

- The diesel generators are at 85' above sea level inside a turbine building.
- Diesel fuel storage tanks 85' above sea level west of the turbine building.
- Batteries are located at the 119' above sea level in an auxiliary building.
- The power block is located on a cliff that is at 85' above sea level and is enclosed in concrete
- Reservoirs and dry cask storage are located 310' above sea level.
- The Spent Fuel Pool is located on the 140' elevation of the Fuel Handling Building.

Back Up Power Supplies

Nuclear plants are required to have emergency AC power sources (diesel generators) to provide electrical power to plant safety equipment when there is a loss of power from the electrical grid (loss of off-site power).

Each unit at Diablo Canyon has three air-cooled emergency diesel generators (2.6 megawatts each), which do not require an external water supply for cooling. These generators are seismically qualified, with enough fuel onsite to produce power for one week. The run time can be extended by reducing the loads on the emergency diesel generators. Even with one Diesel Generator in service power can be provided to both units. These generators are tested on a monthly basis to ensure that they successfully start and accept electric loads.

Back Up Cooling

Diablo Canyon has two reservoirs on-site; each has 2,500,000 gallon capacity (5.0 million gallons total). They serve as the make-up water supply for the plant and also provide fire protection. In addition, the reservoirs can provide gravity-fed cooling back to the plant and spent fuel pools.

Safety water supplies for reactor core cooling include: Refueling Water Storage Tanks (400,000 gallons per unit); Condensate Storage Tanks (200,000 gallons per unit) and the shared Fire Water Tank (300,000 gallons).

Diablo Canyon also has an on-site fire department and two fire engines that can provide fresh or seawater pumping to plant systems.

Spent Fuel Storage

Spent (used) fuel at DCPD is stored in two different systems:

Spent Fuel Pools - Wet Storage: Much of the spent fuel is stored in the Spent Fuel Pool, a reinforced concrete structure with a stainless steel plate liner. Shielding and protection of the spent fuel in the pools is provided by maintaining 23 feet of borated water over the spent fuel. Heat is removed by a cooling system which constantly re-circulates the spent fuel pool water through heat exchangers. The base of the pools are below grade level, on bedrock, and the walls of lower portions of the pools are also below grade, such that the top of the spent fuel storage racks are near the exterior ground level to the east of the Auxiliary Building. DCPD has redundant capabilities to add water into the spent fuel pool – even with the loss of electrical power.

Independent Spent Fuel Storage Installation (ISFSI) - Dry Storage: Older spent fuel is stored at the ISFSI in dry casks, which are totally sealed from the environment in a Multi-purpose Canister (MPC) that is constructed of stainless steel. The MPC is placed into a massive overpack that is over 20 feet tall, and is constructed out of two steel vessels, each 1 inch thick, with the space between the vessels filled with approximately 28 inches of concrete. The overpacks shield against radiation exposure and encapsulate and protect the MPCs. The dry casks are seismically qualified and anchored to a steel reinforced concrete pad over 7 feet thick. The dry casks utilize a totally passive cooling system that requires no electricity or pumping to safely cool the fuel. Rather, the system uses naturally occurring convection to pull cool air in at the bottom and allow warmer air to exit the top of the cask like a chimney.

Emergency Plans and Procedures

Diablo Canyon has in place several plans and procedures with detailed actions to be taken in responding to an emergency. Those plans and procedures include the following:

- o Emergency Plan – License required, NRC approved
- o Emergency Plan Implementing Procedures – Specify how Emergency Plan is implemented
- o Casualty Management Procedures – Earthquake, Tsunami, Stranded plant
- o Abnormal Operating Procedures – Actions that are taken to address expected malfunctions within design conditions
- o Severe Accident Management Guidelines – Actions taken to address expected malfunctions outside of design conditions.

Emergency Planning and Training

The company has robust emergency preparedness training for personnel. Emergency Planning drills and exercises are conducted annually at Diablo Canyon. Every year, employees perform four table top drills and four full scope exercises. This schedule allows each of our four Emergency Response Organization Teams two opportunities to test their skills annually. In addition, both the Nuclear Regulatory Commission and the Federal Emergency Management Agency conduct an evaluation of both Diablo Canyon and San Luis Obispo County's full scale exercise biannually. During an evaluated exercise year, full scope exercises are increased to five. San Luis Obispo County participates in all of Diablo Canyon's full scope exercises at various levels.

DCPP Elevations

310' Dry Cask Storage and Fresh Water Reservoirs

85' Power Block; Diesel Generators

45.6' Auxiliary Saltwater Snorkels

Surface of Spent Fuel



Plant Elevations

