Powers Engineering Response to Preliminary Bechtel ClearSky™ Back-to-Back Cooling Tower Designs for DCPP Units 1 and 2

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1. Executive Summary

There are several substantive deficiencies in the Bechtel ClearSky™ back-to-back plume-abated cooling tower alternative for the Diablo Canyon Power Plant (DCPP) south parking lots that undermine the feasibility of this alternative and add substantially to cost. These deficiencies are: 1) artificially limiting the performance of the cooling tower(s) to operate at the alarm point of the Unit 1 and 2 steam turbine-generators at design ambient conditions, 2) inadequately reinforcing the existing surface condensers and cooling water ducts under the Unit 1 & 2 steam turbine-generators, creating an artificial need to do major excavation in the parking areas to keep the cooling tower basin heights to no more than 115 feet above mean sea level (MSL), and 3) circulating far more water than necessary through the cooling tower(s), resulting in a larger cooling tower than necessary that is more difficult to locate in the available parking areas.

Bechtel proposes 44-cell ClearSky™ cooling towers designed to limit backpressure to 5.0 inches of mercury. According to Bechtel, the steam turbine high backpressure alarm level is 5.0 inches mercury. In the opinion of Powers Engineering, it is not advisable to design the cooling towers to operate at or near 5.0 inches mercury. This high backpressure operating level would allow PG&E credible grounds to assert that the cooling towers could compromise the reliability of DCPP power output. Bechtel has also evaluated a smaller alternative with 34-cells that will operate at higher backpressure levels, up to 6.5 inches mercury.

Contributing factors to the high backpressure at design conditions are: 1) unnecessarily high cooling water flowrate of 868,300 gpm, and 2) use of relatively small cooling tower cells that measure 54 feet width (W) by 42 feet length (L). However, design optimization would allow a 34-cell tower design using 54 feet (W) and 48 feet (L) cells, or a 28-cell tower design using 60 feet (W) by 60 feet (L) cells, to achieve a backpressure at design conditions of approximately 4 inches of mercury.

New nuclear units in the U.S. have the same heat removal load as DCPP Units 1 and 2 and have closed cycle cooling water flowrates ranging from 600,000 to 631,000 gpm. Cooling tower optimization would include reducing cooling water flow from 868,300 gpm to 600,000 gpm.

The optimized 34-cell cooling towers would fit in single contiguous parking areas with a common elevation. The 44-cell cooling towers are too large to do so.

Bechtel does not appear to have accounted for the fact that the existing Unit 1 and 2 surface condensers are located at a mean elevation of approximately 80 feet above MSL. The pressure rating of the upgraded surface condensers will be 50 psig (115 feet). The return cooling water from any cooling tower with a base elevation of less than 195 feet (80 feet + 115 feet) will not exceed the pressure rating of the upgraded Unit 1 and 2 surface condensers.

There are no available parking areas suitable for cooling towers with elevations above 135 feet above MSL at DCPP. Therefore there is no need to reduce the elevation of the candidate parking lots to avoid over-pressuring the upgraded Unit 1 and 2 surface condensers regardless of where the cooling towers are located.

The difficult-to-access circulating water ducts/tunnels under the Diablo Canyon steam turbine building can also be lined with steel liners or composite fiber reinforced polymer (CFRP) structural liners to increase the pressure rating to at least the pressure rating of the surface condenser(s). These techniques eliminate the need to dig up and replace pipe or tunnel runs that are difficult to access. Alternatively, continuous pressure relief valves, also known as plunger valves, can be installed in the cooling tower cold water return lines to limit water pressure to within the limits of existing cooling water ducts under the DCPP turbine building.

The parking lot back-to-back cooling tower designs now being evaluated by Bechtel are substantially similar to the cooling towers evaluated by Enercon for PG&E in 2009 and by TetraTech for the State Water Resources Control Board in 2008. The only difference is that plume-abated ClearSky™ back-to-back cooling towers are now considered feasible and are utilized in the Bechtel design. Both Enercon and TetraTech evaluated non-plume abated back-to-back cooling towers.

TetraTech (2008) estimated an installed capital cost of $894 million for retrofit cooling towers at DCPP. Of this total, $209 million is allocated for demolition of existing structures in the DCPP parking lots and $207 million is a contingency budget. Enercon (2009) estimated an installed capital cost of $2.689 billion for retrofit cooling towers at DCPP. This total included a contingency budget of $448 million.

Both TetraTech and Enercon use non-plume abated back-to-back cooling towers of approximately the same size in approximately the same parking lot locations. Enercon costs are consistently 2 to 3 times greater than those identified by TetraTech for the same equipment, including (but not limited to) the cooling towers, cold water basin, circulating water pumps, and surface condenser upgrades.

The generic nuclear plant ClearSky™ back-to-back cooling tower cost estimate provided by SPX to Powers Engineering in 2009 puts the TetraTech and Enercon cost estimates into perspective. SPX estimated the installed cost of a ClearSky™ back-to-back cooling tower in a typical application, for a cooling system load approximately 10 percent greater than the cooling system load of DCPP Units 1 and 2, of about $230 million. For two units the installed capital cost would be about $460 million.