Public Hearing (9/16/09)
Once Through Cooling
Deadline: 9/30/09 by 12 noon

Department of Water and Power the City of Los Angeles

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September 30, 2009

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Ms. Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
1001 "I" Street, 24[TH] Floor
Sacramento, California 95814

Dear Ms. Townsend:

Subject: Comment Letter – Once-Through Cooling (OTC) Policy

The Los Angeles Department of Water and Power (LADWP) appreciates the opportunity to review and comment on the State Water Resources Control Board's (State Board) draft Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (draft Policy) dated June 30, 2009, and its associated Supplemental Environmental Document (SED). LADWP provides the following observations and comments[1], as well as the enclosed specific comments (Enclosure 1), for your consideration and looks forward to working with the State Board on the development of the Statewide Policy.

LADWP commends the State Board on the current draft Policy and expresses appreciation for numerous improvements from the prior versions. It is clear the State Board has worked hard to make the Policy environmentally protective while being mindful of the need to maintain a viable and reliable energy supply system for the State of California. LADWP is particularly appreciative of the willingness of the State Board to reach out to other state agencies in a collaborative fashion to tackle this very complex issue. LADWP is pleased to see the following positive improvements:

- The draft Policy provides flexibility in achieving compliance based on site specific circumstances as reflected in its attempt to provide more than one compliance track for circumstances where Track 1 is not feasible.

[1] The following list of consultants assisted LADWP in the preparation of these comments, they are as follows: EPRI, MBC, Tenera, and Maultbesch Consulting. Dave Bailey (EPRI) and John Steinbeck (Tenera) participated as part of the State Board's expert review panel for this draft policy.

- Allowing credit for technology-based improvements specifically designed to reduce impingement and entrainment that were implemented prior to the effective date of the Policy (e.g., the velocity cap used at LADWP's Scattergood Generating Station and prior repowering efforts which reduced once-through cooling [OTC] usage).

- Recognition that consideration of costs relative to environmental benefits using the wholly disproportionate cost test has a role in implementing the draft Policy.

- Increasing the flexibility for interim compliance measures and impingement and entrainment monitoring.

- Recognizing that use of dry cooling is not a viable option for retrofitting existing generating units.

While there has been overall improvement due to these changes, the draft Policy as currently written, presents challenges and is not yet workable. The dilemmas and proposed solutions, including an explanation of the alternatives LADWP can pursue and the results they will yield, are outlined below.

LADWP Overview

LADWP is the nation's largest municipally owned utility serving approximately 4 million people. Its service territory covers the City of Los Angeles and many areas of Owens Valley. It is a vertically integrated utility, which is to say, it owns and operates its own generation, transmission, and distribution systems. For this reason, it does not rely on the energy market to meet its power needs. LADWP is mandated by the Los Angeles City Charter to meet its customer's electrical needs in a reliable and cost-effective manner. LADWP's load forecast predictions state that our customer's electricity consumption will increase at an average rate of 0.9 percent per year, and the peak demand will increase an average of 60 MW per year. Therefore, LADWP must have sufficient capacity to provide its customers with a reliable supply of electric power.

LADWP owns three coastal generating stations which utilize OTC, generating a total of 2672 MW (MW) which are critical to the current and future power needs of the City of Los Angeles. Presently, LADWP's coastal generating stations represent 30 to 35 percent of LADWP's power capacity and the majority of the in-basin generation. LADWP must continue to operate the coastal power plants at their current location and at their current capacity for the following reasons:

- The location and continued operation of the coastal plants is absolutely critical not only from the energy they supply, but also for the stability and balance they provide to LADWP's transmission grid.

- The coastal power plants support the local load in the western and southern portions of our system. The laws of physics preclude delivering electricity to these portions of the city solely from energy imported from the northern portion of our transmission system. Additionally, our ability to import power in the north is dependent upon our generation in our southern system. If the coastal, southern generation were eliminated, our ability to import energy would be severely constrained, impacting LADWP's ability to serve its native load.

- The city is built out and therefore, there is no new location to site replacement power plants.

- LADWP is expanding its effort to promote rooftop solar and local distributed generation, however, these local energy sources will not be enough to replace the thousands of MW that the coastal plants represent.

- LADWP's transmission system was established and has evolved around the existence of the coastal plants. Upgrading existing transmission or building new transmission in a highly congested urban setting is also not viable.

- To maintain its energy supply and mandated reliability requirements, LADWP cannot relinquish any of the MW provided by the current plants. Furthermore, the power loss from any one of these plants (e.g., from repowering or retrofitting) must be replaced at the site before an older unit can be brought offline.

- An in-basin supply of power ensures that LADWP can produce and deliver electricity in the event of emergencies or natural disasters such as earthquakes or wildfires. The recent fires affected our transmission lines which in turn restricted our ability to import power from our renewable sources and other power supplies. LADWP had all but one coastal unit in operation for several days during the "Station Fire" to provide energy and grid stability to the City.

- Lastly, as noted below, LADWP has an aggressive renewable energy policy. However, the need for the natural gas-fired coastal plants will be even more critical in their role of balancing these intermittent resources.

For the reasons noted above, the value of the coastal plants cannot be captured by a simple metric such as annual energy produced. The reality is that every MW of capacity from these plants is vital to the essential public service of electricity supply to the City and any loss of capacity must be made up by construction of new power generating facilities in essentially the same location. LADWP's in-basin plants are critical to LADWP's City Charter responsibility of ensuring a reliable supply of energy to its citizens.

Role of LADWP Coastal Power Plants and Renewable Resource Integration

As part of complying with Assembly Bill (AB) 32 and LADWP's strong commitment to environmental stewardship, LADWP has developed a renewable portfolio standard policy that has instituted a shift in LADWP's generation to a more environmentally sustainable mix. As part of this shift, the Mayor has established a goal of both reducing Greenhouse Gas (GHG) emissions to 60 percent below 1990 levels by 2030, and providing 20 percent renewable energy to its customers by 2010 and 40 percent by 2020. It is anticipated, that some intermittent renewable resources, such as wind and solar (including in-basin "roof top" solar), may require a back-up energy supply source to meet peak demand conditions. The aggressive pursuit of renewable power, supported by the in-basin coastal plants, will allow LADWP to further achieve its GHG reduction goals by divesting of its coal energy resources. Therefore, the role of the in-basin coastal plants will remain critical in providing grid stability and flexibility to start up on demand with varying outputs to meet real time demands. LADWP's coastal plants also provide a firming supply of energy to current and future renewable power, a reliable source of local power in the event of emergencies and instances of peak energy demand, and stability to LADWP's electrical distribution grid.

Repowering at LADWP – Past, Present, and Future

LADWP supports the goals set forth in the State Board's draft Policy, namely, to reduce the use of OTC and to minimize the OTC impacts on marine life. Minimization of OTC impacts, as opposed to elimination of impacts, is also consistent with Section 316 (b) of the Clean Water Act. LADWP has been pursuing these goals by diminishing the use of ocean water with every power plant repower. LADWP has been engaged in power plant repowering for the last 15 years and has completed repowering projects at three of its facilities, two of which were at its coastal power plants. To date, LADWP has reduced the number of OTC units from 14 to 9. By 2017, it expects to have completed two more repowerings, one at the Haynes facility and the other at Scattergood, leaving only five units remaining that will use OTC.

LADWP wants to do its part in furthering the state's goals and in reducing impingement mortality (IM) and entrainment (E). LADWP has, and continues to recognize, that repowering of it aged and less efficient generating units is necessary. However, repowering efforts require a thorough and thought out replacement planning effort. Repowering today can either be with combustion turbines, which are quick start but less efficient, or with combined cycle units, which are more efficient but less responsive than combustion turbines. Replacing units before you know what you need is faulty planning. Thus planning and replacement is an iterative process that requires both a reassessment of the current energy portfolio after each repowering and a look ahead. Concurrent repowering efforts do not allow for proper planning, and more importantly, would remove needed MW from the system without a source of replacement.

Both of LADWP's planned repowering projects envision the use of closed cycle cooling (CCC). However, once completed, no additional space at Haynes and Scattergood would be available for future repowering using CCC without the need to demolish existing structures. Demolition would remove needed MW without any replacement source. As previously noted, MW cannot be removed from the system without first having replacement MW in the same amount and in the same location in order to support the local load in the western and southern portions of our system. Furthermore, many of the facilities that would need to be demolished provide common services to the entire plant (e.g., ammonia storage tanks, heavy duty cranes, process water delivery lines, electrical buswork to the adjoining substation, etc.). For the reasons outlined above, sufficient time is a critical element in making progress toward our mutual goals and will be discussed later in our comments.

Notwithstanding the need for sufficient time, there may be facilities where the elimination of OTC will simply not be possible or environmentally beneficial as will also be discussed later in these comments. In these instances, LADWP would seek installation of the best performing impingement and entrainment control technology, along with appropriate operational measures, to minimize the continued use of OTC and to achieve the state Policy standards. For these circumstances, the availability of the wholly disproportionate test is absolutely critical since total compliance with the Track 2 standard will not be possible without it.

LADWP provides the following general comments on the draft Policy and SED with our more specific comments in Enclosure 1.

General Comments

1. **Overall Benefits of the Policy**

LADWP suggests that the State Board more fully examine and characterize the actual environmental benefits to be gained by implementing the draft Policy. The draft Policy seems to focus on impingement and entrainment numbers which alone provide no meaningful context as to how those losses affect California's coastal fish populations and fisheries. It is important to consider the high natural mortality of both fish eggs and larvae, as well as the dramatic impact that natural climatic forces (such as ocean warming) are having on fish populations. [See Enclosure 2, Issue 1]. Simply stating the sum total of entrainment losses may be misleading since lumping different life stages (i.e., eggs versus larvae), which have very different natural mortality rates, is not accurate. It also ignores the fact that the vast majority (99.9 percent) of early life stages do not survive as a result of natural mortality regardless of entrainment. The single most determinant factors for these species' sustainable health are suitable oceanographic conditions and the availability of adequate, quality habitat rather than OTC usage. [See Enclosure 2, Issues 2 and 4].

Finally, there is no technical information to support the assumption of 100 percent entrainment mortality for all facilities for both ichthyoplankton and zooplankton, which have exoskeletons and as a result are much less susceptible to damage as they pass through the cooling system.

2. There is No Reasonably Foreseeable Means of Compliance

The draft Policy provides that a Track 2 compliance alternative may be pursued if it can be demonstrated to the satisfaction of the Regional Board that the Track 1 compliance path is infeasible. Track 2 requires the IM&E impacts be reduced to a level comparable with closed cycle cooling. The draft Policy discusses that the assessment of entrainment impacts shall be based on sampling which includes all ichthyoplankton and zooplankton, with the latter defined as invertebrates larger than 200 microns. This zooplankton requirement effectively negates a Track 2 compliance option, leaving installation of cooling towers as the only compliance option.

State and Federal agencies, research institutions, and the scientific community acknowledge that there is little need to protect zooplankton populations. The California Energy Commission states, "Adults and other stages of small planktonic invertebrates (e.g. copepods) are generally not sampled due to their small individual size and the assumption that because of their large population sizes, and rapid growth and reproduction, ecologically important impacts are unlikely" (Issues and Environmental Impacts Associated with Once-Through Cooling at California's Coastal Power Plants CEC-700-2—5-013, June 2005. Appendix A). Detailed studies that were conducted as part of the 316(b) studies performed in the late 70's and early 80's by many of the power plants concluded that there were no detectable effects from plant operation on local zooplankton populations. [See Enclosure 2, Issue 6]. These and other studies of impacts to zooplankton concluded that the reasons, as noted in a 1979 EPRI study entitled, "Ecosystem Effects of Phytoplankton and Zooplankton Entrainment", include:

- The rapid reproduction potential of plankton permits relatively rapid replacement making entrainment impacts negligible.
- Plankton are transient, and therefore, losses in a given area are replaced by mixing.
- Plankton are opportunistic colonizers and are highly resistant to perturbations.

Environmental Protection Agency (EPA) recognized the low vulnerability of phytoplankton and zooplankton in its 1977 draft 316(b) guidance which stated that because of their short life span and population regeneration capacity, these organisms should be less vulnerable to adverse impacts than macroinvertebrates and fish. In 2004, EPA reaffirmed that a rule protective of all life stages of fish and shellfish would be equally protective of all aquatic organisms, including plankton as a result of the above factors.

With the exception of Aquatic Filter Barriers, which have little or no application in California, the technology options listed in Section 4.1 of the SED, and in fact all technology options commercially available, cannot exclude organisms that are 200 microns (0.2 millimeter).
For example, the fine mesh ristroph screens and wedge wire screens that have been manufactured and performance tested are 0.5 millimeter (mm) and larger. Thus, a Track 2 requirement that requires entrainment impact reductions commensurate with cooling towers for aquatic life 200 microns or larger does not effectively exist. If the installation of cooling towers is infeasible, the power plant owner or operator is faced with no "reasonably foreseeable means of compliance" with the draft Policy.

3. Can Costs be Reasonably Borne by Industry?

The State Board, in deciding to set a 316(b) Best Technology Available (BTA) compliance standard, has stepped into USEPA's standard-setting role. LADWP is unaware of any California Water Code provision that sets forth the process for establishing BTA standards. Therefore, LADWP is assuming that the State Board has utilized and made its own, the federal requirements applicable to EPA associated with setting a BTA standard. Those requirements, as noted on page 54 of the SED, include: (1) the age of the equipment and facilities involved; (2) the process employed; (3) the engineering aspects of the application of various types of control techniques; (4) process changes; (5) the cost of achieving such effluent reduction, non-water quality environmental impact (including energy requirements; and (6) other such factors as the EPA Administrator deems appropriate. Thus, the SED must fully address all of these requirements. LADWP believes the SED falls considerably short in addressing these areas, including any consideration of the costs to industry.

The SED recognizes the guidance provided in the Riverkeeper II court decisions (Second Circuit and US Supreme Court) which allow for considering whether the BTA costs can be reasonably borne by industry. As indicated in the SED, if a large percentage or majority of units would be prematurely retired under the Policy (SED, Section 3.6), this would suggest the cost could not be reasonably borne.

The Second Circuit Court Decision determined that EPA could choose to reject closed-cycle cooling as BTA based on several factors that included whether or not the industry could bear the cost of the technology. Nevertheless, the State Board has elected to implement a Policy that requires OTC facilities to retrofit with cooling towers as BTA. (Note: As discussed above Track 2 is not a viable option with the zooplankton inclusion.) The current Policy and accompanying documents provide for no analysis or information to support that the cost of requiring retrofits can be borne by these facilities and in fact most information suggests they cannot.

The SED, in its discussion of intake flow rate and velocity reductions as BTA, Section 3.11 on page 70-Alternative 3 (as recommended by staff), states that many fossil fuel units will have to retire or repower to achieve compliance. This indicates that staff recognizes that the cost of compliance cannot reasonably be borne; however, the costs of repowering were ignored in the analysis. Neither Tetra Tech nor EPRI in their respective reports on the cost of cooling towers considered the costs associated with repowering. The SED (pgs. 108 and 109), correctly acknowledges the difficulty and costs associated with retrofitting an existing facility with cooling towers as opposed to installing them at a brand new facility. In so doing, the SED encourages repowering and recognizes that many facilities cannot bear the cost of retrofits.

Finally, the SED contains some annualized costs prepared by State Board staff, however, there is no real data or analysis to indicate whether or not the costs could in fact be borne. The costs referenced from the TetraTech report appear to include only capital costs and these costs did not include the cost of extended outages that may be required at some facilities, the loss of revenue from reduced generating efficiency, the permitting and monitoring costs, and other costs to comply with various mandates and policies. The total of these costs could easily equal or exceed the capital costs considered over the life of the facility.

The electric utility industry is undergoing an unprecedented era of change and transformation. LADWP estimates that between now and 2017, it may expend approximately $11 billion dollars. These costs, which will be passed on to the ratepayers, stem from the following five areas: 1) climate change and GHG issues, purchasing air emission allocations and/or offsets; 2) purchasing and/or developing renewable energy resources to meet a 20 percent and 40 percent renewable portfolio standard by 2010 and 2020, respectively; 3) making the necessary transmission upgrades for integrating renewables, or investing in new transmission lines to deliver renewable energy to load centers; 4) repowering aging less efficient generating units, such as Haynes Units 5 and 6 and Scattergood Units 1 and 2; and 5) complying with the impending state and/or federal 316(b) requirements. The costs of implementing the OTC Policy, combined with the costs areas facing California utilities as noted above, represent costs that cannot be reasonably borne by the utility industry within the time frame set forth in the draft Policy.

The draft Policy will have major impacts on the regulated community, rate payers, and the neighborhoods where LADWP facilities are located. The OTC compliance costs will be several hundreds of millions of dollars for LADWP, and according to a NERA[2] report, over $3 billion dollars to the electric utility industry. LADWP includes this report in its comments by reference. Additionally, at the September 16th public

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[2] Using guidance from Federal and California state agencies on methods that could be used to develop detailed cost-benefit assessments, and using methodology established by the USEPA for its Phase II Rule, NERA performed a conservative assessment of the draft Policy. The NERA report concludes that a cost-benefit analysis is an important means of clarifying "what is at stake" in terms of key decisions regarding the draft Policy.

hearing, State Board members specifically requested comments on how a cost-benefit analysis might effectively be applied. The NERA report provides a useful framework for use by the State Board and/or Regional Boards in performing site-specific cost-benefit analyses.

4. Wholly Disproportionate Test

The wholly disproportionate test should apply to all OTC facilities. Additionally, the test should be applied 1) on a facility basis and 2) to all units, not just the repowered units with a heat rate of 8500 BTU or less.

According to State Board staff, the less than 8500 BTU per KWhr criteria for application of the disproportionate test represents the BTU rating generally associated with the efficiency of repowered generating units. By excluding all but repowered units and nuclear plants from the disproportionate test, the State Board has signaled its preference for repowered units and that all conventional fossil units should be eliminated.

Notwithstanding the above argument, at a minimum, the wholly disproportionate test should apply to the entire facility wherever repowering has taken place. Furthermore, the wholly disproportionate test should be available to any facility with a repowered unit regardless of its heat rate. The Harbor Generating Station which was repowered in 1993, reducing the OTC usage by 75 percent, has a heat rate of approximately 9500 BTU per KWHr. This repowered facility, which achieved significant OTC reductions, should not be excluded from the wholly disproportionate test.

5. What Should Constitute "feasible" under Track 1

At the Public Stakeholder meeting on September 16, 2009, the Board requested comments on what factors should be considered to demonstrate Track 1 feasibility. LADWP offers the following suggestions:

- Adequate Space – Whether or not there is adequate space is an important feasibility criterion. The draft Policy suggests a preference for repowering, preferably with dry cooling. LADWP is currently considering cooling towers in the planning of its repowering projects for Haynes and Scattergood. However, LADWP is concerned that there is inadequate space to accommodate the use of Track 1 for all units (ie., future repowering efforts for subsequent units) at these facilities.

The biggest assumption made in the draft Policy for each of the facilities was that adequate square footage would be available to construct the necessary closed-cycle cooling towers. While a paper view of the facility yields sufficient space, a more in depth analysis of each facility indicates severe limitations with finding available space to construct cooling towers without significant facility redesign. In some cases, the space would not be available.

The Tetra Tech publication, "California's Coastal Power Plants: Alternative Cooling System Analysis", conclusions for Harbor generating station rely on the ability to acquire land adjacent to the generating station. The open lot identified in the Tetra Tech report is currently crisscrossed with underground oil transmission pipelines and is located in an area of known port expansion. The ability to purchase this land is questionable. No other area exists on the facility large enough to construct the cooling towers without significant demolition of existing structures and relocation of those processes and activities.

The conclusion for Haynes Generating Station is that a significant portion of the facility currently occupied by out-of-service fuel storage tanks could be used to construct cooling towers for each of the units. This area however, is slated to be the site of the pending repower project for Units 5 and 6. The area will be used to construct new generating units and the air cooling systems for those repowered units. Once these new units are added, the facility property will be fully built out. There will not be any room for retrofitting or repowering Units 1 and 2 without demolishing retired units or common facilities.

The Tetra Tech conclusions for Scattergood were to build cooling towers in two locations that currently contain common critical system structures for the operation of the power plant. The relocation of these facilities is not practical, plus the additional infrastructure associated with the Unit 1 and 2 repowering will consume all currently available space and complicate any future repowering efforts.

- Acquisition of Necessary Permits, Licenses, and Approvals – As noted in the Tetra Tech report on the cost of closed-cycle cooling, the analysis determined that not all facilities were expected to be able to obtain the necessary environmental permits. The inability to acquire the necessary permits due to factors beyond the control of the applicant, such as safety due to proximity to airports, human health, property damage due to salt drift, environmental justice, etc., would reasonably constitute a Track 1 retrofit as being infeasible.

- Engineering Feasibility - The draft Policy has relied heavily on the assumptions and design parameters of the Tetra Tech publication. This paper looked at the technical and logistical feasibility of installing closed-cycle cooling to replace OTC at the power generating facilities. This paper used as a basis for its feasibility, the simple redesign of the facility's cooling systems and not repowering.

From a technical design standpoint, Tetra Tech concluded that a new closed-cycle cooling system could be developed for each of the LADWP facilities, Harbor, Haynes and Scattergood. The design of the closed-cycle system did not really take into consideration the issues surrounding the ancillary problems that such a system would create for each facility. Technically, a closed-cycle system is designable, but practicality dictates that other overarching problems that arise in the system designs need to be solved such as increased air emissions, lower discharge volumes, potentially higher concentrations of known pollutants, additional parasitic load on the system, and greater thermal inefficiency adding to increased reduction in power generation.

- Economic Feasibility – Due to the existing remaining life and current capacity utilization, a generating unit may not be able to bear the cost of a retrofit. As previously mentioned, this was a reason identified by the Second Circuit for rejecting the use of a closed-cycle cooling retrofit. Therefore feasibility from an economic standpoint would be a reasonable criterion.

As mentioned above, feasible constitutes the following:

- Having sufficient space without demolishing existing structures, processes, or common facilities needed for continued plant operation;
- Having the space to site cooling towers away from electrical switchyards where salt water drift, even with the most effective drift eliminators, will settle on sensitive electrical equipment causing an arc and the transmission of energy to fault;
- Having reasonable and adequate access to sufficient reclaimed water sources, including the delivery of such sources to the power plant;
- The ability to successfully obtain the necessary licenses, permits, and approvals; and
- The retrofit is economically cost-effective.

Feasibility should not be identified as simply the ability to design a structure that will meet some predetermined design criteria, but should be based on the ability of that designed structure to seamlessly integrate into the existing plant layout and associated structures.

6. Schedule

LADWP is very concerned with the compliance dates as published in the draft Policy, along with the procedure used to evaluate whether or not these dates can be changed, both in the Policy and in NPDES permits. As noted in the opening comments of this cover letter, LADWP shares the State Board's goal of reducing OTC usage and minimizing impingement and entrainment. However, these goals cannot be accomplished within the timeframe set forth in the draft Policy.

As previously noted, the coastal plants are critical to the reliable supply of energy to the City of Los Angeles. In the 40's and 50's, the Department's generation and transmission system was established and designed to deliver energy from these coastal plants to the City's customers. Later, as the Department began to access resources outside of the city, an external transmission network was constructed to import this energy. These imports enter the system primarily from the northern part of the city. There is very limited capability to upgrade and expand the in-city transmission network in a large metropolitan area such as the City of Los Angeles. Thus, while we can import nearly the entire demand of the city, this power cannot be reliably delivered throughout the city. In order to meet the North American Electric Reliability Corporation's Reliability Standards (as required by FERC), the Department must maintain generation within the city to offload the internal circuits. Current system conditions require at least one Haynes unit and at least one Scattergood unit to be on line 365 days per year.

In addition, these generating units provide dynamic stability by virtue of their rotating mass which is critical to a reliable electric supply. The inertia provided by these units is necessary in order to import large amounts of energy. Along with this is their ability to dynamically respond to voltage deviations and supply voltage support and control.

In-basin generation is also critical to reliable energy supply as the external transmission system is vulnerable to risks such as fire and earthquake. This was clearly demonstrated in our current situation where a transmission line still remains out due to contamination and damage from the "Station Fire."

Another requirement for LADWP's coastal generation is to supply energy during scheduled and forced outages of the transmission system when local needs must be met in part by local generation.

The need for some coastal generation exists year round with higher amounts necessary during high loads and during maintenance periods. Because of this, generation cannot be shutdown for the period of time it would take to remove and replace the generation. Replacement capacity must be made available prior to retiring existing generation.

The dates stipulated in the draft Policy for LADWP's coastal plants, Harbor, Haynes, and Scattergood, are not possible. Two plants cannot have the same compliance date. Since LADWP relies on its own power with its own grid, power must be moved around within its system. For example, if sufficient power is not available from Haynes, replacement power would need to come from Harbor's combined cycle units, including the Unit 5 steam turbine which relies on OTC.

In earlier discussions with State Board staff, and in follow up written communication, it was identified that Haynes may possibly be able to repower Units 5 and 6 by 2013 and with flow reduction technologies be able to meet a 72 percent reduction by 2015. This 72 percent flow reduction, however, would not achieve the current Track 2 compliance standard. Nevertheless, since these initial discussions with State Board staff, the repower has been held up by the lack of emission reduction credits (ERCs) from the SCAQMD, in addition to other delays. LADWP has no current resource forecast plans relative to Units 1 and 2. LADWP will likely retrofit its cooling water intake structure with the best available impingement and entrainment control technology. Pilot tests will be needed to determine the best available technology and its associated performance level. Therefore with this new information LADWP has determined that Haynes will need at least until **9 years** from the date of Policy adoption to fully repower 4 existing generating units.

Contingent upon the availability of ERCs, Scattergood can commence the repowering of Units 1 and 2 upon completion of the Haynes 5 and 6 repowering; however, the retirement of Units 1 and 2 cannot take place until the new repowered units are up and running. Since LADWP has no current resource forecast plans relative to Unit 3, LADWP will likely retrofit its cooling water intake structure with the best available impingement and entrainment control technology. Pilot tests will be needed to determine the best available technology and its associated performance level. LADWP will need at least until **12 years** from the date of Policy adoption for compliance at Scattergood.

Harbor may be able to meet a deadline of **5 years** from the date of Policy adoption. As mentioned earlier, the in-basin plants make up 30 to 35 percent of Los Angeles' power capacity. The dates as stated in the draft policy place LADWP's grid reliability at risk. In order to ensure reliability, and as reflected above, LADWP will need a minimum of 12 years to comply with the provisions of the draft Policy.

LADWP also proposes for the State Board's consideration, an alternative schedule approach to meeting the Track 1 or Track 2 compliance standard. For those facilities that may want to consider totally repowering all the units at a facility in a sequential manner over time, possibly with only cooling towers or a very limited use of OTC, the State Board may want to consider a long compliance glide path with interim milestones dates for flow reduction until full compliance is achieved. In this way, a facility owner need not invest in the installation of IM/E technology that would not be needed at some future date because the facility will have been fully repowered with cooling towers or some minimal flow scenario compliant with the Track 1 standard. Compliance with the interim mitigation measures would still be a requirement.

Finally, the draft Policy states fixed compliance dates for existing power plants. This seems to be in opposition to the statement in the SED (Section 2.4) that further studies would be undertaken by CAISO to help identify a plan for the retirement, retrofit, or repower of these ageing facilities. Furthermore, as previously mentioned, LADWP is its own balancing authority and is not a part of the CAISO. LADWP commits to working with the State Board in providing any further studies regarding LADWP's system and requests, <u>relative to LADWP facilities only</u>, that LADWP be included as a member of the Statewide Advisory Committee on Cooling Water Intake Structures (Committee).

<u>Committee Schedule</u>

LADWP is also concerned about the frequency with which the Committee meets, namely, once every two years. LADWP believes that obstacles and changing energy supply and transmission scenarios will arise on a dynamic basis and the state needs to be in a position to rapidly respond to these changes. LADWP believes that meeting every two years is not frequent enough to address the needs of both the Regional Board and the power plants. For example, if the Committee just met six months ago but new information has come to light that significantly impacts the schedule such that the Committee revises its recommendation to the Regional Board, both the Regional Board and permittee should not be held in a state of limbo for 18 months not knowing whether the State Board concurs with the revised schedule recommendation. In this example, the facility would not know for 18 months whether the Committee recommendation will be accepted. This could create project planning delays, affect construction contract bids and negotiations, construction schedules, and uncertainty for the CAISO as to whether or which plants can be retrofitted, repowered or replaced before another plant. A more fluid process is needed. LADWP recommends that the Committee meet quarterly with semi-annual recommendations to the State Board. If the Regional Board requests and the Committee concurs; the State Board should be able to change the policy at any time. Contrary to the concerns expressed by the State Board members at the September 16th hearing, the entire Policy need not be subject to any revisions, only the stated compliance dates.

The Committee also needs to broaden its focus and examine the need for any schedule adjustments to allow for obtaining environmental permits, licenses, and approvals where delays have occurred through no fault of the power plant owner. LADWP also believes that the Committee needs a member with a background in construction engineering to provide this added and important perspective to Committee discussions and decisions.

The draft Policy as written does not allow for the flexibility of the Regional Board to open a permit to change a compliance date when needed. The Regional Board should be able to open the permit for interim dates leading to final compliance dates themselves.

In closing, LADWP provides the following recommendations and changes to the draft Policy:

- Eliminate the requirement to protect zooplankton. Currently there is no data or information provided to indicate zooplankton suffer mortality as a result of entrainment. Further, due to the short life cycle and rapid reproduction of these organisms significant impacts are unlikely to occur. Making this change to the Policy will create a viable Track 2 option. To achieve Track 2 compliance, zooplankton would have to be protected at the expense of fish and shellfish eggs and larvae which would become impingeable on the 200 micron screens.
- Allow the use of the wholly disproportionate cost-benefit test regardless of heat rate and allow it to be applied on a facility basis.
- Modify the compliance dates to reflect from date of Policy adoption.
- Allow for a more fluid and flexible process for the Committee to meet in order to review constantly changing information and recommend compliance date changes. Beginning in 2012, LADWP recommends that the Committee meet quarterly and report to the State Board semi-annually. Also allow for a better integration of the Regional Boards with the change of dates so modifications can be made to the NPDES permits without delays.

- Increase membership in the Committee to include a representative from LADWP for only those discussions that pertain to LADWP and a representative from the construction engineering industry who can bring an important and added perspective to the Committee.
- Provide an additional compliance path whereby if utilities opt for repowering with closed cycle cooling rather than impingement and entrainment control technology retrofits and/or operational measures, they can have an extended schedule with milestone dates and increasing flow reductions until Track 1 levels are achieved.
  In the interim, allow for mitigation until compliance is achieved; and/or,
- Provide a "staged" approach to compliance, i.e., rather than a final milestone deadline for a facility's compliance, define interim milestones with interim reductions.

LADWP appreciates the opportunity to provide the above comments and recommendations and looks forward to working with the State Board in developing a final OTC Policy. Additional specific comments regarding the draft Policy for your consideration are enclosed (Enclosures 1 and 2).

If you have any questions with these comments, please feel free to contact Ms. Susan Damron of the Legislative and Regulatory Affairs Office or Ms. Katherine Rubin of the Environmental Affairs Division at (213) 367-0279 or (213) 367-0436, respectively.

Sincerely,

Aram Benyamin
Senior Assistant General Manager
Power System

Sincerely,

Mark J. Sedlacek
Director of Environmental Services

KR:rp
Enclosures
c: Mr. Charles R. Hoppin, State Water Resources Control Board (SWRCB)
Ms. Fran Spivey Weber, SWRCB
Ms. Tam Dudoc, SWRCB
Mr. Arthur Baggett, SWRCB
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Mr. Dominic Gregorio, SWRCB
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Ms. Katherine Rubin, LADWP

Los Angeles Department of Water and Power (LADWP) Specific Comments on the Draft Policy and Supplemental Environmental Document (SED)

1. Prior Technology Installations, draft Policy Page 10, Section 4.B.

Consistent with draft Policy language on page 3, Section 2.a.2 and with previous discussions with State Water Resources Control Board (State Board) staff, including the meeting on September 8, LADWP understands that "technology based improvements that are specifically designed to reduce impingement mortality and/or entrainment and were implemented prior to the effective date of the Policy may be counted towards meeting Track 2 requirements". It is further LADWP's understanding that technology based improvements, such as previous repowerings, will count towards compliance. Therefore, this intent should be carried throughout the language in the Policy.

LADWP suggests that the wording in paragraph B. on Page 10 be consistent with this intent and be re-worded as follows:

"...Track 2, as well as, any ~~recent~~ technology-based improvements that are specifically designed to reduce impingement mortality and/or entrainment and were implemented prior to the effective date of the Policy."

2. Interim Mitigation, draft Policy, Page 4, Section 2. C(2) and Definition of "Power Generating Activities", Page 12.

The draft Policy needs to clarify the phrase "critical system maintenance" and "not directly engaged in power generating activities". Page 39 of the SED, Section 2.5 - Cooling Water Flows, points out that older units may run on "hot standby" status. However, "hot standby status" is an instance where circulating water is necessary but the unit is "not directly engaged in power generating activities". This is an example of when it is not feasible to cease cooling water flow when electricity is not being generated.

The SED, page 75, Section 3.12, on incidental cooling water indicates that a 90% reduction in cooling water is necessary when the plant is not engaged in power production activities. There is no technical basis to support this reduction as reasonable or achievable. While there is an exemption via a demonstration, it is based on flows necessary for safe operation. This demonstration allowance should also include flows necessary to protect plant equipment.

The definition of Power-generating Activities on page 12 of the draft Policy should be modified to include operational maintenance activities that are imperative to protect the integrity of the plant. These operations include keeping the circulating water pumps on to prevent biofouling and/or obstruction of the condenser tubes by fouling organisms.

3. Implementation Plan, draft Policy Page 5.

The draft Policy calls for the submittal of Implementation Plans from all 19 facilities within six months of the effective date of the Policy. It is LADWP's understanding that the Implementation Plan is conceptual in nature in order for the Committee to have some sense of the facility's compliance pathway and to begin assessing the viability of the compliance dates in the state Policy. It is important that revisions to the conceptual Implementation Plan and their resubmittal to the Regional Board be allowed whenever new or updated information presents itself. Otherwise the six months as stipulated in the draft Policy is not a reasonable time period. At least two years would be necessary to completely develop an Implementation Plan in light of the many biological, engineering, and technical areas of concern when looking at a complex facility such as a power plant. The expenditure of hundreds of millions of dollars may hinge on the contents of this Implementation Plan, and each plant should be afforded the necessary time to properly prepare and look at all options to determine the best path to compliance. Biological and engineering pilot studies, as well as any economic analyses, would need to be conducted in order to support detailed resource and project planning requirements and to properly inform LADWP management for their selection of the appropriate compliance pathway at each facility.

Furthermore, should these Implementation Plans be detailed and not conceptual in nature, LADWP has concerns regarding the ability of the Statewide Advisory Committee on Cooling Water Intake Structures (Committee) to initially review and comment on 19 Implementation Plans within the scheduled six month window as outlined in the Policy. In order for the Committee to be able to review all 19 plans, more time may be needed.

4. Committee Composition, draft Policy Page 2

The membership representation for the Committee should be expanded to include a representative from the LADWP for any discussions relative to <u>only</u> LADWP facilities. LADWP is a vertically integrated utility which manages its own generation, transmission and distribution systems. As its own balancing authority, LADWP is not subject to the resource and transmission planning oversight of the Energy Commission or the CAISO and as such, is not subject to direction from those organizations. LADWP should be allowed to inform the Committee on all matters pertaining the control and operation of LADWP's transmission system and generation at the coastal facilities. None of the other Committee members would be able to address LADWP's system.

Committee composition should also consider including the local air districts, such as the South Coast Air Quality Management District (SCAQMD). Since the draft Policy's proposed schedules will be greatly impacted by the policies and the availability of emission reduction credits within their district, SCAQMD's input and voice would be a valuable addition to the Committee and should be considered.

Lastly, the Committee may benefit from the ability to have construction expertise specifically related to power plants (e.g., repowering construction, cooling tower construction, etc.) and may want to consider adding such knowledge base to inform the Committee.

5. Track 2 Monitoring Provisions, draft Policy Page 11

Baseline

More certainty is needed in the draft Policy language that the Phase II Rule impingement (IM) and entrainment (E) characterization studies previously approved by the Regional Board and conducted by facility owners are still valid if no major facility changes or source water changes have occurred. In addition, zooplankton monitoring and its definition should be removed from the draft Policy.

The draft Policy as currently written would require a baseline IM/E study unless the discharger demonstrates that any prior study is acceptable to the Regional Board. LADWP believes that greater certainty should be provided that these comprehensive, year-long IM/E studies conducted in order to comply with the 2004 Federal Rule should be used as an acceptable baseline. Accordingly, LADWP recommends that the draft Policy language be modified in both the impingement and the entrainment monitoring sections as follows:

> "The prior baseline IM/E study, approved by the respective Regional Boards in fulfillment of the federal Phase II 316(b) Rule, shall suffice in lieu of conducting a new baseline study unless the Regional Board deems the study unsatisfactory and provides specific modifications that are necessary."

Zooplankton

Entrainment monitoring in the draft Policy requires that zooplankton be included in the sampling efforts. Zooplankton biomass will numerically dominate any baseline entrainment sampling due to their vast population in the source waters. Therefore, installing control technology that focuses on zooplankton protection will cause other organisms larger than 200 microns, such as many fragile soft-bodied fish eggs and ichthyoplankton larvae, to become impingeable organisms and their corresponding survivability drops, perhaps to zero. This would imply that it is more important to protect zooplankton than fish and shellfish eggs and larvae.

State and federal agencies, as well as other researchers, understand that there is little need to protect or monitor zooplankton populations. These populations are generally not sampled due to their small individual size, their large population sizes, and their rapid growth and reproduction. Additionally, these often hard bodied organisms can survive passage through a power plant cooling system with minimal mortality [See Enclosure 2, Issue 6]. Lastly, the recently completed IM/E characterization studies utilized a net size larger than 200 microns. A 333 micron mesh entrainment sampling net is considered the standard sampling protocol. A change in the net size could compromise the year-long data set of information.

For the reasons stated above, LADWP suggests that the IM/E studies performed in 2006 be acceptable in order to provide baseline information for the facility as long as there have been no facility modifications and there is no evidence that the source water has changed. LADWP also suggests that the need to sample and monitor for zooplankton and its definition be removed from the draft policy. This removal recommendation is also consistent with LADWP's comments regarding the need for a viable Track 2 compliance mechanism.

6. Track 2, Policy Page 3

a. Viability of Track 2 Compliance

LADWP is concerned that due to the Track 2 requirement, namely to include zooplankton protection, this option is not viable. Retrofits with wet closed-cycle cooling are also likely to not be viable due to the age, current capacity utilization and urban/suburban locations of our affected units. If the facility has not undertaken, or is unable to undertake repowering, this would leave the facility with no reasonably foreseeable means of compliance and it would have to shut down.

Section 4.1 of the SED lists the "reasonably foreseeable means of compliance" that were evaluated by the State Board staff. Ten IM/E control technology alternatives are listed and discussed in this section. Two of the ten alternatives were wet closed-cycle cooling and closed-cycle dry cooling. Wet closed-cycle cooling is the Track 1 technology and dry cooling is recognized as not viable for retrofits. If cooling towers are infeasible, this leaves eight alternatives for Track 2.

In order to achieve a level of compliance comparable to Track 1 (i.e. within 10%), facilities must be able to significantly reduce both impingement and entrainment. The major difficulty is in reducing entrainment, as opposed to impingement, comparable to Track 1. Two of the technologies (velocity caps and barrier nets) are only effective for reducing impingeable sized organisms and provide little, if any, benefit for entrainable life stages, thus leaving six Track 2 technologies for entrainment.

Three of these technologies (aquatic filter barriers, fine mesh cylindrical wedgewire screens and finemesh traveling screens rely on screening to either exclude entrainable organisms or collect and return them to the source waterbody. Since the draft Policy requires protection of zooplankton 200 microns (i.e. 0.2 mm) in size, none of these three technologies will be able to achieve a level of protection equivalent to Track 1. A screen mesh size of 0.5 mm (i.e. 500 microns) is the smallest size considered practical due to biofouling and debris conditions in the Pacific marine environments. The Electric Power Research Institute (EPRI) is aware of no studies or deployments of 200 micron screening technologies. The smallest mesh size evaluated by EPA in the Phase II Rule was 0.76 mm. Additional comments on zooplankton protection requirements are provided in the biological section of these comments (Enclosure 2, Issue 6), expected benefit of protecting zooplankton).

Notwithstanding the above discussion, a number of unknowns remain relative to the actual performance of the control technology (i.e., the percent IM/E reduction that can actually be achieved) and the survival level of eggs and larvae returned to an "unaffected" source waterbody via piping returns over a considerable distance (applicable to all LADWP facilities). Pilot studies, which have yet to be performed, would provide this information and a clearer picture on whether, and to what extent, Track 2 compliance can be achieved.

Two of the remaining three alternatives rely on flow reductions and the third is based on a change in the intake location. The two flow reduction alternatives are reduced use of cooling water pumps and variable frequency drives. They are both based on the same principle, flow reduction, with the difference being that variable speed drives provide a finer level of flow control than turning off a cooling water pump. The problem with this option is that reducing flow directly limits the ability of LADWP's facilities to generate electric power, especially during the period of summer peak power demand when generation from these units is most needed. Use of these options is further complicated by Track 2 monitoring requirements that are discussed in more detail on the specific reasonably foreseen alternatives below and in Attachment 1. Additionally, while LADWP will be considering the use of variable speed drives to achieve further impact reductions, the use of this technology alone will not achieve compliance with the Track 2 standard. The final entrainment reduction option, change in intake location, is not expected to result in a significant entrainment reduction. The result is that there is no viable Track 2 alternative for LADWP's three affected facilities under the policy as currently written.

As noted above, Section 4.1 of the draft SED presents ten reasonably foreseeable compliance alternatives; however, the additional reasonably foreseeable alternatives of re-powering and/or replacing existing units with new units is not discussed or evaluated. While the Policy itself, in the Introduction Sections H and J, makes direct reference to expectations for repowering or unit replacement and the draft Policy outcomes are discussed extensively in Appendix C, Joint Proposal of Energy Agencies (July 22, 2009) of the draft SED, there is no discussion within the body of the SED on these alternatives. Additionally, in Section 3.11 of the draft SED on the question of "Should the Proposed Policy Include a Statewide Compliance Schedule", three alternatives were considered. The third alternative, the Staff recommended Alternative 3, "recognizes the likelihood that many fossil-fueled units will achieve compliance through retirement, re-powering, or infrastructure upgrades". LADWP expects that these options would play a role in its own compliance strategy. Therefore, the draft SED should include consideration of these options in the list of reasonably foreseeable means of compliance. These alternatives have the potential to pose environmental and reliability issues not addressed in the current draft SED impact analysis.

A few examples of important considerations relative to the repowering and/or replacement alternatives not currently considered in the draft SED include:

Energy Supply Impacts – The SED needs to consider a number of energy supply impacts. First, a number of existing facilities may have the ability to continue to generate electric power during construction of a wet closed-cycle cooling system, such that system tie-in with the unit could be accomplished during a scheduled routine outage or in a relatively short amount of time. However, in some circumstances, in order to provide construction space for new units with closed-cycle cooling, demolition and removal of existing generating units is necessary. Under these circumstances, a significant amount of time will occur and the need for replacement generation will be necessary. This generation down time could add one to several years to the period when no generation would be available from the replacement units. Second, significantly more space is required for new combined cycle units with closed-cycle cooling (especially dry cooling) than for retrofitting an existing unit with closed-cycle cooling. The result being that a facility may not have adequate space to repower and/or replace existing units with closed-cycle cooling **and** maintain the necessary generation level equivalent to the existing facility. Third, due to the lead time required for permitting an entire new facility, including the timeframe for demolition, initiating projects earlier could be required. This early initiation could result in an increased risk of short-term energy supply since such capacity reductions would occur earlier and last longer than the wet closed-cycle cooling retrofits contemplated in the draft Policy.

Cost of Repowering and/or Replacement – In evaluating the cost of compliance to affected OTC facility owners and rate payers, the current draft SED analysis is limited to providing the cost of wet closed-cycle cooling retrofits. The cost of OTC unit repowering and/or replacement with dry closed-cycle cooling was not evaluated and that cost could be significantly different than a wet closed-cycle cooling retrofit. From the standpoint of the facility owner, the cost associated with the lost revenue during the extended outage as a result of demolition and the new unit construction cost does not appear to be considered. There are also higher costs associated with dry cooling due to the decrease in generation efficiency that are not currently considered.

Environmental Impacts of Repowering and/or Replacement – Section 4.2 of the SED provides a discussion of the environmental impacts associated with wet closed-cycle cooling. The draft SED states that environmental impacts of dry cooling were not evaluated since dry cooling is not considered a viable option for existing units; however, dry cooling is identified as a preferred technology for new or repowered units (last paragraph 4.1.2). Given that repowering and replacement has been selected, and is likely to continue to be selected for a number of OTC units (including some LADWP units), it would seem important to discuss the environmental impacts associated with these draft Policy outcomes. While dry cooling does eliminate cooling water impingement and entrainment impacts, there are environmental impacts that should be addressed, such as additional space, more noise, aesthetics, and increased air emissions resulting from decreased generation efficiency. Another environmental impact for unit replacement is the solid waste generated due to demolition of units replaced.

Specific Technical Comments on the Alternative Fish Protection Technologies Discussed in Sections 4.1.3 through 4.1.10

LADWP had EPRI review the reasonably foreseeable alternative fish protection technologies and operational measures discussed in Sections 4.1.3 through 4.1.10 of the draft SED. EPRI has played a leadership role on behalf of the electric power industry in conducting research on the feasibility, cost and performance of these technologies. EPRI offered a number of technical comments to improve the accuracy and completeness of the discussion of these alternatives in the draft Policy. Please refer to Attachment 1.

b. Track 2 Compliance Assessment

LADWP believes that assessing Track 2 compliance, namely the percent reduction in impingement and entrainment from the baseline, should be evaluated over the span of one full year or over the permit term. Additionally, compliance should be assessed on a facility basis rather than on a unit by unit basis.

7. Track 1 Compliance, Policy Page 3

a. Compliance on unit basis versus Cooling Water Intake Structure (CWIS)

Compliance for Track 1 should be based on each CWIS and not on a unit by unit basis. If the goal of the draft Policy is a 93% flow reduction in order to achieve an IM & E reduction, it does not make any difference if the end result is based on a unit by unit basis or whether it is on a CWIS basis. A 93% reduction achieved unit by unit or as a facility in total would still be a 93% reduction. CWIS reduction would allow for better and more cost effective planning and flexibility in meeting the compliance goals without changing the end result.

b. Replacement versus repower of an existing facility, CCC as BTA

In the SED, Page 60, it states as an example of compliance under Alternative 1, a facility repowered with dry cooling. It appears that the State Board is presuming power plant replacement is a form of BTA technology for use on an existing facility. Replacement or repowering of a unit is not a form of BTA.

c. Basis for 93% intake flow reduction requirement

During a power plants initial design phase there is an option to use a condenser cooling system that either uses a relatively larger amount of what with a lower thermally heated effluent or one that uses less water that results in a hotter thermal discharge. Facilities that are designed to use less cooling water may not be able to achieve a 93% reduction in cooling water flow under Track 1. A case in point is LADWP's Scattergood facility where it is estimated the expected reduction in flow under Track 1 would be less than 93%.

Sub-paragraph (1) "Track 1" I Paragraph A "Compliance Alternatives" in Section 2 "Requirements for Existing Power Plants" requires a reduction in "intake flow at each unit, at a minimum, to a level commensurate with that which can be attained by a closed-cycle wet cooling system." It further states "A minimum 93 percent reduction in intake flow rate for each unit is required for Track 1 compliance...".

The water use requirement for a closed-cycle cooling system is the sum of the water evaporated, the water discharged from the cooling system as "blowdown" and the drift from the cooling tower.

- The quantity of drift is negligible compared to the total.
- The amount of blowdown is set as a fraction of the make-up flow to maintain the concentration of dissolved solids in the water at an acceptable level. For a system using seawater with a nominal salinity of 35,000 parts per million (ppm) as make-up, the blowdown is typically set to maintain the salinity of the circulating cooling water at approximately 50,000 ppm. This corresponds to a "cycles of concentration" (n) of 1.43 (= 50,000/35,000). This requires a make-up flow to the closed-cycle cooling system of x 3.33 times ($n/(n-1) = 1.43/(1.43-1) = 3.33$) the evaporation rate. Lower blowdown rates will lead to higher salinity in the circulating water with possible adverse consequences to the materials of construction of the cooling tower and condenser.
- The amount of water evaporated is a function of the heat load on the cooling system.

Consider the following assumptions:

1. The circulating water flow rate for the closed-cycle cooling system is the same as it was for the once-through system in order to preserve the use of the existing condenser and the circulating water pumps.

2. The heat load on the condenser with the closed-cycle cooling system is approximately 4% greater per megawatt of net plant sendout than it was with the once-through cooling system. This is a result of both increased operating power requirements and slightly reduced annual average plant efficiency.

3. The evaporation rate from the cooling tower is approximately 1% of the circulating water for each 10 °F of cooling. For a fixed heat duty, the circulating water flow and the cooling water temperature rise are inversely proportional to each other and the evaporation rate is fixed for a fixed heat duty.

   Therefore, the evaporation rate and the required make-up flow can be estimated for each unit based on the design heat duty, the cooling water flow and the cooing water temperature rise for the original once-through cooling system and the assumptions listed above.

There is no way to modify or redesign a closed-cycle system to reduce the amount of water evaporated for a given heat load other than to use some type of hybrid cooling where a fraction of the load is carried by an air-cooled heat exchanger. This would significantly increase the cost, the space required, the operating power required and the duration of the outage to accomplish the retrofit required to site the cooling equipment in order to achieve a minimal reduction in the total withdrawal to meet an arbitrarily set "% reduction" of 93%.

d. Closed Cycle Cooling as BTA

Currently the draft Policy requires closed cycle cooling or its equivalent as the BTA. The SED is insufficient in its analysis of concluding that closed cycle cooling is BTA. In its analysis of whether or not the industry could bear the cost, the document only considered the cost of wet closed cycle cooling. It did not consider bearing the cost of repowering with dry cooling. In addition, the analysis lacks a complete assessment of the environmental impacts associated with closed cycle cooling, leaving out pertinent impacts such as drift, noise, PM10, GHGs, etc. Also, the SED lacks a system-wide cost benefit analysis that would demonstrate closed cycle cooling as BTA. LADWP believes that a system-wide cost benefit analysis should include the following costs: the plant modifications necessary to meet AB 32 climate change requirements; renewable development; transmission line upgrades; retrofit and/or repower costs, etc. Without this type of analysis, the draft Policy may be requiring actions that are unreasonably costly when compared to the benefits.

8. Wholly Disproportionate Demonstration, draft Policy Page 9

a. Application to all units

The wholly disproportionate test needs to apply to 1) the facility as a whole and 2) to all units, not just repowered units with a heat rate of 8500 BTU or less. According to State Board staff, the less than 8500 BTU per KWhr criteria for application of the disproportionate test represents the BTU rating generally associated with the efficiency of repowered generating units. LADWP repowered its Harbor Generating Station, the result of this repower was a 75% flow reduction of OTC. The unit heat rate is approximately 9500 BTU per KWHr. This repowered facility, with a clearly significant OTC reduction, should not be precluded from the wholly disproportionate test.

At a minimum, the wholly disproportionate test should apply to the entire facility wherever repowering has taken place. Furthermore, the wholly disproportionate test should be available to any facility with a repowered unit regardless its heat rate.

b. Basis for Unit Cost

The Policy text specifies that the cost of compliance should be compared to the dollars per megawatt hour of electrical energy produced over an amortization period of twenty years. The basis for this cost metric and its comparison to the benefits methodology is not spelled out or substantiated. Additionally, as footnoted in the Cover Letter, NERA has provided both a cost-benefit analysis of the Policy itself and has provided suggested guidance on how to conduct site-specific cost-benefit analysis.

c. Habitat Production Forgone

Use of the Habitat Production Forgone methodology is problematic when used for fish populations that do not have any specific habitat in the source water, such as northern anchovy and pacific sardines. (See Enclosure 2, Issue 3.12) These species release their eggs into the water column which are then transported into embayments, even though their primary habitat for these types of fish is in coastal areas. Therefore, this type of methodology is not appropriate for all facilities, particularly open ocean offshore intakes. LADWP would support the "other" methods approved by the Regional Board as a measure of environmental benefit.

d. Temperature Requirement

Discharge temperature is already regulated by the California Thermal Plan and Ocean Plan. These state plans address the protection of beneficial uses in the receiving waters from thermal impacts. LADWP believes that the OTC Policy should restrict its regulation to only the impacts associated with cooling water intakes issue and leave the handling of any potential thermal issue to the state's two existing policy documents. In particular, LADWP does not believe that thermal issues should be a component in a wholly disproportionate test that is intended to examine the costs and benefits of a CWIS's best available control technology. LADWP believes that this requirement should be removed.

9. Environmental and Social Impacts

The Environmental and Social impacts of the draft Policy need to be fully evaluated and not just at a facility or regional level. This needs to be a high level review to see how the proposed draft Policy will impact these issues on a wide ranging basis. The following issues need to be considered in evaluating the draft Policy:

a. Environmental Impacts of Other Reasonably Foreseen Technologies

In Section 4.2 of the draft SED, Page 93, in the third paragraph it states, "Staff did not identify any potential impacts for alternative technologies and operational measures (fine mesh screens, barrier nets, fish return systems, wedgewire screens, velocity caps, offshore intakes, variable speed pumps and seasonal operation). These technologies, if effective at a particular location, can be implemented without any adverse impacts." While they may not be as significant as impacts associated with wet or dry closed-cycle cooling, there are potential environmental and/or social impacts associated with some of the alternative technologies. An analysis of these impacts should be included in the SED. A listing of potential impacts for these technologies includes:

- **AFB** – Because an AFB requires a relatively large surface area in order to provide sufficient cooling water flow at a low through screen velocity to protect fish, the length of the AFB may be relatively extensive, especially in areas where depths tend to be limited which is the case for most of the inshore intakes that might use this option. Deployment of the net can result in entrapment of some fish and loss of aquatic habitat for organisms behind the net. There is also potential impairment of boat transportation in navigable waterways. However, if this impact is significant the AFB construction permits would not likely be granted. This would be expected to be the case for all of LADWP's facilities.
- **Barrier Net** – This technology presents the same problems as the AFB, however to a lesser extent, since the surface area and length of a barrier net for impingement is smaller.
- **Intake Relocation** – For all once through cooling facilities in California, to relocate the intake to a location that would significantly reduce impingement and entrainment means relocating the intake further off shore. Extending the intake offshore would probably require dredging for a least a portion of the pipe run. Two resulting impacts are either short term construction impacts as a result of dredging and/or the longer term loss of benthic habitat if the pipe or intake tunnel is laid on the bottom.
- **Narrow Slot Cylindrical Wedgewire Screens** – At LADWP's Scattergood Station, use of narrow slot cylindrical wedgewire screens would require placing screen modules in some type of array offshore on the ocean bottom. Because

the distance from the shoreline is too far to allow use of the on-shore compressed air tanks, which remove debris from the modules, it is anticipated that some type of offshore platform would be required for maintenance of the screen modules and the compressed air tanks. Such a platform would be not unlike offshore oil platforms that can be found along the coast. Various environmental permits and approvals would be required to address: (1) dredging to install such platforms and run piping to the modules; (2) potential water navigation concerns; and (3) aesthetics. This would be especially true due to the dense population in areas where LADWP's facilities are located.

Use of any of the options above would require environmental permits, licenses, or approvals that provide further evidence that some level of environmental impact would occur.

b. Wastewater Use Impacts

The draft Policy on page 5, at 3.A.2, states that "If the owner or operator selects closed-cycle wet cooling as a compliance alternative, the owner or operator shall address in the implementation plan whether recycled water of suitable quality is available for use as makeup water". Use of wastewater from a wastewater treatment facility would require the installation of piping to transport the wastewater from the treatment facility to the power plant. A wastewater return piping system may also be required, since the facility would not likely have the treatment system necessary to treat such wastewater prior to discharge. Depending on the location of the facility and the wastewater source, there are a number of potential environmental issues associated with right-of-way construction that could result from pipeline installation. While the draft SED is not required to evaluate project level impacts, the draft SED should acknowledge that these impacts could occur. Additionally, while LADWP's Scattergood Generating Station is located immediately adjacent to a wastewater treatment facility (Hyperion) this is not the case for LADWP's other affected generating stations. Identification of the potential impacts in the draft SED was not discussed. Staff needs to qualitatively acknowledge the potential for such impacts as a result of the draft Policy.

Furthermore, as California's drought worsens and water providers look increasingly to water recycling as a major source of water supply, the state must consider the highest and best use of this resource. The draft Policy and draft SED should address this issue.

c. Cumulative Environmental Impacts

Section 4.12 summarizes California's CEQA Guidelines for determining whether or not a policy will result in cumulative environmental impacts. The text points out, "The cumulative impact analysis need not be performed at the same level of detail as a "project level" analysis but must be sufficient to disclose potential combined effects that could constitute a significant adverse impact." The section concludes with a determination that "Implementation of the proposed Policy will not result in cumulative impacts."

Specific impacts discussed in the Draft Policy include:

- Decreased power generation and a reduced power reserve margin in California resulting from:
  - expected retirement of some units
  - expected repowering and/or replacement of some units
  - the energy penalty associated with wet closed-cycle cooling of some retrofits and dry cooling associated with repowering and/or replacement of other units.
- Concerns for transmission adequacy and security:
  - expected need for transmission upgrades in some areas
  - uncertainty regarding which facilities would be retired, retrofitted, repowered or replaced and the schedule needed to accommodate the selection.
- Environmental impacts associated with:
  - CO_2 increase due to:
    - Outages and inefficiencies of nuclear facility retrofits
    - Inefficiencies associated with retrofits and repowering with closed-cycle cooling.
  - wet closed-cycle cooling retrofit environmental impacts discussed in Section 4.2 of the Draft SED
  - dry cooling (identified in the Draft SED as the preferred technology for new generation) environmental impacts (not yet discussed) resulting from some repowered units
  - impacts associated with some alternative fish protection technologies that may be selected (not yet discussed)
  - Impacts associated with new transmission lines or upgrades

- o Right-of-way impacts associated with use of wastewater for cooling tower make-up water (not yet discussed).
- o solid waste generated by demolition of retired or replaced units
- o potential need for additional generation at greenfield sites due to inefficiency of closed-cycle cooling for retrofitted, repowered or replaced units; inadequate space for equivalent replacement generation at some sites or abandoned existing sites.

It is not clear how this list of draft Policy impacts, most of which are discussed in the draft SED for the 19 affected facilities, does not have the potential to result in cumulative impacts. The basis of this conclusion seems to contradict the rest of the information discussed in the document. Furthermore, as noted in the enclosed biological comments (Enclosure 2, Issue 1), climate change impacts are thought to contribute to the oceanic warming that has been observed off the coast of California for the last several decades. The CO_2 impacts associated with the Track 1 BTA, namely cooling towers, would represent a serious long-term cumulative impact that should be addressed in the draft SED. It is hard to imagine that a Policy that could result in premature retirements of major generating facilities/units, a 5% increase in greenhouse gas emissions, increases in other air pollutants, potential impacts to energy supply in the state, the need to upgrade transmission systems, the need to construct new generation to offset unit retirements or efficiency reductions would not be considered to result in long term cumulative impacts.

10. U.S. Environmental Protection Agency New Phase II/III Rule

Section 3.1 provides the basis for needing the draft Policy and indicates a lack of progress from the USEPA on providing follow up to the vacated Phase II/III policies. Based on meetings with USEPA, LADWP was told that they have a budget and staff working on a draft Rule that will encompass both Phase II and Phase III into a single Rule. They plan to release the draft Rule in the Fall of 2010. The final rule would then be scheduled to be released approximately one year after the draft is released, sometime in late 2011 or early 2012. It is incorrect that Rule litigation would extend the time frame for Rule compliance (i.e. the litigation of the prior Phase II Rule did not stop the implementation of that Rule). The State Board's claim that they are further along than the USEPA on this issue is only because it is bypassing any real evaluation of the recent data from the IM/E characterization studies, any consideration of draft Policy's overall benefit to the state, a comprehensive analysis of the actual performance associated with the alternative fish protection technologies, and through analysis of the economic issues involved. The draft Policy asserts that the current use of Best Professional Judgment (BPJ) is costly. However, the State Board has not indicated what that cost will be or why the approach of the draft Policy is more efficient. Threatened and Endangered species that may be affected by current OTC facilities are being dealt with by the US Fish and Wildlife Service.

Detail Comments:

1. Table 20, page 83 of the SED

This Table should have an additional column added for Total Dissolved Solids (TDS). Since some of the facilities are brine, some are treated wastewater, some are saltwater, therefore need TDS to get the proper picture

2. Air Issues

Section 2.6, Table 7, Baseline Air Emissions – Criteria Pollutants: This section consists only of Table 7 which indicates the air emissions from fossil units. There is no text associated with this section to explain its significance or why it is in the report. It is not clear what this section has to do with the draft Policy.

Section 2.7, Table 8: This section consists of a table of CO_2 emissions from fossil units. There is a short paragraph on methane gases and CO_2. It is not clear what this Section has to do with the draft Policy. The link between this table and the draft Policy should be provided.

Section 2.7.1 and Table 9: This section consists of Table 9 and a short paragraph on combined cycle units. It is not clear what this Section has to do with the draft Policy. The text should connect this Section to the draft Policy.

3. SED Section 3.6, Page 58, 2nd full paragraph:

The text confuses the 0.5 Feet Per Second (fps) flow rate and the design velocity by stating that fish can detect and avoid flows greater than 0.5 fps. This is not the case. Fish are not able to detect flows of 0.5 fps.

4. Table Flows – Table 2 – Estimated Annual Entrainment and Table 3 – Estimated Annual Impingement, SED Pages 31/32, Tables 2&3

The design flow for Haynes is listed as 968 million gallons per day (mgd). This value should be changed to 863 mgd based on current plant configuration.

A note regarding the Haynes flows during the 2000-2005 time period. This period included the repowering of Units 3 & 4. Consequently, during this time, the cooling water flows for these units was significantly reduced. Flow rates have subsequently rebounded since the startup of the new combined cycle units. Any analysis or calculations performed relative to the use flow data between 2000 and 2005 should be altered accordingly.

5.Table 4, California OTC Power Plants, SED pages 34/35

The flow for Haynes Generating Station is listed at 968 mgd. This value should be changed to 863 mgd based on current plant conditions.

6.SED Figure 11, Figure 11 – Average Cooling Water Flow: Power Generation Ratios for OTC Power Plants, page 38

The listed input of Haynes 9&10 should be corrected to read Haynes Unit 8. Figure 11 and other references throughout the draft SED document should correct the reference to Haynes Units 9 & 10 and replace it with Haynes Unit 8. Unit 8 is the steam turbine of the combined cycle system which uses the OTC. Units 9 and 10 do not use OTC.

8. SED page 39, Table 6, Table 6 – Monthly Median Cooling Water Flows

The listed input of Haynes Units 9 & 10 should be corrected to read Haynes Unit 8.

9. SED Page 68, Table 14, Table 14 – Reclaimed Water Sources

The Haynes Design Intake Capacity is listed as 858 mgd. This should be corrected to 863 mgd to be consistent with the rest of the document.

The Harbor Design Intake Capacity is listed as 81 mgd. This should be corrected to 108 mgd to be consistent with the rest of the document.

Specific Technical Comments on the Alternative Fish Protection Technologies Discussed in Sections 4.1.3 through 4.1.10

LADWP had the Electric Power Research Institute (EPRI) review the reasonably foreseeable alternative fish protection technologies and operational measures discussed in Sections 4.1.3 through 4.1.10 of the Draft SED. EPRI has played a leadership role on behalf of the electric power industry in conducting research on the feasibility, cost, and performance of these technologies. EPRI offered a number of technical comments to improve the accuracy and completeness of the discussion of these alternatives in the draft Policy.

- **General** – In Section 4.1 on page 85, the text lists impingement mortality and entrainment technologies grouped into categories based on their function. Intake relocation is listed as an operational modification. Operational modifications are those changes that can be made without a significant change to the cooling water intake structure design, for example, rotating the traveling screens more frequently to return impinged organisms to the water or reducing the use of cooling water pumps. Changing the intake location is a significant cooling water intake structure design change. EPRI suggests listing the change in intake location in a separate category. It is further recommended that seasonal operation, also listed as an operational change, be listed under flow reduction since that is the major mode of operation for this alternative.

- **4.1.3 Barrier Nets** – Barrier nets use "mesh" rather than "slot size" as mentioned in the first paragraph. Slot size is a term used for cylindrical wedgewire screens. EPRI has conducted specific research on this technology and published a report on over a dozen existing barrier net deployments, as well as a design manual for barrier nets. The existing barrier net deployments and recommended mesh size is ¼ inch. This is slightly smaller than the 3/8 in mesh screen size used for the majority of cooling water intake structures and therefore excludes all impingeable sized organisms. The basis for the reference to the "relatively large slot sizes (1/2 in.) in the SED is not clear and that size is larger than currently used for existing barrier net deployments.

  The text also states that barrier nets have been most successful where they have been deployed on a seasonal basis. While it is correct that there are highly effective seasonally deployed barrier nets, there are also highly successful year round barrier net deployments. One example is a year round deployment in Minnesota using deicing and a second is Chalk Point on the Chesapeake Bay. EPRI does agree there is limited, if any, benefit for reducing entrainment. EPRI also agrees that use of barrier nets is not feasible for open ocean intakes such as Scattergood. Barrier nets are also not practical for Haynes or Harbor due to their intakes being located in heavily used navigable waterways.

- **4.1.4 Aquatic Filter Barriers** – The text describes the aquatic filter barrier (AFB) as being constructed of panels with of "small-pore (less than 20 microns) mesh. This description suggests the AFB could exclude 200 micron zooplankton. Lovett is the single facility that has deployed an AFB as described in the draft SED text. The earliest AFB used at Lovett did attempt to use the 20 micron mesh size, however, that size proved infeasible. Use of that mesh size resulted in tearing of the net due to clogging and overtopping of the net. This resulted in modification of the AFB design and use of a larger mesh fabric with 500 micron perforations to correct those problems. The final version of the AFB used a "G-weave" that did not have perforations. This net had an effective mesh size of 0.5 mm or 500 microns. The AFB is essentially a very sophisticated barrier net designed to exclude entrainable life stages in addition to impingeable sized organisms. It uses an air burst cleaning system to remove debris. It is subject to the same limitations as barrier nets in terms of not being suitable for use in an open ocean environment such as Scattergood. As pointed out in the description, the AFB is significantly larger than a barrier net and therefore would be even more problematic in terms of deployment for either Harbor or Haynes in the navigable waterways where the intakes are located.

- **4.1.5 Intake Relocation** – EPRI generally agrees with the characterization of this alternative. An exception is that LADWP's Haynes Station is listed as a potential candidate for this option. EPRI does not agree that Haynes is a good candidate for this alternative since the existing intakes are currently located in the Long Beach Marina. Therefore to reach the ocean, the intake would need to be extended beyond the breakwater, approximately another approximately 1. 5 miles. This is not practical due to the associated cost and maintenance issues and the uncertainty as to how much entrainment reduction would actually be achieved. For this reason, Haynes makes a poor candidate for this option. This is also true for Harbor due to its location in the inner Los Angeles Harbor. Scattergood is probably LADWP's best candidate for this option. However, as pointed out in the SED text, the problem of trading entrainment of one set of species for another, along with the high cost of going far enough offshore to minimize this risk, makes this an unlikely compliance option for Scattergood as well. Also problematic are the schedule constraints for this option. The draft Policy requires LADWP to commit to compliance options within six months of the final Policy issuance. It would require a least a year to collect the entrainment sampling data necessary to determine the entrainment reduction credit for this option.

- **4.1.6 Velocity Caps** – As discussed in this Section, LADWP's Scattergood Station currently employs a velocity cap that recently demonstrated a 95% reduction in impingement. However, as discussed in comments on Section 4.1.5, due to the current location of the cooling water intake structures for Harbor and Haynes in inland navigable waterways, this option is not practical for either of those facilities. Also as pointed out in the SED text, this alternative provides no significant benefit for reducing entrainment.

- **4.1.7 Variable Frequency Drives and 4.1.8 Seasonal Operation** – Both of these alternatives reduce entrainment and impingement through flow reduction. The major difference between the two is the finer level of flow reduction control that can be achieved using variable frequency drives than through turning cooling water pumps on or off on a seasonal or diel basis when generation requirements make such reductions possible. The major problem with these alternatives is the direct relationship between cooling water flow and the ability of a generating unit to generate electric power. Further, as pointed out in the draft SED discussion, the period of peak power demand may occur during periods of high larval fish densities. While some of these units may potentially be able to qualify for Track 2 by reducing flow, the Track 2 monitoring requirements, which require protection of 200 micron and larger zooplankton, makes use of this alternative especially problematic since no zooplankton entrainment studies have been conducted to document when the highest densities occur. This is especially critical since zooplankton are likely to numerically dominate the samples and compliance with the standard will be driven by zooplankton rather than ichthyoplankton. See Enclosure 2, Issue 6 for further discussion of the zooplankton issue.

- **4.1.9 Narrow-slot Cylindrical Wedgewire Screens** – The title of this section and the second sentence of the first paragraph suggest this technology uses a screen mesh. This is not the caseas mesh is used to refer to multiple openings in a net or wire screen. This technology uses one continuous wire wrapped around a support structure creating a slot as the wedge shaped wire is wrapped around the support structure. The space between the wrapped wire determines the slot width to exclude fish and debris. Therefore it is suggested the title of this section be modified to read "Narrow-slot Cylindrical Wedgewire Screens".

  The last sentence in the first paragraph indicates the airburst system releases organisms trapped on the wedgewire screen, suggesting that is the purpose of the airburst system. The sole purpose of the airburst system is to remove debris or the buildup of fouling organisms and keep the wedgewire slots open to ensure adequate cooling water flow. In one design, a mechanical brush system is used rather than the airburst system. The airburst is triggered as a result of the change in water pressure when the slots clog. No studies have ever been conducted relative to the benefit of this system to remove trapped or impinged organisms. The only fish protection design features of this technology are the small slot size to exclude organisms and the low through screen velocity. It should also be noted that by adding additional modules, the through screen velocity can be decreased to less than 0.5 fps through screen velocity which can improve performance for smaller entrainable life stages.

The third paragraph could be clarified in its discussion of two points. One is the discussion of EPA's provision for use of pre-approved technologies and the second discussion is in the use of cylindrical narrow-slot wedgewire screens as the only pre-approved technology specified in the Phase II Rule. The Phase II Rule allowed facilities to provide information to demonstrate that a technology would have a high level of performance. A successful demonstration, which included providing opportunity for public comment, allowed exemption from certain Comprehensive Demonstration Study requirements. As stated in the last sentence of this draft SED paragraph, use of other pre-approved technologies was allowed based on a successful demonstration. Narrow-slot cylindrical screens were specifically pre-approved for entrainment in the Phase II Rule when used in free flowing freshwater rivers, since rivers provide a continuous ambient flow that exceeds the 0.5 mm maximum through screen design flow of cylindrical screens. Because all of California's once through cooling power plants withdraw cooling water from either the Pacific Ocean or an estuary, the ambient currents are more variable and may not be adequate during slack tides, cylindrical screens would not have qualified for pre-approval in California.

The basis for the statement in the fourth paragraph that, "The distance from shore that would be required (2000 feet or more)", is not clear and should be clarified. This statement is most likely referring to an application for a specific facility that probably has an offshore intake. However, in general, cylindrical wedgewire screens have been deployed inshore and there is one such small deployment in San Francisco Bay. There are also cylindrical wedgewire screen module deployments on bulkheads rather than from offshore pipes. The text should be modified to reflect there is no generic requirement that this technology must be located 2000 feet or more offshore. However, this may be the case for some facilities with offshore intakes.

Narrow-slot cylindrical wedgewire screens have never been designed, tested or deployed anywhere in the world with a spacing designed to exclude 200 micron zooplankton and EPRI does not believe such narrow spacing is feasible in the high biofouling Pacific Ocean environment.

- **4.1.10 Modified Traveling Screens (Ristroph Screens)** – A number of changes are recommended to improve the accuracy and completeness for the description of this alternative. On page 92, in the first full paragraph, the sentence states that "modified screens have been shown to reduce impingement by 90% or more". The statement should be changed to say that modified screens reduce impingement **mortality** by 90% or more, since such screens do nothing to change the rate at which fish are impinged or collected on the screens. The fish protection operational mechanism is instead based on improving impingement survival.

  The first paragraph discusses "The term Ristroph Screens refers to a particular modification where individual screen panels are fitted with water-filled buckets that collect fish temporarily". While Ristroph is one modified traveling screen design for fish protection, there are a number of others including designs manufactured by Geiger, Hydrolox and Brackett-Green. Buckets are fitted onto each of these design but they are not "water-filled". Rather as they rotate any organisms caught on the screens are gently washed from the screens with a low pressure wash into the fish collection bucket that is filled with source water as it emerges from the water. There is also a design manufactured by Beaudrey that uses an underwater vacuum to remove trapped fish from the screens rather than a bucket system.

  The third paragraph states that "Screen slot sizes typically need to be within the range of 1 - 2 mm in order to be effective as an entrainment reduction measure". The basis for the lower end of the range is not clear as there are existing fine mesh screen deployments with 0.5 mm mesh at Big Bend, Barney Davis and Prairie Island. However, as for the AFB and narrow-slot wedgewire screens, EPRI is not aware of any data or information that fine mesh travelling screens have ever been designed, tested or deployed with a mesh size to collect 200 micron zooplankton and/or used to protect ichthyoplankton, with the exception of the Lovett AFB where the 20 micron mesh size was attempted but determined to be impractical. Unless data or information is provided on this topic, this option, as currently proposed, is not considered practical for use at any California facility including LADWP's facilities.

Enclosure 2

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Introduction

The California State Water Resource Control Board (SWRCB) released their Draft Substitute Environmental Document on Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling Discuss (SED) in July 2009. To assist with the review and development of the SED the SWRCB convened an Expert Review Panel that was composed of seven members including Dr. Michael Foster who directed the panel. The panel members included biologists who have been involved in conducting or reviewing most of the studies on the environmental effects of once-through cooling (OTC) in the state. As a result it would have seemed that the SED would have incorporated more of the recommendations provided by the panel especially in documenting the biological benefits of the policy. Most prominently, a majority of the panel encouraged the SWRCB staff to adopt a policy that would encourage reduction of OTC and provide for methods of compliance that would provide real benefit to the environment. The same concern that the SED did not provide adequate documentation on the potential environmental benefits of the policy was voiced by Chairman Hoppin at the SWRCB workshop held on September 16, 2009 in Sacramento. Other areas where the SED did not incorporate information from the Expert Panel are pointed out in the following comments.

Another question raised by the SWRCB members who attended the workshop held on September 16, 2009 in Sacramento was regarding the existence of any standards for determining the significance of losses occurring due to the operation of OTC systems. One source of guidance on this issue comes from a recent review on population level effects on harvested fish stocks by two EPA scientists.[1] Newbold and Iovanna modeled the potential effects of entrainment and impingement on populations of fifteen fish stocks that are targeted by either commercial or recreational fisheries using empirical data on entrainment and impingement, life history, and stock size. For twelve of the fifteen species, the result of eliminating the use of once-through cooling to remove the effects of power plant entrainment and impingement potentially affecting the species had very little effect on the populations (less than 2.5% change). For the other three species, the effects ranged from 22.3% for striped bass on the Atlantic coast to 79.4% for Atlantic croaker. Their overall conclusions were that population level effects were negligible for most fish stocks but could be severe for a fishes with impacts similar to their three examples. The largest effects of IM&E at CA facilities is usually to non-harvested fishes at levels below the levels of to the harvested fishes analyzed by Newbold and Iovanna and as a result probably represent very low risk to these populations.

Importance of Documenting Benefits of Policy

The SED presents the goals of the Policy, if adopted, but does very little in documenting the benefits that would occur if implemented. The SED provides numeric estimates of impingement and entranment losses for most of the once through cooled facilities. However, as pointed out by Chairman Hoppin at

[1] Newbold, S. C. and R. Iovanna. 2007. Population level impacts of cooling water withdrawals on harvested fish stocks. Environ. Sci. Technol. 41:2,108–2,114.

the Stakeholder meeting on September 16, 2009, such numbers provide no real context for evaluating their significance other than reducing impingement mortality and entrainment (IM&E). In these comments a series of key issues and multiple lines of analysis are provided to inform what expected Policy benefits are likely to result from the Policy:

1. **Impingement and entrainment losses are not a significant factor causing declines to California's coastal fisheries**

   A basic premise for the Draft Policy is that California's fisheries are in decline and that based on numbers of fishes impinged and entrained a Policy is needed to protect fish populations. It is therefore important to consider the major factors that are causing the decline and how significant impingement and entrainment is as a factor. This section will focus on the first part of the question in terms of what are those factors. Two major factors are known to have contributed to declines; climate change and overfishing.

   Analyses provided in Attachment 1[2] show that coastal marine populations, especially fish and zooplankton, have been predominantly regulated by oceanographic conditions since at least 1972. Examination of data collected continuously since then and comparison with similar data sets, fails to indicate when any previous changes in OTC use have occurred, such as the start up of SONGS Units 2&3 in the early 1980s. This event resulted in a marked net increase in southern California cooling water withdrawals, but not a corresponding change in the population levels of coastal species. For comparison, the effect on all seven common croaker species (a fish commonly impinged at power plants) was evident in their declining abundances from 1982 -1995 a period when commercial gill net fishing was allowed in State waters. The populations of two croaker species have increased since the gill net fishing ban despite continued power plant operation; indicating that fishery practices and fishing pressure has a greater impact on fishing populations (Attachment 1). All fish populations, however, did not respond similarly as the effect of oceanographic conditions, specifically rising sea temperatures associated with climate change, undermined the post-fishery rebound in 1995.

   Potential implications of the State's policy requires further development and examination of the factors regulating coastal marine resources, specifically how they pertain to the effects of climate change. Most marine resources are regulated from the bottom up, meaning the ecosystem is regulated by basic processes such as water temperature and nutrient concentration that cascade up through trophic levels. This is evidenced by the close association between zooplankton biomass and oceanographic processes as described in Attachment 1. There are no apparent responses of fish nor zooplankton communities to changes in power plant operations since data first started becoming available from the following sources in 1950 (CalCOFI data), 1972 (power plant impingement data), or 1974 (King Harbor plankton sampling). This lack of a defined response to historic changes in OTC use strongly indicates that no such response will be realized with the implementation of a policy severely reducing the use of OTC.

[2] Attachment 1. Miller, E.F. A review of the patterns in southern California marine plankton and fish communities in relation to oceanographic conditions with considerations of once through cooling.

The rise in seawater temperatures and associated geochemical changes in nearshore waters (reduced primary productivity, ocean acidification, etc.) provides clear insight into the association of populations with climate change parameters. Biological communities, including the nearshore fishes of California, are experiencing biogeographic shifts in response to the changing climatic conditions such as rising seawater temperatures, a documented effect of anthropogenically-accelerated climate change. Under the current Draft Policy requirements, greenhouse gas emissions by the affected power plants will increase anywhere from 10 to 14%, as per presentations in Section 4.5.1 of the SED. The Draft Policy presents a scenario of all facilities repowering to combined cycle units with closed cycle cooling would result in a net decrease in CO_2 emissions of 14%. Given the aggressive goals of AB32, a fourth scenario should be evaluated: all facilities repower with combined cycle units and continue OTC use. Based on the prior scenarios, this may result in a net decrease of 28% in CO_2 emissions, or a significant step towards meeting the AB32 goals. It should be noted that several state, federal, and international regulatory agencies have stated that climate change is impacting marine resources through the aforementioned parameters and that anthropogenic emissions of greenhouse gases are clearly accelerating these changes.[3,4,5,6] The abundance patterns for 18 of 21 species analyzed in Attachment 1 were significantly related to rising seawater temperature. Eight species negatively responded to rising temperatures and all eight are species with more northerly distributions or cooler water affinities. Ten species were the opposite, exhibiting positive responses to rising temperatures with each species exhibiting a more southerly distribution or warm water affinity. All ten of the warm water fishes are increasing in abundance, despite the continued operation of OTC. The purpose of the SED is to require the use of the best technology available to minimize environmental impact, which, according to CEQA, includes the effect of the project on climate change. These effects may far outweigh any AEI caused by the use of OTC to both marine and terrestrial systems worldwide.

Reviews of historic data, as presented in Attachment 1, clearly indicate that oceanographic variability, partially driven by climate change, will ultimately determine the fate of California's coastal marine resources. The increase in CO_2 emissions that will result from the implementation of this policy will protect a proportional handful of individuals at the expense of the populations in general, both locally and globally. The cumulative effects of this policy require a much greater detailed analysis of its potential impacts to the coastal marine resources, consistent with the recent revisions to CEQA regarding climate change.

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[3] Bindoff, N.L., et al. 2007: Observations: Oceanic Climate Change and Sea Level. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[4] California Natural Resources Agency. 2009. California Climate Adaptation Strategy Discussion Draft. Available: http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-D.PDF

[5] Ocean Protection Council. 2007. Resolution of the California Ocean Protection Council on Climate Change. 14 June 2007.

[6] United States Global Change Research Program. 2009. Global Climate Change Impacts in the United States. Available: http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts.

Enclosure 2

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In summary, important points from this analysis are that climate change has been identified as the major cause of species shifts and declines for some species. Secondly, quantified data has determined that commercial fishing has been a contributing factor and that a change in fishing policy resulted in a measurable response in the fishery. This provides a benchmark for evaluating IM&E losses since those losses can then be measured in context to the commercial fishing losses as an indicator of the likely response from the Draft Policy will be discussed below.

2. Large entrainment loss estimates isn't sufficient to assume a significant benefit from the Draft Policy.

The SED especially seems to focus on the effects of entrainment due to the large numbers and uncertainty associated with impacts. The entrainment losses in particular appear large leading to the assumption that these numbers result in significant impacts to affected species and that significant benefits will result in terms of increasing fish populations that are currently in decline for some species. First of all, the entrainment estimates presented in the SED are for total fish larvae and do not show that the estimates from the individual plants include numerous species of fishes. For example, the studies at the Diablo Canyon Power Plant on the open coast in central California collected 178 different taxonomic categories of fishes between October 1996 and June 1999, whereas only 20 categories were collected over a yearlong study in south San Diego Bay in 2001. The entrainment numbers for individual species ignore any consideration of how fish species maintain their populations and causes of population declines for some coastal species. While larval entrainment estimates often appear very large (sometimes billions of larvae per year), it is important to remember that ichthyoplankton will suffer in excess of 99% natural mortality as they develop through their larval stage. Houde7 estimates that for a typical marine species, only 180 individuals per every million larvae (>99.9% mortality) will survive the larval stage due to natural mortality. To illustrate this, the 44,584,991 northern anchovies entrained by Scattergood Generating Station in 2006 amount to approximately 79,220 age-1 adults.8 This number of fish translates to less than 1400 lbs, or less than 0.01% of the 2006 California northern anchovy commercial landings.9 As a frame of reference, estimated northern anchovy entrainment at Scattergood represents the spawning production of 16,273 mature females or less than 1% of the total commercial landings in 2006. Similarly, the entrainment estimate for white croaker was 34,295,926 or the reproductive output of 19 mature females, or 2% of the number of fishes collected during the most recent Bight-wide assessment,10 a study required for most power plants by the Los Angeles Regional Water Quality Control Board. While the entrainment estimates appear large as a number out of context,

[7] Houde, E.E. 2002. Mortality. In L.A. Fuiman and R.G. Werner (eds.). 2002. Fishery Science: The Unique Contributions of Early Life Stages. Blackwell Publishing, Malden, MA.

[8] MBC Applied Environmental Sciences, et al. 2007. Scattergood Generating Station Clean Water Act Section 316(b) Impingement Mortality and Entrainment Characterization Study Final Report. November 30, 2007.

[9] CDFG. 2008. Review of some California fisheries for 2007: coastal pelagic finfish, market squid, Dungeness crab, California spiny lobster, highly migratory species, ocean salmon, groundfish, California halibut, hagfish, Pacific herring, and recreational. California Cooperative Oceanic Fisheries Investigations Reports 49:15-38.

their actual representation to the population is far less, as illustrated by the northern anchovy and white croaker examples. In this context, scientific sampling across the Bight in 2003 led to the loss of 45-times as much white croaker biomass as did the entrainment at Scattergood.
In summary, simply focusing on raw numbers can be very misleading due to the high natural mortality rates (i.e. on the order of 99%) that will continue to occur regardless of the Policy. Secondly, as discussed in the answer to the first question, when losses are considered in context to commercial species for a dominant entrained offshore species (i.e. northern anchovy) the losses represent a fraction of 1% of the commercial harvest at a single power plant such as the Scattergood Generating Station.

3. **Current and historical studies have been based on valid methods to evaluate impingement and entrainment losses**

In order to better quantify the significance of IM&E losses it is important to first consider whether or not there are valid analytical tools available to evaluate the impingement and entrainment impacts. One rationale for the policy presented in the SED is that the original EPA 1977 guidance for evaluating impacts is outdated and that there have been significant advances in the methods for quantifying impacts due to OTC. When the Phase II Rule was suspended, the EPA recommended that permitting authorities implement 316(b) using BPJ. The only guidance for these BPJ determinations was an EPA document from 1977[11] that presented a framework for assessing the potential for a cooling water system to result in adverse environmental impacts (AEI). This framework was used by many studies that were completed in the late 1970s and early 1980s. Contrary to the statements in the SED, the methods of data collection and analysis from several of these studies were identical to the methods used in studies completed over the past five years. In fact, the primary analytical approach recommended by the California Energy Commission and other state agencies for assessing the effects of entrainment, which is also critical to the calculations for scaling restoration using the method of Habitat Production Foregone recommended in the SED, was developed and used in earlier assessments for the South Bay Power Plant and San Onofre Nuclear Generating Station. The same 1977 EPA guidance for assessing AEI was also used in recent IM&E studies at the LADWP power plants and remains a useful framework for assessment. The recent studies using this EPA guidance all concluded that the existing cooling water intake systems did not result in AEI to fish and shellfish populations.

The EPA guidance provided a logical framework for assessing the potential for an intake system to result in AEI that is predicated on the language of Section 316(b) that the design and operation of the cooling water intake system employ the best technology available to minimize adverse environmental impacts. As pointed out by Chairman Hoppin at the September 16, 2009 SWRCB workshop on the policy, the intent of 316(b) is to minimize, not eliminate the potential for AEI. Therefore the USEPA guidance indicated that assessment of AEI should be based on an evaluation of population level effects, not just losses of individual organisms. In its 1975 Draft BTA Guidelines, the EPA stated that "[a]dverse environmental impacts occur when the ecological function of the

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[10] Allen, et al. 2007. Southern California Bight 2003 Regional Monitoring Program: IV. Demersal fishes and megabenthic invertebrates. Southern California Coastal Water Research Project. Costa Mesa, CA.

[11] United States Environmental Protection Agency (EPA). 1977. Guidance for evaluating the adverse impact of cooling water intake structures on the aquatic environment: Section 316(b) P.L. 92-500, 58 p.

organism(s) of concern is impaired or reduced to a level which precludes maintenance of existing populations..." Additionally, in the 1976 Development Document, released in conjunction with the EPA's previous Section 316(b) rules, the EPA stated that "[t]he major impacts related to cooling water use are those affecting the aquatic ecosystems. Serious concerns are with population effects that...may interfere with the maintenance or establishment of optimum yields to sport or commercial fish and shellfish, decrease populations of endangered organisms, and seriously disrupt sensitive ecosystems."

The 1977 EPA draft guidelines acknowledge that the determination of the extent of AEI when it is occurring is difficult to assess. They state that "Adverse aquatic environmental impacts occur whenever there will be entrainment or impingement damage as a result of the operation of a specific cooling water intake structure. The critical question is the magnitude of any adverse impact. The exact point at which adverse aquatic impact occurs at any given plant site or water body segment is highly speculative and can only be estimated on a case-by-case basis..."

Due to the obvious difficulties with determining the extent of AEI, the draft guidance provides some general guidelines. These involve determining the "relative biological value of the source water body zone of influence for selected species and determining the potential for damage by the intake structure" based on the following considerations of the value of a given area to a particular species:

- principal spawning (breeding) ground;
- migratory pathways;
- nursery or feeding areas;
- numbers of individuals present; and
- other functions critical during the life history.

Recent 316(b) demonstrations for power plants in southern California followed this general approach provided by 1977 guidance, using additional criteria that were specific to the marine environment around individual cooling water intake structures that were directly applicable to the affected populations that included:

- distribution (pelagic, subtidal, nearshore subtidal & intertidal);
- range, density, and dispersion of population;
- population center (source or sink);
- magnitude of effects;
- long-term abundance trends (e.g., fishery catch data);
- long-term environmental trends (climatological or oceanographic); and
- life history strategies (e.g., longevity and fecundity).

The studies assessed the relative value of each of these criteria for several species to better assess the extent of the impact that the losses might have on the local environment and the population at large. Specifically, these additional criteria evaluate the potential for AEI in a larger context using the characteristics of the source water and the biological community. For example, not all of the fishes and shellfishes in the source water are subject to entrainment or impingement, and only a few species occur in high abundance in both entrainment and impingement samples. These differences in the vulnerability to entrainment and impingement occur due to different life histories of the species, and the differences in habitat preferences and behavior that may occur at different life stages. The potential magnitude of the losses due to entrainment and impingement depend on many factors but one of the most important in determining which species are at greatest risk is their distribution and habitat relative to the intake location. The extreme case of highest risk would occur for a rare or endangered species with a distribution that was limited to the area in the vicinity of the intake. Conversely, although entrainment of larvae from a species such as northern lampfish might occur, the primary distribution for this species is the outer coastal waters from Baja California to the Bering Sea and Japan to depths of 9,500 ft. Entrainment of larvae from this species present no risk of AEI to an adult population that occurs further offshore.

4. **Impingement and entrainment losses are not significant factors limiting populations of entrained species.**

There are a number of points that can aid in informing the benefits of the Policy relative to the effects of impingement and entrainment. Several important points are offered in this context as follows:

a. Entrainment of Species Transported from Their Natural Habitat - The fish larvae entrained at each plant include fishes that have been transported into the area of the intake where they become subject to entrainment but would otherwise not contribute to sustaining adult populations of these fishes. Entrainment for plants on the open coast, especially, includes larvae from fishes that primarily inhabit deeper offshore habitats that may be transported into nearshore areas by currents. These larvae are essentially lost to the population since they are unable to survive in nearshore areas, which do not include any adult habitat for that species. For example, the 12th most abundant fish larvae entrained at the LADWP Scattergood Generating Station offshore intake in Santa Monica Bay was northern lampfish. As noted above, this is a deepwater fish that lives in offshore areas to depths of 9,500 ft. Similarly, entrainment at Scattergood also included large numbers of gobies that live in mudflat areas of embayments such as Marina Del Rey that is just north of the plant. For example at the Huntington Beach and Scattergood Generating Stations gobies important entrained species. The goby larvae are transported by tidal currents out of their native habitat into nearshore areas where they survive until they either die or are eaten. The probability that they will contribute to the adult population in embayments is essentially zero and as a result the adoption of the provisions and requirements of the policy to protect these non local habitat species provides no benefit to these fish.

b. Habitat as a Limiting Factor for Many Entrained Species – Many of the fish larvae entrained by OTC systems are from species that occupy specific habitats as adults and therefore these populations are limited by the availability of that habitat and not the availability of larvae. Examples include nearshore rockfish that rely on availability of rocky reef areas, kelp bass that rely on healthy kelp beds, and gobies that rely on mudflat habitat in embayments.

   An extreme example is the garibaldi, the California state marine fish, which occupies rocky habitat in semi-protected waters. In these habitats, adult garibaldi maintain and defend a territory which includes a shelter hole, grazing area, and for some males, a nest site.[12] Long-term abundance data from King Harbor in Redondo Beach (with a power plant) and from the Channel Islands National Park (with no power plant) monitoring program[13] show similar average abundances, as would be expected in a highly territorial species, over the period from 1985–2003 when the two data sets can be compared (Figure 1). Since garibaldi is not fished, one of the primary differences between the two areas where the data were collected is the presence of the intakes for the Redondo Beach Generating Station in King Harbor. An entrainment study for the Redondo Beach Generating Station was recently completed, but regardless of the additional larval mortality due to entrainment the long-term data on this species indicate that there would be no effect on adult population levels since, as discussed by Clarke,[1] garibaldi populations are more likely limited by food supply or by the minimal space requirements for nesting males. Garibaldi is in the damselfish family that is one of the most prominent groups of fishes on coral reefs throughout the tropics where the importance of available habitat as a factor controlling populations has been well documented and is particularly acute.

Another example of a group of fishes that are more likely to be limited by habitat and not affected by entrainment larval mortality are several species of gobies that, as indicated above, occupy mudflat habitat in embayments. In those environments they are the dominant fish, comprising the largest percentage of the total larvae entrained at power plants located in those habitats (Table 1). Data available from south San Diego Bay and Agua Hedionda Lagoon, the locations of the South Bay Power Plant and Encina Power Station, respectively, provide evidence that OTC is not affecting adult goby populations at these locations. At the South Bay Power Plant, estimates of goby entrainment from sampling done in 2001 were approximately the same as estimates from entrainment studies done in 1979-1980. While this type of comparison cannot be used to determine the long-term effects of entrainment by the South Bay cooling water system since there are no data from before plant operation for comparison, it might indicate that no large-scale declines in the adult spawning stock have occurred over the time period between the two studies when the plant was operating. This conclusion is supported by results from a study of fishes in San Diego Bay showing increased abundances of gobies over 1994-1999, a period when the plant was operating.[14]

The source water for the Encina Power Station intake is Agua Hedionda Lagoon. The intake volume relative to the volume of the source water in the lagoon is larger than any other location in the state resulting in the complete turnover of the lagoon water in less than two days when the plant is operating at full power. Despite the seemingly large potential for impacts to the lagoon, studies done over the past several years have shown that the lagoon supports a fish community and densities of gobies in mudflat areas that were similar or

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[12] Clarke, T. A. 1970. Territorial behavior and population dynamics of a Pomacentrid fish, the garibaldi, *Hypsypops rubicunda*. Ecological Monographs. 40:189212.

[13] Data summarized in Tenera Environmental, Inc. 2006. Compilation and analysis of CIAP nearshore survey data. Prepared for California Department of Fish and Game. http://www.dfg.ca.gov/mrd/fir/sss.html

[14] Allen, L. G. 1999. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California. Final Report: Sampling Period July 1994 to April 1999. Prepared for U.S. Navy and the San Diego Unified Port District.

higher than other embayments without a power plant intake. Also, recent entrainment studies (2004-2005) showed that concentrations of goby larvae were approximately 5 times higher than concentrations measured during a previous entrainment study in 1979.

The results from both south San Diego Bay and Agua Hedionda Lagoon indicate that implementing the Policy provisions and requirements will provide very little benefit to fishes such as garibaldi and gobies whose populations are primarily limited by the availability of habitat and not because of OTC impingement and entrainment. Across the state, gobies comprise approximately 40 percent of the total fish larvae entrained with the total percentage at some plants being 80 percent (Table 1). Therefore there will be little if any benefit resulting from the reduction or elimination of OTC at locations with high entrainment of these fish larvae.

c. <u>The Extent to Which Entrained Species Are Subject to Other Impacts Such Commercial and Recreational Fishing or Are California or Federally Protected Species</u> - Statewide, the vast majority of the fish larvae entrained are small forage species like gobies that are not at risk because they are not also not recreationally and commercially fished. This is important because fishing targets adult fishes that are reproductive and producing eggs and larvae. Additional mortality at the adult life stage when fishes are reproductive is much more critical to most populations than the small levels of additional larval mortality resulting from OTC. Larval mortality due to OTC would be important in the case of a fish that occupies a limited habitat in the vicinity of a power plant or is listed as threatened or endangered, but no listed species have been documented in any of the recent entrainment studies. The only facilities with the potential to affect protected fish species are located on estuaries rather than the ocean and there are existing Federal and/or State laws that specifically protect those species. In terms of Marine Mammals and Sea Turtles, LADWP has already installed exclusion bars at Scattergood, the site most likely to affect such species. Bulkhead intakes at both the Haynes and Harbor generating stations have exclusion bars spaced to prevent the intake of marine mammals and sea turtles.

d. <u>The Correlation Between Densities of Entrained Species with Changes in Once Through Cooling Water</u> Flow – As discussed in point 1 above, response to changes in commercial fishing policy resulted in a measurable response in the targeted fish population levels. Furthermore, these responses have occurred independent of changes to cooling water withdrawals in California. Examining the responses to flow reductions should provide insights into the likely benefits that would result from the Draft Policy.

While the entrainment estimates are large, and have undoubtedly varied over time as OTC use has varied, population indices have not registered a corresponding change.[15] In the case of white croaker and northern anchovy, the populations have varied in close association with oceanographic conditions. Nearly all power plants with OTC in California, including two of the three Los Angeles Department of Water and Power stations, began operation after 1950; Harbor Generating Station began operation in 1943. Focusing on northern anchovy and white croaker (included in the Family Sciaenidae or croakers), both species' larval

[15] Attachment 1. Miller, E.F. A review of the patterns in southern California marine plankton and fish communities in relation to oceanographic conditions with considerations of once through cooling.

densities increased markedly from 1951 through at least the mid-1970s. Croakers reached their peak density in 1978 while northern anchovies peaked in 1980.[16] These increases occurred at a time when the plants were always based loaded (eg. operating all the time) as opposed to the current usage levels. Therefore it seems likely that any future reductions in entrainment will not result in a corresponding increase in the wild stocks.

In a more localized example, analysis of ichthyoplankton sampled near the Redondo Beach Generating Station Units 7&8 intake structure (1974-2006) in relation to OTC flow at the facility (1979-2006) revealed that four of the seven species analyzed exhibited significant positive relationships with OTC flow, or simply, larval densities declined as OTC use at the facility declined.[17] The remaining three species, and total ichthyoplankton density, did not relate to OTC flow, positively or negatively. Cooling water flow at the two remaining facilities in the Santa Monica Bay, El Segundo Generating Station and Scattergood Generating Station, either maintained their flow (Scattergood) or similarly reduced their cooling water circulation (El Segundo). Therefore, the net cumulative OTC flow in the area declined over time. Entrainment at Redondo Beach for the four analyzed species in 2006 ranged from 7,238 bluebanded/zebra gobies to 33,282,431 CIQ gobies (complex of shadow, cheekspot, and arrow gobies).[18] Cumulatively, the larvae from these fishes accounted for 18% of the total entrainment at Redondo Beach. The relationship between larval abundance for these four species and OTC flow indicates that a reduction in OTC may not result in a net increase in local larval densities.

e. Larval Fish and Eggs Entrainment Survival – At Scattergood, 84.9% of Sciaenid fish eggs survived entrainment in the summer months.[11] Furthermore, USEPA[19] documents several instances where ichthyoplankton entrainment survival ranged from 20% to over 80% for most species detailed. Clearly, an assumption of 100% entrainment mortality is overly conservative. This is especially likely to be true for many low capacity units that may operate cooling water pumps for operational reasons but reject little if any heat into the water.

f. Cumulative Impacts – The SED indicates that there is a need for further research on the cumulative effects of closely situated power plants. While it is difficult to assess the cumulative effects of multiple stressors on fish populations, the cumulative effects of OTC from multiple plants are very easy to quantify since they are additive within the confines of a single waterbody. A cumulative impacts analysis of entrainment for all of the coastal power plants in southern California showed that the additional mortality resulting from OTC ranged from 0.2 to 1.4 percent based on the design intake volumes for all of the plants and 0.1 to 0.8 percent based on the actual average flows. The range of estimates depends on the number of days the larvae are in the water column exposed to entrainment. The upper

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[16] Moser, H.G., et al. 2001. Distributional atlas of fish larvae and eggs in the Southern California Bight Region: 1951-1998. California Cooperative Oceanic Fisheries Investigations Atlas 34.

[17] Pondella, D.J. II, et al. in press. The ichthyoplankton of King Harbor, Redondo Beach, California 1974-2006. California Energy Commission, PIER Energy-Related Environmental Research Program. CEC-500-04-025.

[18] MBC Applied Environmental Sciences and Tenera Environmental, Inc. Redondo Beach Generating Station Clean Water Act Section 316(b) Impingement and Entrainment Characterization Study Final Report. December 19, 2007.

[19] USEPA 2002. Case Study Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule. Chapter A7.

range is for larvae exposed to entrainment for 40 days. While larvae of a few fishes such as northern anchovy may have planktonic durations at the upper range of the estimates, many nearshore fishes have shorter planktonic durations and are exposed to entrainment for much shorter periods of time. Most fisheries biologists would not consider an additional mortality of 1.0 percent or less as presenting any risk to a fish population, especially when many of the fishes affected are not at risk due to commercial or recreational fishing pressure. This low level of additional mortality is another indication of the small benefit provided by implementation of the Policy.

5. **The SED currently fails to acknowledge the benefits of OTC for some facilities**

Water quality in semi-enclosed and enclosed bays such as Alamitos Bay, South San Diego Bay, and Agua Hedionda is naturally regulated by tidal flushing. Prior to development, this presumably led to periods of increased residence time and possible stagnation during neap tides. Today, these bays are developed to varying degrees, especially Alamitos Bay and south San Diego Bay which are both extensively developed as either industrial or private vessel marinas, or both. The development of these communities has further altered the natural circulation patterns, and introduced pollution sources to the bays. South San Diego Bay is unique due to the presence of a relatively large green sea turtle population (60-80 animals) which is believed to inhabit the area due to the habitat and the warm water discharge from the South Bay Power Plant. Similarly, the San Gabriel River, which accepts the discharge from both Alamitos and Haynes Generating Stations, has recently become home to additional green sea turtles, also presumably due to the warm water discharge. Recent research on stingray populations has found the nearshore waters of Seal Beach provide spawning habitat for stingrays, again due to the influence of the warm water discharge.[20,21] Both of these beneficial effects, sea turtles and stingrays, would be negatively impacted by the loss of the thermal discharge. Given the Endangered Species listing for green sea turtle, losses of these habitats may substantially diminish any cumulative benefit resulting from the State's OTC policy implementation.

In addition to the aforementioned effects, water quality, and by association the biological communities, in general has greatly benefitted from the seawater withdrawals in these areas by the various OTC facilities. In Alamitos Bay, source water for two power plants that use OTC, the historic water residence time in the bay was six days prior to OTC use.[22] Use of OTC has lowered this to 1-3 days residence time, which has led to improved water circulation and, ultimately, elevated dissolved oxygen levels. Brown and Caldwell[23] determined dissolved oxygen, due to reduced circulation, is

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[20] Hoisington, G., IV. and C.G. Lowe. 2007. Abundance and distribution of the round stingray, *Urobatis halleri*, near a heated effluent outfall. Marine Environmental Research. 60:437-453.

[21] Vaudo, J.J. and C.G. Lowe. 2006. Movement patterns of the round stingray *Urobatis halleri* (Cooper) near a thermal outfall. Journal of Fish Biology 68:1756-1766.

[22] Woods Hole Group. 2005. The Economic Value of Natural Resource Services Potentially Impacted by a Change in Cooling Regime at the Haynes and AES Alamitos Generating Stations. May 2005.

[23] Brown and Caldwell. 1979. Embayment Ecological Studies: Physical Oceanographic and Water Quality Data Report.

most problematic at the inner-most reaches of the Bay. Without the operation of OTC by both facilities, the waters grow stagnant, dissolved oxygen levels decline below biological thresholds, and fish kills similar to those reported during red tide blooms can occur. This is confirmed by comments from City of Long Beach officials who noted that when the facilities were operating near capacity they effectively flushed the Bay, reducing pollution and accumulation of contaminants, which helped maintain healthy water quality conditions.[24] With declining OTC withdrawals at AES Alamitos Generating Station the water quality in the Bay has declined due to the increased residence time and concentration of storm water runoff.

The economic impact of the loss of circulation due to OTC cessation should be incorporated into the State's evaluation of the proposed policy. Losses to ecological services that are currently improved by the use of OTC in Alamitos Bay (see above) amount to 3,341 acres or a monetary loss of $19.2 million (in 2004 dollars) annually due to reduced boating and beach activity within the Bay.[15] These additional data warrant considerable evaluation in the cumulative benefits review of the proposed policy.

6. There is little if any expected benefit from including zooplankton in the Policy

The Draft Policy significantly differs from EPA's Phases I, II and III Rulemakings by including zooplankton over 200 microns in addition to fish and shellfish. Neither the Draft Policy nor the SED provide any information for their inclusion. The only mention of these organisms is to provide a definition and identifying they need to be included in Track II Compliance monitoring. EPA's decision not to include zooplankton was due to the short life cycle of these organisms (zooplankton lifecycles are measured in weeks rather than years) and the associated rapid regeneration period.

The general assumption of 100% mortality of all entrained plankton (larval fish and zooplankton) is an overestimation for zooplankton. Studies by Marine Biological Consultants[25,26] documented the survival of entrained zooplankton. The net zooplankton mortality across the three facilities studied ranged from 20.3% to 41.6%, or substantially less than the assumed 100% mortality. Intersea Research Corporation[27] examined zooplankton survival specific to Scattergood Generating Station. Their results exceeded that reported by Marine Biological Consultants[9,10] with latent entrainment

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[24] DeLong, G. 2007. Alamitos Bay Water Quality. Available: http://www.longbeach.gov/news/displaynews.asp.

[25] Marine Biological Consultants. 1973. Phase II plankton mortality studies. Annual Report prepared for Southern California Edison Company. March 1973.

[26] Marine Biological Consultants. 1973. Plankton mortality study at Huntington Beach Generating Station. Prepared for the Southern California Edison Company. June 1973.

[27] Intersea Research Corporation. 1981. Scattergood Generating Station cooling water intake study 316(b) demonstration program. Prepared for The Los Angeles Department of Water and Power, Los Angeles, California. November 1981.

survival in the winter averaging 91.1% while summer sampling documented a 95.3% mean survival. These data suggest that an assumption of 100% mortality for entrained zooplankton may be overly conservative as prior studies have documented substantial survival among species common to the nearshore southern California environment. Furthermore, determination and enumeration of the Policy's benefits will be problematic, at best, given the overall decline in zooplankton biomass in both the nearshore and offshore areas of California.[5] Climactic forces, most importantly oscillations in seawater temperatures and primary productivity, drive variability in the zooplankton communities.

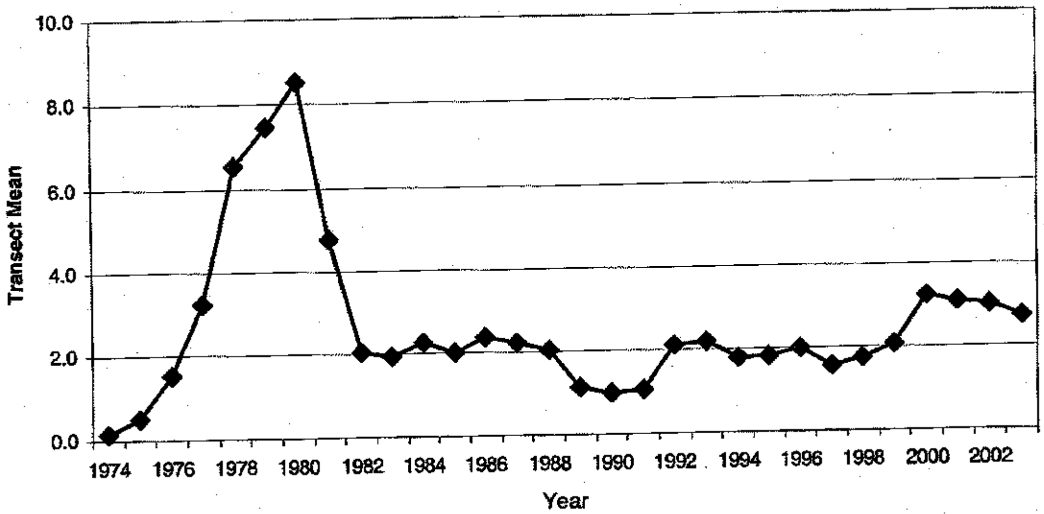
Additionally, since 1974, zooplankton biomass in King Harbor adjacent to the Redondo Beach Generating Station Units 7&8 intake structure has declined in a nearly corresponding rate with declining OTC flow at the facility (Attachment 1). The decline in zooplankton at King Harbor is consistent with that described for the Northeast Pacific zooplankton communities. Furthermore, this pattern is consistent for ichthyoplankton in the area, with four of seven species analyzed by Pondella et al.[10] significantly correlating with declining OTC flow at the facility (Attachment 1). The positive relationship between OTC flow and local ichthyoplankton densities is contradictory to the common opinion regarding entrainment impacts. While within a given year entrainment is directly proportional to flow, the assumption of a more damaging effect of low capacity units that operate only during the summer months is not supported by historic empirical data, as evidenced by the King Harbor case.

The above and additional points are discussed in greater detail in an EPRI report on impingement and entrainment impacts to California's Coastal Fisheries. This report was specifically prepared to inform the 316(b) Policy. The report is an excellent source of technical information on expected benefits and should be included as a reference in the SED.

Enclosure 2

P14/22

a) King Harbor



b) Channel Islands East (Anacapa and Santa Cruz Islands)

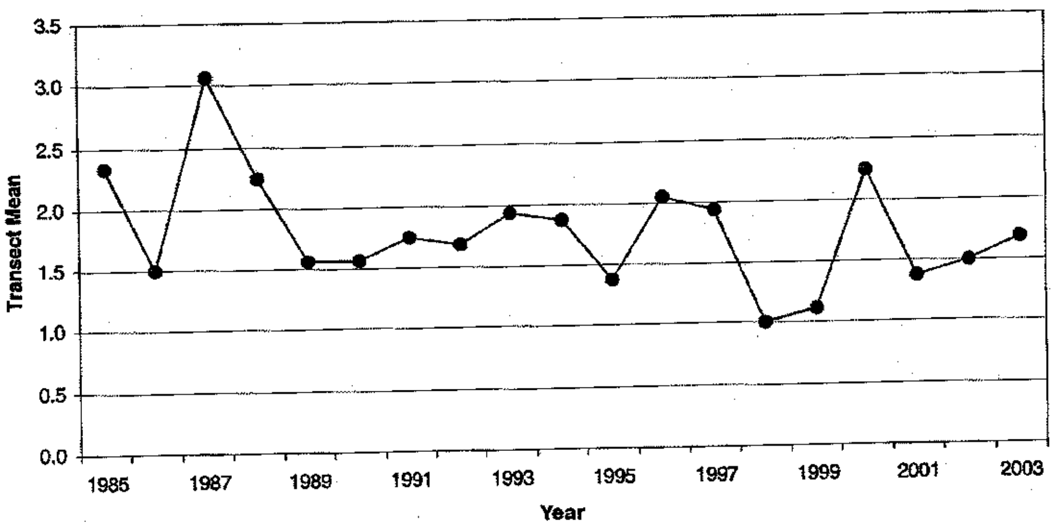


Figure 1. Average annual abundance of garibaldi along benthic fish transects sampled at a) King Harbor, Redondo Beach, CA, and b) the Channel Islands National Park at Anacapa and Santa Cruz Islands. Data summarized as part of a California Department of Fish and Game statewide monitoring study (Tenera Environmental 2006a).

Enclosure 2

P15/22

Table 1. Total entrainment estimates from data provided in SED (Steinbeck 2008) with percentage of gobies (includes arrow, cheekspot, shadow, bay, and yellowfin gobies and longjaw mudsucker) to total entrainment and estimates based on those percentages.

Plant	Design Flow (mgd)	Average Flow (mgd) based on 2000-2005 data	Average Concentration and Design Flow Entrainment Estimate	Average Concentration and Average Flow Entrainment Estimate	Percent of Gobies to Total Fish Larvae	Estimated Goby Larvae from Design Flow Entrainment Estimates	Estimated Goby Larvae from Average Flow Entrainment Estimates
South Bay Power Plant	601	417	2,404,046,574	1,667,406,878	77%	1,842,701,699	1,278,067,372
Encina Power Station	857	621	4,366,667,796	3,162,648,118	62%	2,708,644,034	1,961,790,627
San Onofre Nuclear GS Unit 2	1,219	1,139	3,311,307,168	3,095,251,683	1%	49,007,346	45,809,725
San Onofre Nuclear GS Unit 3	1,219	1,154	3,311,307,168	3,136,923,690	1%	48,676,215	46,112,778
Huntington Beach GS	514	179	299,647,084	104,339,074	33%	100,231,950	34,901,420
Haynes GS	968	258	4,349,235,947	1,159,662,085	50%	2,185,056,140	582,614,231
Alamitos GS Units 1&2	207	121	748,306,544	437,854,835	71%	530,250,017	310,263,936
Alamitos GS Units 3&4	392	281	1,414,971,165	1,013,733,478	66%	936,852,408	671,192,935
Alamitos GS Units 5&6	674	413	2,455,020,121	1,503,394,233	61%	1,499,526,290	918,273,198
Harbor Generating Station	108	59	156,285,731	85,447,634	79%	122,934,356	67,213,109
Redondo Beach GS Units 5&6	217	51	354,702,404	83,037,227	34%	121,166,341	28,365,517
Redondo Beach GS Units 7&8	675	254	772,198,644	290,801,357	12%	92,046,078	34,663,522
El Segundo GS Units 1&2	207	69	147,969,610	49,437,254	5%	7,368,887	2,461,975
El Segundo GS Units 3&4	399	265	284,430,472	189,290,759	4%	12,258,953	8,158,432
Scattergood GS	495	309	506,083,227	315,634,578	5%	25,911,461	16,160,490
Southern California Totals			**24,882,179,655**	**16,294,862,883**		**10,282,632,176**	**6,006,049,268**
Percent of Gobies to Total						**41%**	**37%**
Diablo Canyon Power Plant	2,528	2,287	1,765,916,778	1,597,319,020	4%	77,347,155	69,962,573
Morro Bay Power Plant	668	257	830,540,168	318,942,511	45%	372,497,265	143,045,716
Moss Landing Units 1&2	361	193	584,101,411	311,537,103	83%	484,044,839	258,170,797
Moss Landing Units 6&7	865	387	934,658,478	418,350,825	83%	774,551,481	346,687,328
Potrero Power Plant	231	193	303,519,077	252,843,159	67%	203,175,670	169,253,210
Southern California Totals			**4,418,735,911**	**2,898,992,617**		**1,911,616,410**	**987,119,625**
Percent of Gobies to Total						**43%**	**34%**
Totals for State *	**13,404**	**8,906**	**29,300,915,566**	**19,193,855,500**		**12,194,248,586**	**6,993,168,894**
Percent of Gobies to Total						**42%**	**36%**

* - excludes Contra Costa and Pittsburg power plants which had no recent data, and Ormond Beach and Mandalay power plants where data on gobies were not available

Enclosure 2

P16/22

Comments on Issues and Alternatives

SED Page 48 Issue 3.4 Alternative Requirements for Low Capacity Utilization Facilities

1. Contrary to statements in the SED there is a strong relationship between capacity factor measured in cooling water volume and levels of entrainment. The data from Appendix E were used to examine the relationship between capacity utilization rate (CUR) and impacts based on statements in the SED that the impacts at facilities with low CUR are not necessarily less than facilities with high CUR. This is contradictory to the approach used to calculate the estimates in Appendix E recommended and reviewed by the members of the Expert Review Panel and also with other statements in the SED that entrainment is proportional to cooling water flow (pg. 56). In examining the relationship between entrainment and cooling water flow it is important to account for differences among locations that might affect the average concentration of larvae in the source water. In general, the concentration of fish larvae in embayments will be higher than areas of open coast. There might also be differences between locations in southern and northern California since the seasonal abundances of fish larvae are very different between the two regions. By just accounting for these differences the correlation for the relationship increases from 0.26 to 0.78 (Figure 2).

   As shown by the high correlations and discussed among the members of the Expert Review Panel, the relationship with capacity factor is very strong for entrainment but is less direct for impingement which is affected by many factors. While it is more difficult to predict impingement due to differences in intake design and location, and the effects of storms, winds and other factors on debris levels, it is clear that a strong relationship exists between entrainment and plant operation. Plants that are operating at low CUR will have proportionally lower impacts after adjusting for seasonal differences in larval concentrations.

Enclosure 2

P17/22

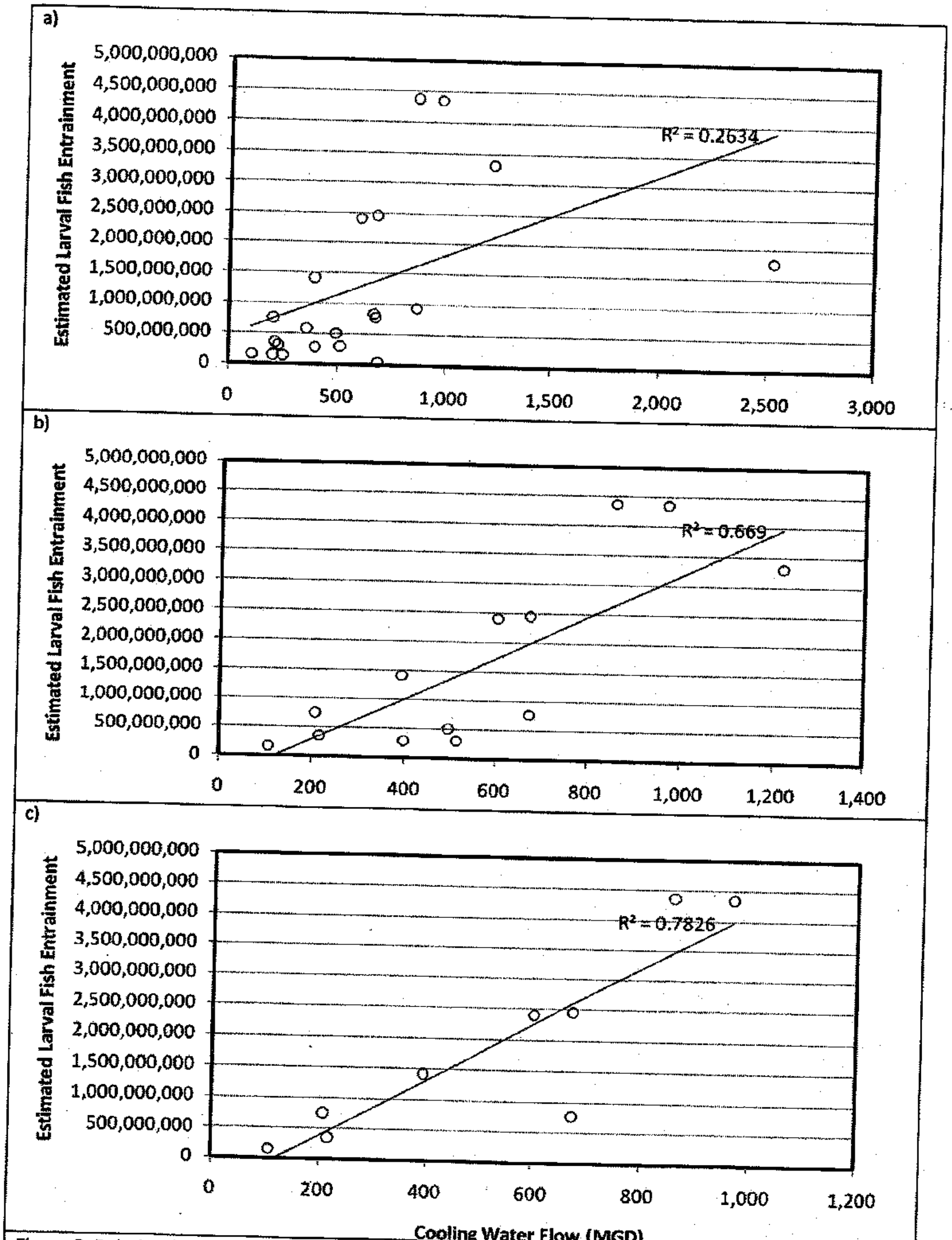


Figure 2. Relationships and correlation coefficients between cooling water flow volume (million gallons per day [mgd]) and total entrainment based on design flow for a) all California power plants, b) plants in southern California, and c) plants in embayments in southern California. Data from Steinbeck (2008).

Enclosure 2

P18/22

SED Page 64, **Issue 3.9 Monitoring Requirements**

Monitoring requirement for Track 2 compliance provided in Appendix A of Policy

1. **Policy states that impingement "include sampling for all species impinged"**

   In addition to all fishes, over 70 macroinvertebrate species were recorded, and data presented, during monitoring at Scattergood Generating Station in 2006, including shellfish, cnidarians, non-shellfish arthropods, gastropods, etc. While many of these macroinvertebrates were enumerated, their presence in the impingement samples is related to the fouling community that develops within the intake structures themselves. For example, the intake and discharge conduits and structures provide substrate for fouling organisms, such as mussels and barnacles, that would otherwise be absent in sandy substrate environments. These fouling organisms occasionally become dislodged, or are eliminated during marine growth control procedures, and are subsequently impinged. Recent impingement studies have focused on "shellfish" or "motile macroinvertebrates", which reduces the time and effort required to identify and quantify fouling invertebrates, and we would recommend a similar approach.

2. **Entrainment monitoring include sampling for all ichthyoplankton and zooplankton (meroplankton) species**

   All of the entrainment studies conducted at coastal power plants over the last 15 years have focused the sampling on fish eggs and larvae and larvae from a few select invertebrates (meroplankton). The study plans for several of these studies have been collaborative efforts involving staff and scientists from the utilities, consultants, staff from regulatory agencies, as well as independent scientific experts from academia. The scientists involved in formulating the plans for these studies have generally resisted calls to include sampling for a broad range of invertebrate larvae for several reasons. First of all, shellfish such as crabs and lobster go through multiple stages before developing into a larval form that can be identified to species. To address the issue of impacts on invertebrates many of these studies have included processing samples for later stage larvae of commercially important species. Another reason the studies have not included a broader suite of invertebrate larvae is the additional sampling needed to adequately sample the small earliest life stages of many of these species. The mesh used in most of these studies for sampling fish larvae is 0.33 millimeters or 0.01 inches. A common mesh size used for invertebrate larvae is a third smaller at 0.20 millimeters. This small mesh size creates enormous problems for sampling as the nets clog and become less efficient. Essentially, the only way to adequately sample all invertebrate larvae is to conduct a completely independent sampling effort. Finally, a broad range of invertebrates have not been included in the studies because the sampling efforts have been designed to include source water sampling that is used to estimate the proportional effects of entrainment on the populations. This estimate of proportional mortality can then be used to extrapolate impacts to life stages not included in the sampling. The same approach is used to account for entrainment of fish eggs which also cannot generally be identified to species. For example, sampling is used to estimate the proportional entrainment mortality for white croaker, a common species of nearshore fish. The estimates are based solely on data collected on the larvae of this species because the eggs cannot be identified to species. From other data on this species we know the number of days the eggs are planktonic and potentially exposed to being entrained. Therefore, when the total mortality due to entrainment is calculated for white croaker, the same proportional entrainment mortality estimated for the larvae is also applied for the number of days the eggs are exposed to entrainment. This same approach is used to account for entrainment of the earlier larval stages of invertebrates not included in the sampling. This approach and the underlying assumptions have been agreed to by all of the scientists involved in these studies.

SED pg 72 Issue 3.12 Interim Requirements Including Restoration

1. Limitations of habitat production foregone (HPF) the suggested approach for interim mitigation or the wholly disproportionate cost-benefit test.

The methodology proposed for scaling restoration projects in the SED is habitat production foregone (HPF) which has been used for impact assessments at several coastal facilities in California. An advantage of HPF is that it converts the somewhat abstract concept of larval entrainment mortality into the more tangible concept of habitat. Although HPF may be a useful model for visualizing or conceptualizing the magnitude of the impact due to OTC there are also several issues related to its interpretation and application. First of all, HPF estimates should not be interpreted literally. The HPF estimate is the size of an area that would be impacted if all effects were concentrated into a single site that received 100% larval loss. First, there is no such area, where all the larval fish died or where there is no recruitment. The effects of entrainment are widespread and diluted over a large area. Second, there is no coastal area that will have long-term impact due to OTC since no habitat has been degraded by the act of larval entrainment. While populations can recoup from the loss of individuals, habitat loss has a much longer lasting impact on a population. HPF is commonly associated with habitat loss rather than individual loss, and this is a misperception.

When interpreted correctly, HPF can provide a useful context for understanding CWIS losses, but there are also issues that need to be considered when using the method for scaling restoration especially across taxonomic groups. The calculations of HPF are dependent on estimates of the proportional mortality due to entrainment calculated using an Empirical Transport Model (ETM) that is usually modified to address the specific characteristics of the source water area being impacted. Consequently, the ETM and HPF need to be interpreted relative to the source water being used in the calculations. The ETM applies to the entire source water where the larvae occur, whereas HPF applies to the area of habitat used in production by adult fishes. For HPF this is the actual habitat occupied by adult fishes where production is occurring; especially important when evaluating cooling water intake system effects using HPF. Therefore it is critical to know the habitat used by adult fish that is necessary for production as well as having an estimate of the area of that habitat in the source water. Thus, while HPF provides another currency for representing losses estimated using ETM it requires additional information making it application problematic. It does not necessarily provide any additional insights into the potential significance of the losses to fish populations and in fact, can be misleading in cases where larvae may not have even been produced in any of the habitats located in the source water, in which case the entrainment losses may be having no effect on the population.

In almost all cases the larvae entrained will include fishes from a variety of habitats within the source water. For example, available habitats in embayments might include mudflats, eelgrass, deep channel, and hard substrate (natural or man-made) shoreline. The amounts of these habitats within the source water contribute differentially to the pool of larvae that could be affected by OTC. As indicated above, the use of HPF is especially problematic for fishes that do not have any specific habitat in the source water associated with production. For example, northern anchovy and Pacific sardine are commonly entrained fishes that release eggs into the water column. The eggs and the larvae can be transported into embayments even though the primary habitat for these fishes is in coastal areas. As a result, larval sources and adult habitat need to be considered in HPF calculations when the method is used to provide context for entrainment losses and when used to estimate the amount of habitat necessary to compensate for entrainment losses. When the source water body is a closed system such as a lake or bay, the average entrainment mortality across a range of fishes could be used to calculate an estimate of the amount of habitat necessary to compensate for CWIS losses. This is especially true if the source water was dominated by one type of habitat. But this is commonly not the case, especially when the method is used for scaling restoration to compensate for effects of entrainment at plants on the open coast where the larvae may come from fishes across a broad range of habitats that have been transported over long distances, and include many species that release eggs into the water column and thus have no specific habitat requirements for production.

Conclusions

Evaluation of the anticipated benefits of the State's proposed policy should be much more robust than what is presented in the SED. Twenty-one of the most common nearshore fish species are experiencing dramatic changes in abundance consistent with poleward biogeographic shifts resulting from the rising water temperatures associated with climate change. Previous changes to OTC use in the State were not evident in an examination of 37 years (1972-2008) of continuous fish monitoring. This strongly suggests that any future changes will result in similar negligible effects to the populations. Given this lack of an empirically derived benefit estimate, the further costs and benefits of the proposed policy need to be carefully weighed. These include effects from climate change and the subsequent effect on marine resources, alterations to beneficial flow regimes within enclosed bays and estuaries and the cascading effect on their water quality, impacts to sensitive species habitat through the reduction in thermal effluent, etc. Most distressing of these is the significant addition to the cumulative impact of climate change that will have pronounced effects on those species the policy is attempting to protect. The net increase in greenhouse gas emissions predicted from this policy could contribute to accelerating climate change, and thus further imperil the nearshore marine resources. This effect will override any benefit potentially realized from the cessation of impingement and entrainment. Furthermore, the analysis of greenhouse gas emissions needs a more thorough review in relation to recent State and Federal guidelines regarding emissions and climate change. The current draft policy fails to adequately incorporate the goals of AB32, or any of the remaining climate legislation and research, into its analysis. Along with reductions in bay/estuarine water quality at several locales, this policy will result in greater impacts than benefits to the local marine community.

Recommendations:

1. Over the past several years IM&E studies have been conducted at all of the LADWP coastal power facilities and most of the other power plants in CA utilizing OTC. These studies provide more data than has ever been available for assessing the effects of OTC and the potential benefits of implementing new state regulations. No analysis of these recent studies is provided in the SED which might have helped quantify the benefits of the policy. The only data from the studies are tables with the estimates of total entrainment and impingement.
2. The SED should consider OTC benefits in addition dis-benefits to accurately characterize the overall net benefit of the Draft Policy. The EPRI Report provided to inform the Rule should be considered and referenced as a source of information to inform Draft Policy benefits.
3. The basis for including 200 micron zooplankton in Draft Policy should be provided. Since this requirement makes most of the Track 2 entrainment technology options infeasible dropping this requirement should be considered.
4. The Draft Policy should incorporate the provisions of the Interim Report of the Interagency Ocean Policy Task Force published by the White House Council on Environmental Quality, especially in contrasting the Draft Policy's goals to reduce impingement and entrainment with the overarching goal of improved ocean ecosystem health. The trade-offs between reduced cooling water intake and the cascading effects on water quality through diminished circulation in enclosed bays and harbors as well as the increase in GHG emissions. Specific provisions include:
   - Policies should seek to prevent or minimize adverse environmental effects including cumulative effects
   - Improve our understanding and awareness of changing environmental conditions, trends, and their causes

Enclosure 2

P22/22

- Increase scientific understanding of the oceans and the global interconnectedness of air, land, ice, and water including their relationship to humans and their activities
- Decisions should be informed by and consistent with the best available science
- Supporting ocean stewardship in a fiscally responsible manner
- Human activities that affect the ocean (such as the Draft Policy) should be managed through an integrated framework that accounts for the interdependence of the land, air, water, ice, and the interconnectedness between human populations and the environment

A REVIEW OF THE PATTERNS IN SOUTHERN CALIFORNIA MARINE ZOOPLANKTNON AND FISH POPULATIONS IN RELATION TO OCEANOGRAPHIC CONDITIONS WITH CONSIDERATIONS OF ONCE THROUGH COOLING.

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Implicit in the current Draft Substitute Environmental Document supporting the State Water Resources Control Board's Water Quality Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Policy) is the assumption that cessation of once through cooling by California power plants will result in increases in local marine populations. To this end, two declarations made by Board staff require further examination to better estimate the net effect of the proposed policy. These declarations include:

1) Once through cooling causes an adverse environmental impact (AEI) on coastal populations (Pg. 28), and

2) The increased emission of greenhouse gases (GHG) such as carbon dioxide will have a "less than significant impact" (Pg. 101).

Item 1 is supported by two staff reports (CEC 2005; USEPA 2004). Neither document included reviews of long-term data on population trends in coastal fish populations that would have provided insights both into prior AEI and the potential benefits to be realized through the implementation of the State's proposed policy. Previous trends in fish populations are critical to this evaluation in light of climactic forcing, especially the effects of climate change, anthropogenic GHG emissions, and the ultimate effects of these factors on the rate of change (OPC 2007; WCGA 2008; CANRA 2009; AB32).

HISTORIC REVIEW OF PATTERNS IN COASTAL POPULATIONS - Critical to this discussion is the state of the nearshore zooplankton communities along the California coastline. Previous authors have documented a marked decline in the plankton biomass along the California coastline (Roemmich and McGowan 1995; Rebstock 2002; McGowan et al. 2003; Ware and Thomson 2005; Miller et al. 2009). This decline directly links to shifts in productivity realized since the 1977 oceanographic regime shift in the Northeast Pacific (Roemmich and McGowan 1995; Mantua et al. 1997; Ware and Thomson 2005). Within the Southern California Bight, zooplankton biomass has declined to a lower stable state since circa 1977 (Figure 1). When viewed in relation to OTC flow across the five facilities examined by Miller et al. (2009), no relationship was detected between flow and plankton biomass. Furthermore, after the startup of San Onofre Nuclear Generating Station Units 2&3 in the early 1980s, the source of the marked increase observed in Figure 1, OTC flow and zooplankton biomass indices have shown similar declines. This indicates that the operation of OTC and zooplankton community dynamics were unrelated. A lack of any prior relationship between zooplankton and OTC suggests that any future alterations to OTC use, such as its cessation, will not result in a corresponding change in the zooplankton community. Given that all prior analyses of zooplankton in the Northeast Pacific have linked its population dynamics to oceanographic forcing, including those parameters most closely monitored in relation to climate change, it appears that the future of zooplankton communities in the area are contingent upon future climate change factors. Such factors include ocean acidification, which may be the cause of the perceived declines in the mean individual copepod size (McGowan et al. 2003) as the species composition has remained relatively stable (Rebstock 2001) and the populations of various copepod species have varied (Rebstock 2002) while the plankton biomass has declined. Historic patterns in zooplankton communities, both nearshore and throughout the Northeast Pacific are critical to this evaluation in light of their dependence on oceanographic forcing, specifically climate change impacts, especially the effect of anthropogenic GHG emissions and their effect on the rate of change (OPC 2007; WCGA 2008; CANRA 2009; AB32). Their past relationship to OTC and climactic forcing are the best indicators of what can be expected with the passage of the State's draft policy.

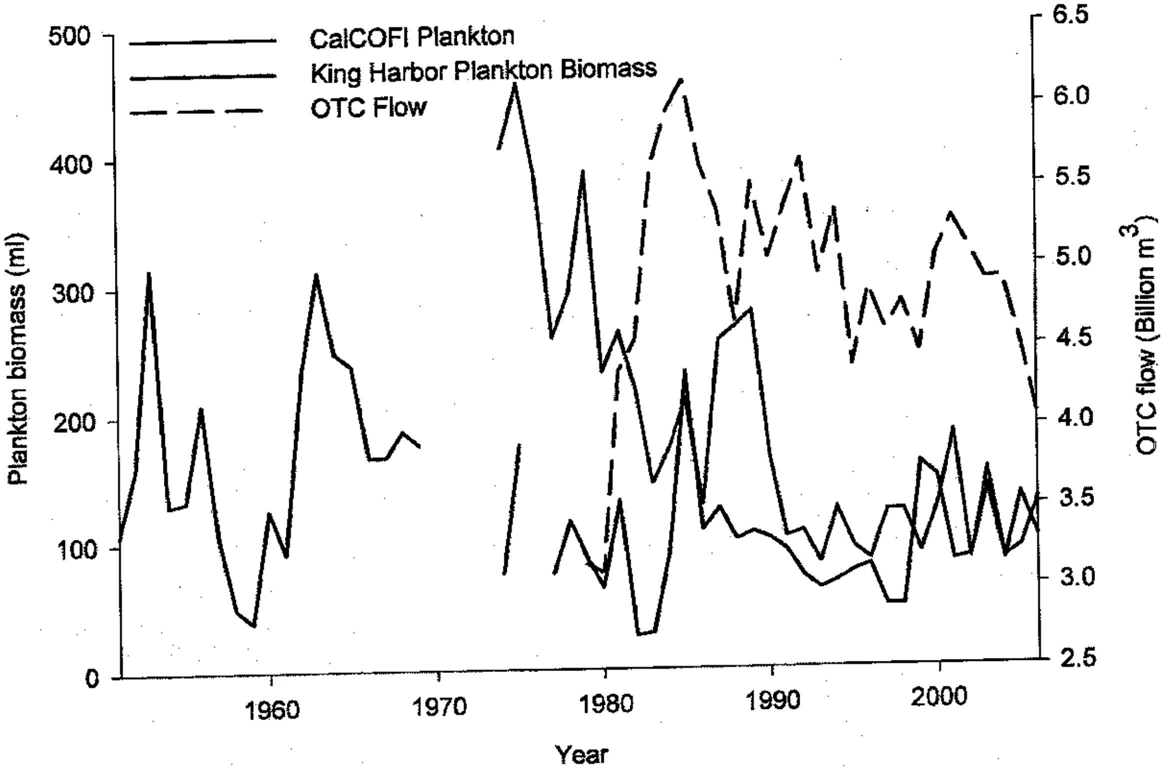

Figure 1. Plankton volumetric biomass (ml) recorded by California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises; in King Harbor, Redondo Beach adjacent to the Redondo Beach Generating Station Units 7&8 intake structure; and the total OTC flow in billion cubic meters for the five facilities analyzed by Miller et al. (2009).

Previous studies by Daniels et al. (2005) on the long-term trends in the Hudson River fish assemblage, the site of much of the founding arguments regarding environmental impacts of OTC, are insightful for this process. Their analysis recorded shifts in the species common to the assemblage. Changes were attributed to a suite of factors, including: invasive species, such as the zebra mussel and non-native fishes; effects of land-use practices; urbanization; non-point source pollution; and global warming (climate change). Many of the Hudson River fishes that declined were typically associated with cooler waters and/or had a more northern biogeographic distribution. Those species that were increasing were the opposite, preferring warmer waters. The effect of urbanization, land-use practices, and global warming had lead to warmer waters that were presumably less suitable to the traditional, cooler water affinity species. Prior reports in California have identified AEI based on brief studies lasting less than a decade, anecdotal evaluation, and expert opinion (Foster 2005; CEC 2005). All lacked a review of empirical datasets with greater than 10 years of consistent monitoring. The most robust study cited by CEC (2005) was the Marine Review Committee studies of San Onofre Nuclear Generating Station (SONGS) during the planning and construction of Units 2 and 3. These studies occurred in the late 1970s through the early 1980s. This was a period marked by dramatic oceanographic change, most important of these being the 1977 oceanographic regime shift (Roemmich and McGowan 1995; McGowan et al. 2003) and the 1982-1983 El Niño. The regime shift was unidentified until the mid-1990s. Its biological impacts are still being evaluated, but it caused demonstrable changes in the marine communities, especially the plankton assemblages that form the base of the marine food web.

A review of fish populations based on power plant impingement monitoring, and comparison to other available fishery-independent data such as the California Cooperative Oceanic Fisheries Investigation (CalCOFI) plankton surveys, establishes a 37-year timeline of fish populations along the southern California coastline. The impingement data is derived from five facilities with open coast, velocity-capped intakes ranging from Ventura to San Clemente, California. Details on the analysis techniques are available in Miller et al. (2009). Analysis of this dataset provides keen insight into the principle stressors acting upon the coastal marine fish populations. Miller et al. (2009) found queenfish abundances to vary spatially among several sites repeatedly sampled over an 11-year period within the Southern California Bight. The pattern exhibited by queenfish populations were found to significantly follow that observed in nearshore plankton biomass, which has been previously described (Roemmich and McGowan 1995) as a clear indicator of oceanographic conditions. The decline in both communities, queenfish and plankton, has been in response to the environmental conditions present after the 1977 regime shift. Moreover, the pattern in each community shows no indication of any alteration in the area due to OTC, such as the startup of San Onofre Nuclear Generating Station Units 2&3 or the progressive decline in OTC water flow in southern California. Lastly, while entrainment has been frequently identified as a principle vector for the reported impact of OTC, the queenfish larval densities have continued to decline in King Harbor in samples taken adjacent to the Redondo Beach Generating Station Units 7&8 OTC intake structure (Miller et al. 2009; Figure 2). In fact, there is a positive significant relationship between cooling water withdrawals and larval queenfish densities. All of these patterns described for queenfish were further consistent with the CalCOFI results across their entire sampling area. These empirical data demonstrate that queenfish populations are variable and susceptible to environmental forcing, specifically factors that impact coastal productivity in the zooplankton community, the major prey source for queenfish. Given that previous changes in OTC use in California were not evident in the queenfish population indices, it is unlikely that any future cessation of OTC would measurably benefit the population dynamics. Furthermore, any procedures that would accelerate the alterations to oceanographic conditions currently observed would further weaken the queenfish populations.

While the analysis of queenfish is demonstrable, investigation of a greater array of species reveals further insights. The croakers, of which queenfish is included, provide an even greater overview of the population patterns, including analysis in relation to oceanographic conditions and commercial fishing effort. This amounts to a cumulative impact study in a more true sense since it encompasses OTC as well as other potential significant sources of variation. All seven croaker species are impinged by the five coastal plants analyzed, but in highly variable numbers. The population indices range from 905.1, on average, for queenfish to 0.8 for white seabass. Entrainment sampling, recent and historic, has recorded few croakers other than white croaker and queenfish, although spotfin croaker and black croaker were both abundant offshore of Huntington Beach Generating Station in 2004. Cumulatively, the croakers accounted for 6% of all entrainment recorded at four of the five power plants analyzed by Miller et al. (in review). While the differences in the impingement abundances vary by greater than three orders of magnitude, on average, the species exhibited remarkable similarity in their historic patterns, consistent with oceanographic forces and commercial fishing practices regulating their populations (Figure 3). Most notably was the depressed period in nearly all species circa 1982-1995, or the period during which the nearshore white croaker gill-net fishery operated (Miller et al. in review). The data suggests this fishery, as either bycatch or the targeted species (queenfish and white croaker), influenced all seven species' population. After the fishery's closure in 1995, most species remained depressed while spotfin croaker and yellowfin croaker increased. Comparisons with sea temperature, or a similar index such as the Pacific Decadal Oscillation or North Pacific Gyre Oscillation, recorded significantly negative relationships between a temperature index and four of the seven species while spotfin croaker and yellowfin croaker

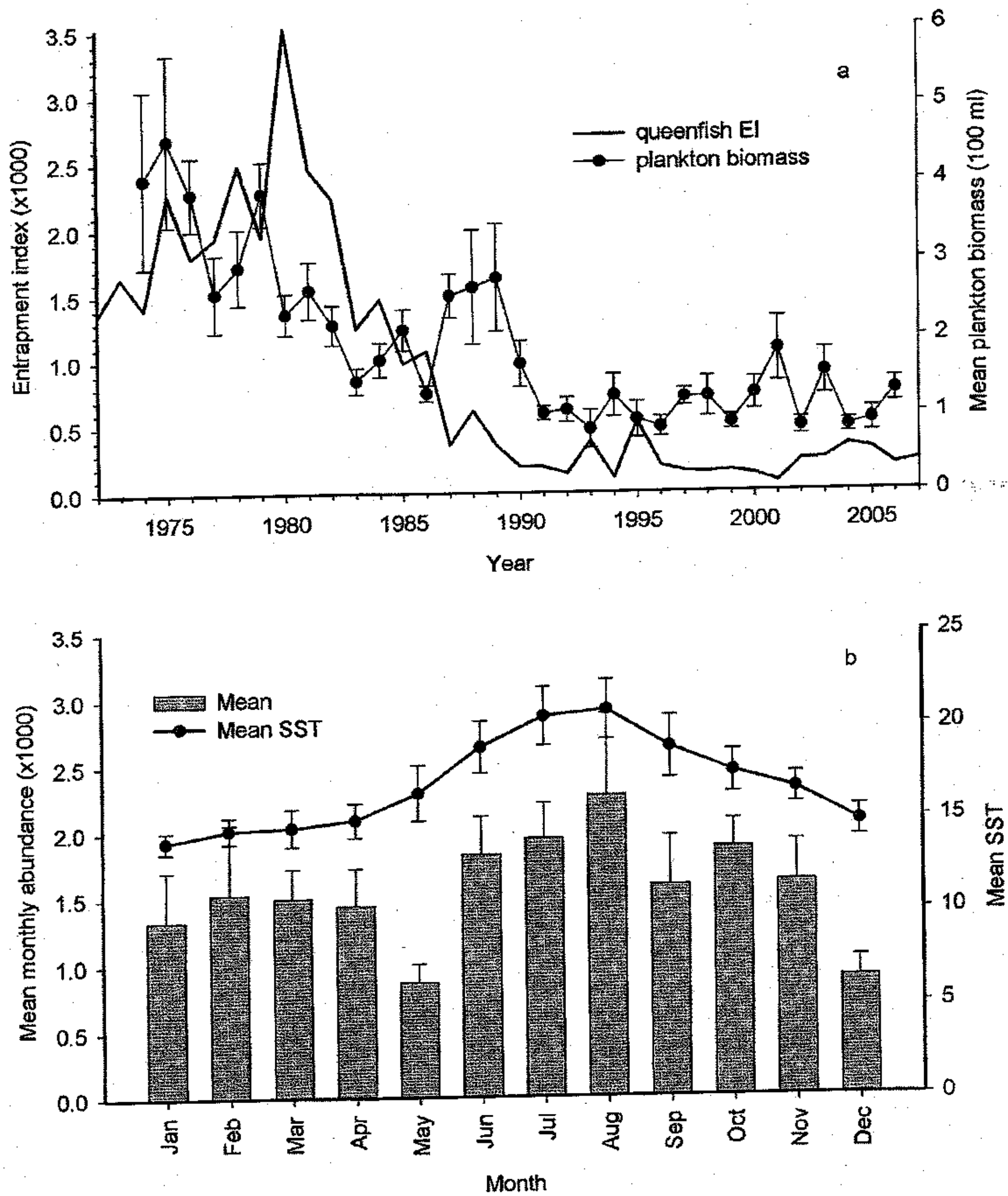

Figure 2. a) Queenfish standardized entrapment abundance at Ormond Beach Generating Station (OBGS), El Segundo Generating Station (ESGS), Redondo Beach Generating Station (RBGS), Huntington Beach Generating Station (HBGS) and San Onofre Nuclear Generating Station (SONGS). Ormond Beach Generating Station sampling period (1979-2007) was shorter than the remaining sites (1972-2007). b) Mean monthly entrapped abundance at SONGS (1984-2007) and mean monthly sea surface temperature (SST) recorded at Newport Beach Pier (1984-2007). (Figure from Miller et al. 2009).

were positively related to the temperature parameters. White seabass was not related but was also heavily impacted by the commercial gill-net fishery (Allen et al. 2007). Seawater temperatures worldwide, and especially along the west coast of North America (McGowan et al. 1998), have been increasing over time with most researchers linking this increase to anthropogenically-forced (GHG emissions) climate change (Bindoff et al. 2007; OPC 2007). Additionally, several researchers have observed poleward biogeographic shifts in populations (Murawski 1993; Genner et al. 2004; Perry et al. 2005), including marine bird and fish species from California (Veit et al. 1996; WCGA 2008; CANRA 2009; Hsieh et al. 2009). The southern California croakers are clearly following this pattern with the cooler-water species such as queenfish and white croaker declining in local abundance to less than 15% of their 1970's levels while yellowfin croaker and spotfin croaker increasing to 3,553% and 355%, respectively, of their 1970's level (Miller et al. in review; Figure 3). In addition to the significant relationships observed with temperature indices, four of the seven species were significantly related to the nearshore plankton biomass trend described in Figures 1 and 2 as well as Miller et al. (2009).

Patterns in the croaker populations observed over the last 37 years, especially their similarities to oceanographic conditions and zooplankton biomass, provides further insight into what may be expected from the implementation of the State's draft policy. Like the queenfish analysis, changes in OTC were not evident in the croaker population analysis. Furthermore, the correspondence between the populations and oceanographic conditions, specifically seawater temperature, pose the greatest concern. The observed shifts from cool water croakers (white croaker and queenfish) to more warm water species (yellowfin croaker and spotfin croaker) indicate that further acceleration of climate change impacts, such as rising seawater temperature, will allow for the increase in the warm water croakers while the cool water species become much more rare, if not extinct, in the area. A lack of prior indications of OTC change evidenced in the croaker dynamics indicates that no future changes to OTC, such as it cessation, will result in a measurable change in the population. Increased GHG emissions, however, will contribute to accelerating climate change which has already had a pronounced effect on the croaker populations.

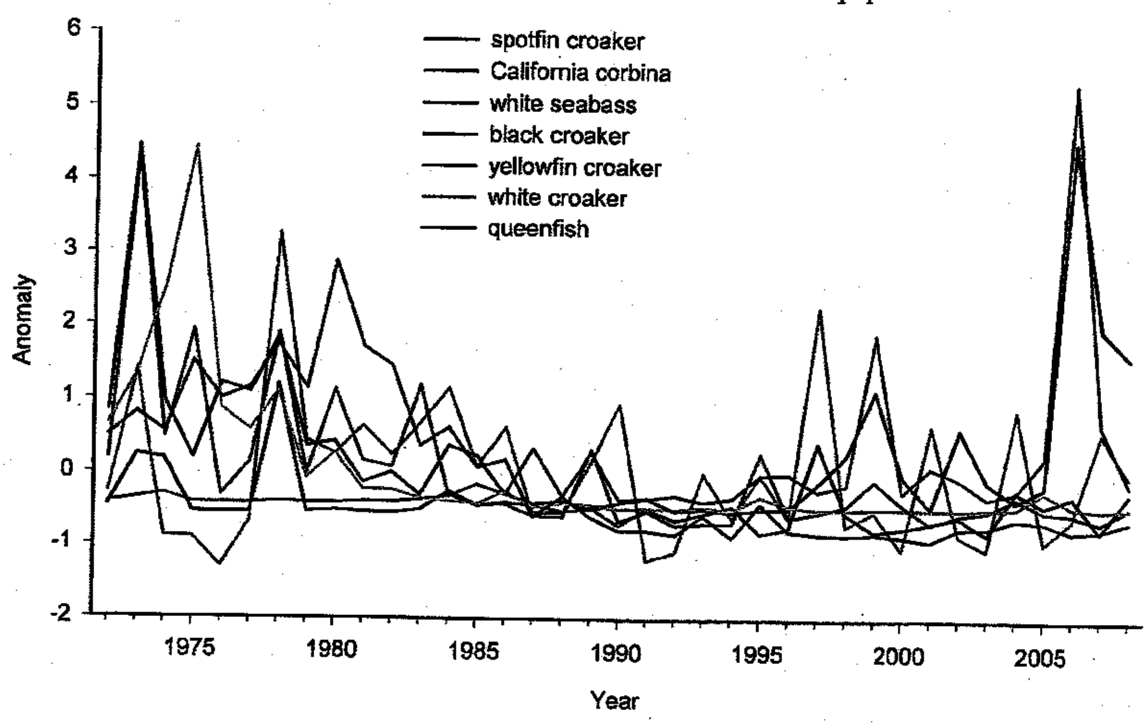

Figure 3. Index anomaly (z-score; deviation from the mean ± 1 standard deviation) by sciaenid species for the entrapment index (EI; 1972-2008). (From Miller et al. in review).

To ensure as complete coverage to all marine fish species, evaluation of a wider selection of species should illustrate the more comprehensive dynamics of the interaction between OTC and the coastal environment. Twenty-one species cumulatively represent 98% of all impinged fishes recorded at the five facilities examined. These include both forage and fished species (recreational and/or commercial). Their patterns further illustrate a defining pattern of oceanographic forcing with no clear relationship to changes in OTC use. These observed patterns are consistent with more extensive longer term studies, such as the CalCOFI program, which further support their use as an index of the population parameters. Each of the 21 species were compared to a suite of oceanographic indices, all of which have some indication to coastal productivity and/or temperature, including: sea surface temperature, seafloor temperature, Pacific Decadal Oscillation, North Pacific Gyre Oscillation, and nearshore plankton biomass. Of these 21 species, nine peaked during or before 1980, three from 1981-1990, while 10 have increased since 1990 (Figure 4). Furthermore, nearly all those species with declining patterns prefercooler-water conditions (Miller 2007) or have biogeographic ranges extending further into more northern latitudes. Those species that are increasing have warmer thermal tolerances and preferences and/or are geographically distributed across more southerly latitudes. A specific example is the decline observed in northern anchovy and corresponding increases in Pacific sardine. This dynamic has been well documented, most recently by Chavez et al. (2003), and has been indicative of the oceanographic climate for millennia, based on analysis of sediments from the Santa Barbara Basin. Northern anchovy is common in cooler water periods in southern California, while Pacific sardine is more common in warm water regimes, such as that beginning in 1977. These data clearly show that while the rising seawater temperatures, and associated effects of climactic forcing, has driven down the abundance of cool water-affinity species, a corresponding rise in warm water affinity species has occurred. The overall community has declined due to the significant proportion of the historic catch constituted by white croaker and queenfish. As with the croakers previously discussed, there is no representation in the population trends of these 21 species to indicate that any changes related to OTC use have occurred since 1972. The lack of such an indication in the past suggests that any future changes, such as cessation of OTC use, will not result in a positive response on the part of these species, including those targeted by recreational or commercial fisheries. A cessation of OTC use in California will not result in greater fishery yields. Moreover, the consistent relationship between these species and oceanographic indictors of climate change, namely seawater temperature, clearly indicate that the nearshore fish populations will continue to shift towards a warm-water fauna. Increased GHG emissions will continue to accelerate climate change, and thus the transition from the fauna common to the Southern California Bight since at least 1972 towards a fauna more common to the Baja California coastline, and further south. This includes most commonly targeted fishery species, such as barred and kelp bass, white seabass, northern anchovy, etc.

The empirical results depicted in Figure 4 correspond with annual larval densities recorded by CalCOFI for all red and blue colored species, where data is available (Moser et al. 2001). This confirms that the patterns observed in Figure 4 are, in fact, representative of the overall population patterns. As stated previously, past performance is the best predictor of the future. In this case, the lack of an OTC-effect on the coastal populations in the past indicates that cessation of its use in the future will not result in a net population increase.

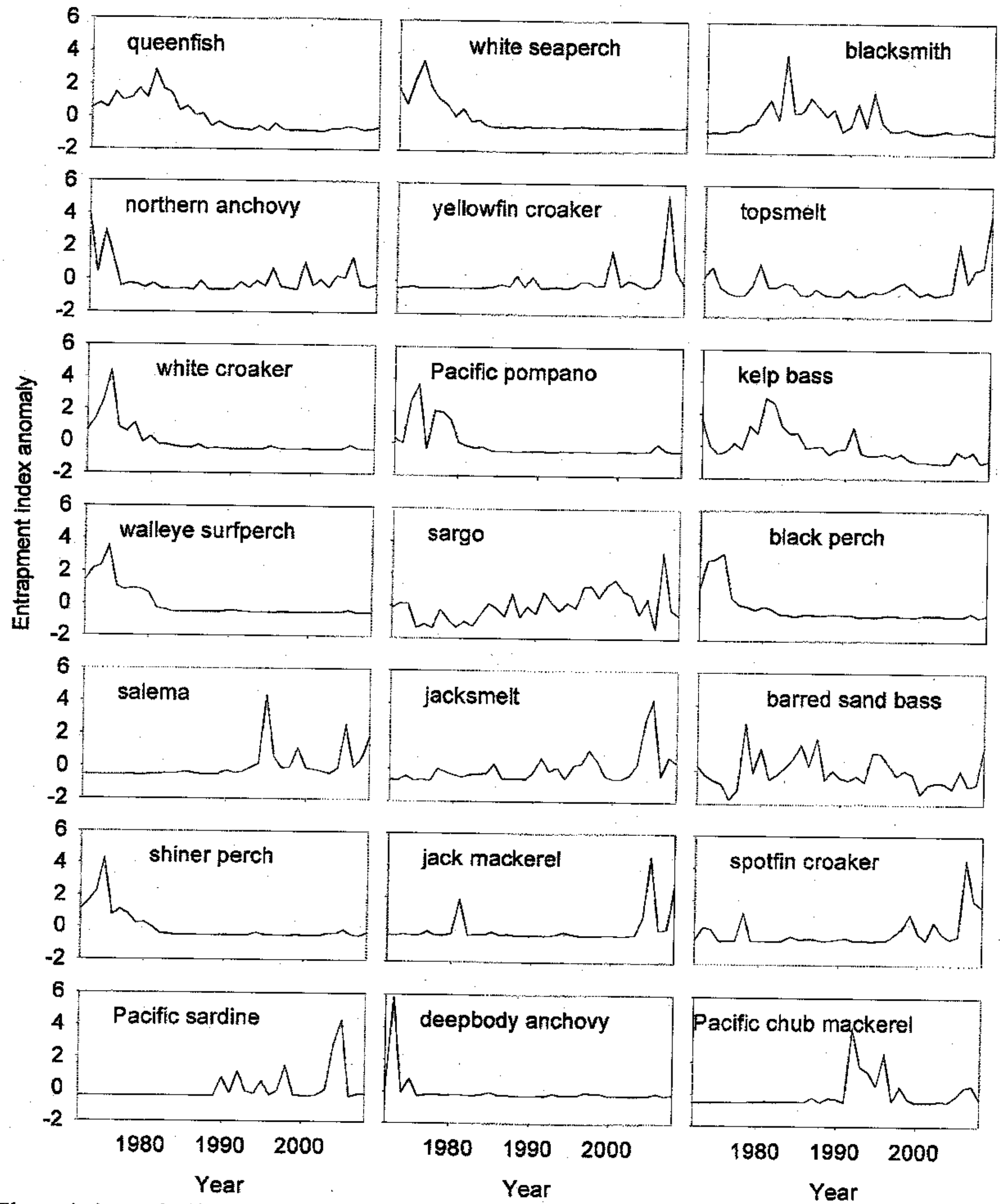

Figure 4. Anomaly (deviation from the mean ± 1 standard deviation) in the populations of 21 common southern California marine fishes which represent 98% of all fishes impinged. Blue color represents a significant ($p < 0.05$) negative correlation with seawater indices. Red color indicates a significant positive correlation with seawater indices. Black indicates no correlation at the $p = 0.05$ significance level.

EFFECT OF INCREASED GREENHOUSE GAS EMISSIONS - As shown in Figures 3 and 4, a substantial portion of the species interacting with OTC have responded to changing water temperatures in the Northeast Pacific. Previous reports from numerous authors (Murawski 1993; Veit et al. 1996; Genner et al. 2004; Perry et al. 2005; Hsieh et al. 2009; Noakes and Beamish 2009) have documented similar responses to rising seawater temperatures throughout the world's oceans. Furthermore, the connection between rising seawater temperatures and anthropogenic GHG emissions has also been well documented by both State (OPC 2007; WCGA 2008; CANRA 2009; AB32) and Federal (USGCRP 2009a,b) agencies as well as international bodies (IPCC 2004; Bindoff et al. 2007). Ultimately, recent reports (CANRA 2009; USGCRP 2009b) unequivocally link the currently accelerating climate change to anthropogenic GHG emissions. In light of these robust findings, the policy's finding of "less than significant" for an increase in GHG emissions from the second largest emitting sector in the state without any supporting data is scientifically questionable. The empirical data on fish population patterns and their response to rising seawater temperatures, which are ultimately driven, in part, by anthropogenic GHG emissions clearly indicate that the policy will likely result in further depressed populations of species associated with cooler water conditions (blue in Figure 3) while the species associated with warmer conditions (red in Figure 3) will continue to increase in the southern California area. The increase in warmer water species, however, cannot be sustained with ever-increasing seawater temperatures as their poleward expansion continues. The "less than significant" finding is not consistent with the scientific information currently available. Nor is it consistent with recent government reports on climate change and its effect on coastal resources as well as adaptation and management plans designed to alleviate or mitigate these climate change effects.

Ultimately, the State's draft policy is designed to reduce the impact of power plant operations on the coastal marine species. It is assumed that the loss of marine life to OTC use is causing an AEI which can most be readily alleviated by the cessation of OTC use. Whether or not an AEI is occurring as a result of OTC use, the direct loss of marine life by the cessation of OTC use will occur. The principle question is will the State's draft policy result in a net benefit to the coastal marine resources. When evaluated in total, the answer is no due to the dramatic increase in GHG emissions that will result from the conversion to a less efficient technology. As previously stated, various regulatory and scientific agencies have determined that anthropogenic GHG emissions, including that from power plants, are accelerating climate change to previously unseen rates. These changes are felt by the marine species through the variety of modifications to oceanographic conditions, specifically water temperature, upwelling, nutrient concentration, ocean acidification, etc. All of these impact primary productivity which directly influences all subsequent parts of the marine food web. The empirical data clearly shows the marine resources of California, and the world, are shifting poleward in response to rising seawater temperatures. As written, the State's draft policy on once through cooling will force significant increases in GHG emissions statewide. This, especially in light of AB32 and other pending State and Federal legislation, cannot be considered "less than significant".

SUMMARY – Analysis of 37 years of fish monitoring, and its comparison to more prevalent studies such as CalCOFI, have clearly illustrated the patterns exhibited by California's coastal marine species. These communities have consistently responded to oceanographic forcing, often factors indicative of anthropogenically-accelerated climate change. Examination of the past population patterns has not revealed a relationship to OTC use in California. This lack of a demonstrable relationship to past operations clearly raises doubt as to the benefit of OTC cessation in the State. There is no empirical evidence that cessation of OTC will result in any change, positive or negative, in the nearshore populations. While cessation of OTC will not affect the populations, the Policy will increase GHG emissions State-wide. Based on the past relationship between populations and climate change-driven oceanographic conditions, such as seawater temperature, any benefit resulting from OTC cessation will be overwhelmed by the negative impact of the increased GHG emissions. The effect of these increased emissions will impair all marine populations, likely driving species such as white croaker and white seaperch to near extinction in the Southern California Bight. The net benefit of the State's policy will be a substantial contribution to the systematic decline of marine resources in California and around the world.

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