

The Role of the AES Powerplant in Surf Zone Water Quality of Huntington State Beach, California

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Abstract: As part of the retooling of the Applied Energy Services (AES) Huntington Beach Generating Station (AES HBGS) in 2001, a near shore beach contamination investigation was required by the California Energy Commission (CEC). The CEC commissioned the study in July 2002 to specifically investigate the impact of the AES HBGS on recent ocean postings and closures. The objective of this study was to assess whether the operation of the AES HBGS was negatively impacting water quality in the surf zone in the vicinity of Huntington State and City Beaches.

The scope of work consisted of: sampling surface water and in plant water daily for 14 weeks at eight sample locations, with sampling every three hours during a two-week intensive period from four of the eight locations; analyzing the water samples for AB 411 microbial indicators (total and fecal coliform, and Enterococcus) and physical and chemical parameters (pH, temperature, salinity, conductivity, DO, turbidity, and ammonia); conducting microbial source tracking on selected samples collected during the intensive sampling period; performing an in plant dye study to check for cross connections of the sanitary sewer system within AES HBGS; performing an outfall dye study to model thermal dispersion from the AES HBGS discharge pipe and to quantitatively predict the potential impact of the AES HBGS on the beach; monitor temperature and salinity profiles of ocean water and in plant water using high sensitivity in situ sensors and data loggers; and to prepare a draft and final report for the CEC and AES HBGS.

The scope of work was designed to address four key questions relating to the potential impact of the AES HBGS on surf zone water quality:

- Is sub-thermocline freshwater drawn into the AES HBGS intake, or entrained into the thermal discharge of the outfall pipe?
- Are bacteria introduced into the AES HBGS intake from the ocean (at low concentrations), and selectively cultured by the elevated temperature of the cooling water in the plant?
- Are land-based sources of bacteria entering the discharge vault in the AES HBGS and are discharged to the ocean causing bacterial contamination of the surf zone of Huntington State Beach.
- Are sanitary sewers within the AES HBGS connected to, or leaking into, the discharge vault?

In excess of 1,500 microbiological water quality samples were collected during the duration of the study. Samples were collected from the eight locations within and adjacent to the AES HBGS; additional storm drain locations; beach and ocean locations. The principal sources of bacteria were Blackford's Ditch, the boiler fireside wash and to a lesser extent the boiler sump wash. Microbial water quality at these locations consistently exceeded AB 411 recreational water quality standards; bacterial concentrations within the two other on-site locations (general purpose retention basin and storm water sump) were lower. Bacterial concentrations at the intake vault and discharge vault were consistently low and exceeded AB 411 21 times.

The microbial source tracking techniques used in this investigation, were able to differentiate the source of microorganisms as either human (positive) or non-human (negative). Of the *Bacteroides* and *Prevotella* microbial source tracking samples collected (64), only two were confirmed as positive (human source); one from the Intake Vault on 21 August at 9:40 PM (very near high tide), and the Discharge Vault on 22 August at 10:05 PM (also near high tide). Parallel measurements (not funded by this project) showed multiple positive results for this assay during the evening high tide of 21 August, 2002 at locations all along the beach, at the Santa Ana River, Talbert Marsh, 6N, 9N, 12 N, 15N, and 18N sites. Of the Enterovirus microbial source tracking samples collected (59), only two tested positive (human source-intake vault at 3:10 on August 21, 2002). Consequently, the AES HBGS was not a significant source of human-derived contamination during this study period.

A dye study was conducted on the restrooms within the AES HBGS. During the 24-hour sanitary sewer dye test, no dye was detected in the discharge vault with an in-situ fluorometer nor was any observed in either the discharge vault or the general purpose retention basin. A dye study was performed on the AES HBGS discharge and within the near vicinity of the AES HBGS outfall, and the results incorporated into a thermal plume model. The thermal plume model has been used to determine the impact of bacteria discharged from the AES HBGS on surf zone water quality at 9N.

Moorings were placed in the vicinity of the AES HBGS intake with an array of temperature, salinity, pressure and current sensors. Temperature, pressure and salinity sensors were placed in the intake vault and discharge vault at the AES HBGS. Investigations were performed on Blackford's Ditch and a storm water-sampling event occurred during the first significant storm of the season in November. No OCSD plume water was drawn into the intake during the August period. However, some portions of the August temperature-salinity (T-S) data demonstrated warmer lower salinity water coming into the intake vault. During September, three cold-water events occurred at the intake mooring (water temperature less than 13.5°C), indicative of sub-thermocline water. Corresponding temperatures in the intake vault were lowered, suggesting partial entrainment of sub-thermocline water by the AES HBGS. As part of this investigation, ammonia sensors were to be deployed on moorings and in the intake vault, however technical limitations of the equipment prevented the successful deployment of the ammonia sensors, consequently ammonia samples were collected from four locations within the AES HBGS facility (discharge vault at zero-feet, ten-feet, and 30-feet depths, and the intake vault). Based on the results collected in this study the following conclusions have been made:

- Sub-thermocline