M. REDONDO BEACH GENERATING STATION

AES REDONDO BEACH, LLC—REDONDO BEACH, CA

Contents

Tables

Figures

Appendices

1.0 GENERAL SUMMARY

Converting the existing once-through cooling systems at Redondo Beach Generating Station (RBGS) to wet cooling towers is technically feasible within the current boundaries of the station, but zoning constraints and proposed redevelopment plans by the City of Redondo Beach create significant obstacles that are unlikely to permit constructing four large wet cooling towers at the site.

In 2002 the City of Redondo Beach adopted the "Heart of the City" Specific Plan following a memorandum of understanding between AES Redondo Beach and the city that outlined possible plans of redeveloping and downsizing the existing site (Figure M–1). The Heart of the City plan calls for comprehensive redevelopment of the King Harbor area by improving access to the marina and creating a "Village Core" that would consist of small commercial shops and residential areas. Prominent pedestrian access areas would include pathways to the marina across a portion of the existing AES site. Voter disapproval led to the plan's rescission and replacement with a "Heart Park" that would revitalize wetlands and preserve open space in the area, although there has been no agreement to proceed at the site.

The final redevelopment vision of the existing location is not clear, but the intent of both the city and the voters appears to favor a transition away from expanded industrial use of the area. Even without a comprehensive development plan in place, the existing site's configuration and its proximity to commercial and residential areas present substantial obstacles for conformance with land use plans and zoning ordinances.

For these reasons, this study did not conduct a detailed evaluation of wet cooling towers for RBGS.

Figure M–1. General Vicinity of Redondo Beach Generating Station

2.0 BACKGROUND

RBGS currently operates 4 steam generating units (Units 5–8) on approximately x acres in the city of Redondo Beach, Los Angeles County, owned and operated by AES Redondo Beach, LLC. Four other steam units (Units 1-4 have been retired but remain on the facility property. Units at RBGS are used infrequently, with the 2006 combined capacity utilization rate equaling 5 percent.

Table M–1. General Information

Unit	In-service year	Rated capacity (MW)	2006 capacity utilization [a]	Condenser cooling water flow (gpm)
Unit 5	1954	175	1.7%	72,000
Unit 6	1957	175	1.7%	72,000
Unit 7	1967	480	6.7%	234,000
Unit 8	1967	480	5.6%	234,000
RBGS total		**1,310**	**5.0 %**	**612,000**

[a] Quarterly Fuel and Energy Report—2006 (CEC 2006).

Figure M–2. Site View

2.1 COOLING WATER SYSTEM

Cooling water for Units 5 and 6 is withdrawn through two submerged conduits extending into King Harbor and the Redondo Beach Marina. The submerged end of each is fitted with a velocity cap that redirects the intake flow and triggers a flight response in motile fish. The onshore portion of the intake consists of trash racks and vertical traveling screens. The four traveling screens (two per unit) are fitted with 5/8-inch wire mesh panels that are rotated automatically based on the pressure differential between screen's upstream and downstream faces (12 inches). A high-pressure spray removes any debris impinged on the screens, including any fish, for disposal at a landfill. Unit 5 is serviced by two circulating water pumps rated at 38,000 gallons per minute (gpm), for a total capacity of 76,000 gpm, or 110 million gallons per day (mgd). Unit 6 is serviced by two pumps rated at 37,000 gpm, for a total capacity of 74,000 gpm, or 106 mgd (AES 2005).

Cooling water for Units 7 and 8 is withdrawn through a submerged conduit that extends approximately 3,000 feet from the facility and is located between the constructed breakwaters that form the entrance to King Harbor. The submerged end of the conduit is fitted with a velocity cap that redirects the intake flow and triggers a flight response in motile fish. The onshore portion of the intake consists of trash racks and vertical traveling screens. The four traveling screens (two per unit) are fitted with 5/8-inch wire mesh panels that are rotated automatically based on the pressure differential between screen's upstream and downstream faces (9 inches). Each unit is serviced by two circulating water pumps, two per unit, each rated at 117,000 gpm, or 169 mgd, for a total capacity of 468,000 gpm, or 674 mgd.

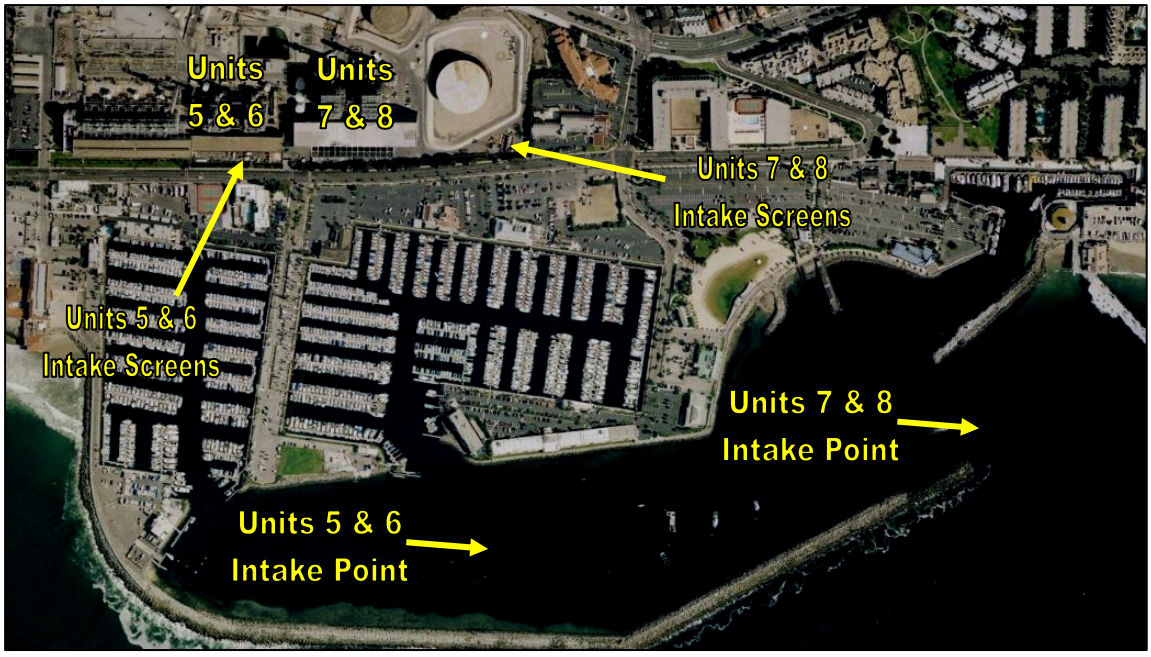

Figure M–3. Intake Locations

2.2 SECTION 316(B) PERMIT COMPLIANCE

Each CWIS currently in operation at RBGS uses a velocity cap to reduce the entrainment of motile fish through the system, although it is commonly thought of as an impingement reduction technology because it targets larger organisms. Velocity caps have been shown to reduce impingement rates when compared with a shoreline intake structure. Likewise, the location of the intake structure in an offshore setting may contribute to lower rates of entrainment when compared with a shoreline intake if the near-shore environment is more biologically productive. This study did not evaluate the effectiveness of either measure.

LARWQCB Order 00-085, adopted in 2000, states the following:

> SCE [Southern California Edison, previous owner]conducted a study (completed in 1982) that addressed the important ecological and engineering factors specified in Section 316(b) guidelines. The study demonstrated that the ecological impacts of the intake system are environmentally acceptable, and provided sufficient evidence that no modification for the location, design, construction or capacity of the existing systems was required. The design, construction and operation of the intake structures was then considered Best Available Technology Economically Achievable (BAT) (sic) as required by Section 316(b) of the Clean Water Act. (LARWQCB 2000, Finding 9)

The order does not contain any numeric or narrative limitations regarding impingement or entrainment resulting from CWIS operation, but does require bimonthly monitoring of impingement at each intake structure (coinciding with scheduled heat treatments). Based on the record available for review, RBGS has been compliant with this permit requirement.

The LARWQCB has notified RBGS of its intent to revisit requirements under CWA Section 316(b), including a determination of the best technology available (BTA) for minimization of adverse environmental impact, during the current permit reissuance process. A final decision regarding any Section 316(b)–related requirements has not been made as of the publication of this study.

3.0 WET COOLING SYSTEM RETROFIT

As noted above, wet cooling towers could be constructed at the current RBGS site, but zoning and local use constraints likely preclude this option. The two most immediate limits concern visible plume and noise.

The site's proximity to existing and future developments, both commercial and residential, would likely require any wet cooling tower to use plume abatement technologies. These towers would occupy a larger footprint than conventional towers and can be taller by 15 feet or more, depending on the various design elements. Furthermore, noise abatement measures would be required, although no measures may be reasonable available that will enable any tower to comply with local noise limitations (55 dBA during daylight hours) given the proximity of nearby office buildings (Figure M–4).

To provide sufficient cooling for the four active units, four cooling towers would be required. For Units 5 and 6, each tower would comprise approximately five 58-foot tall cells with a total length of 240 feet. The towers for Units 7 and 8 would be even longer, approximately 960 feet each, and be located less than 100 feet from the office building shown in Figure M–4. Splitting each tower into multiple arrays may allow for a different configuration and mitigate some of the impacts, but conflicts will remain regardless of the area selected for their placement.

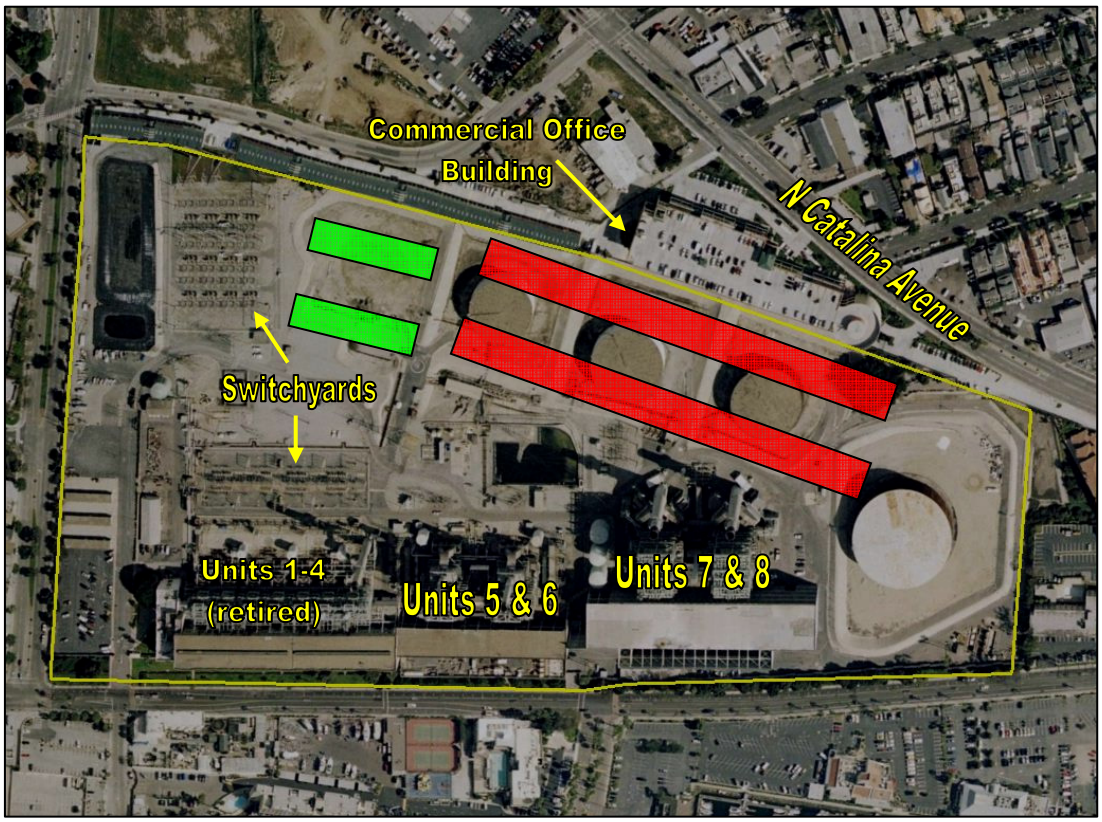

Figure M–4. Hypothetical Location of Cooling Towers

4.0 OTHER TECHNOLOGIES

Within the scope of this study, and using the OPC resolution's stated goal of reducing impingement and entrainment by 90–95 percent as a benchmark, the effectiveness of other technologies commonly used to address such impacts could not be conclusively determined for use at RBGS. As with many existing facilities, the location and configuration of the site complicates the use of some technologies that might be used successfully elsewhere. A more detailed analysis that also comprises a biological evaluation may determine the applicability of one or more of these technologies to RBGS. A brief summary of the applicability of these technologies follows.

4.1 MODIFIED RISTROPH SCREENS—FINE MESH

The principal concern with this technology is the successful return of viable organisms captured on the screens to the source water body. RBGS currently withdraws its cooling water through submerged conduits that extend 2,000 to 3,000 feet from the intake screens at the facility. Reconfiguring the intake structure to place the screens closer to the shoreline is impractical given the developed nature of the area (Redondo Beach Marina). The potential use of fine-mesh screens at RBGS would be dependent upon a biological evaluation that assessed whether impinged organisms could be successfully returned to either King Harbor or Santa Monica Bay and remain viable.

4.2 BARRIER NETS

Barrier nets may prove successful at RBGS in reducing impingement mortality, but their location within the marina or at the entrance to the harbor is infeasible because of the likely interference with recreational and commercial boating.

4.3 AQUATIC FILTRATION BARRIERS

Aquatic filtration barriers (AFBs) are subject to the same siting restrictions as barrier nets.

4.4 VARIABLE SPEED DRIVES

Variable speed drives (VSDs) were not considered for analysis at RBGS because the technology alone cannot be expected to achieve the desired level of reductions in impingement and entrainment, nor could it be combined with another technology to yield the desired reductions. Pumps that have been retrofitted with VSDs can reduce overall flow intake volumes by 10 to 50 percent over the current once-through configuration (USEPA 2001). The actual reduction, however, will vary based on the cooling water demand at different times of the year. At peak demand, the pumps will essentially function as standard circulating water pumps and withdraw water at the maximum rated capacity, thus negating any potential benefit. Use of VSDs may be an economically desirable option when pumps are retrofitted or replaced for other reasons, but VSDs were not considered further for this study.

4.5 CYLINDRICAL FINE-MESH WEDGEWIRE

Fine-mesh cylindrical wedgewire screens have not been deployed or evaluated at open coastal facilities for applications as large as would be required at RBGS (approximately 900 mgd). To function as intended, cylindrical wedgewire screens must be submerged in a water body with a consistent ambient current of 0.5 fps. Ideally, this current would be unidirectional so that screens may be oriented properly and any debris impinged on the screens will be carried downstream when the airburst cleaning system is activated.

Fine-mesh wedgewire screens for RBGS would be located offshore in the Pacific Ocean, west of the facility. Limited information regarding the subsurface currents in the near-shore environment near RBGS is available. Data suggest that these currents are multidirectional depending on the tide and season and fluctuate in terms of velocity, with prolonged periods below 0.5 fps (SCCOOS 2006). To attain sufficient depth (approximately 20 feet) and an ambient current that might allow deployment, screens would need to be located 2,000 feet or more offshore. Discussions with vendors who design these systems indicated that distances more than 1,000 to 1,500 feet become problematic due to the inability of the airburst system to maintain adequate pressure for sufficient cleaning (Someah 2007). Together, these considerations preclude further evaluation of fine-mesh cylindrical wedgewire screens at RBGS.

5.0 REFERENCES

AES Redondo Beach, LLC. 2005. Clean Water Act Section 316(b) Proposal for Information Collection for El Segundo Generating Station. AES Redondo Beach, LLC, Redondo Beach, CA.

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Someah, K. 2007. Personal communication from Kaveah Someah, Groupe Laperrière & Verreault Inc., to Tim Havey, Tetra Tech, Inc.

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