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Comments on Scoping Document – Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling

Prepared by David E Bailey
EPRI
dbailey @epri.com
Prepared for Dr. Michael Foster
Coastal Solutions Group
mfoster@mlml.calstate.edu
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Per instructions, these comments are organized into three Sections that include:

1. Comments Related to Questions
2. Other Scientific Issues
3. Comments on Policy

It is not EPRI's role to provide recommendations on Public Policy per se. Rather, as a research organization, EPRI focuses on the technical information necessary to inform good public policy making. To that end comments are offered on technical issues that the Board may want to consider relative to the proposed §316(b) Policy as reflected in the Draft Scoping Document.

Preliminary comments on the Draft Scoping Document (Scoping Document) were provided to you in an email dated April 9, 2008. Based on the discussions held at our meeting in Sacramento and further review of the Scoping Document and other information these comments are updated.

Comments Related to Questions

The questions below are the revised questions provided in your April 14, 2008 email.

1. How will baseline be defined for:
a. Track II?
b. Interim restoration?

Response - The questions seek comment on credits for existing technology controls and restoration measures for use under Track 2. The following preliminary comments are offered:

- Track 2 as described in the draft Policy requires the that the following parameters be satisfied:

- demonstrate Track 1 infeasible,
- reduce impingement mortality and entrainment to within 90% of that achieved through wet closed-cycle cooling,
- organisms to be excluded include zooplankton 200 microns or larger in size,.
- the 90% reduction must be made from current facility operations and.
- monitoring as specified in Section 4 of the Draft Policy is required.

EPRI has conducted extensive research on alternative fish protection technologies and operational measures. This has been the single largest area of research for EPRI's Fish Protection Program since the Phase II Rule was issued in 2004. EPRI is not aware of any currently available technology or suite of technologies that can meet the Track 2 requirements for California's coastal generating stations. There are a couple of emerging technologies that potentially could achieve Track 2. However, this is not likely to happen in a timeframe set in the Draft Scoping Document for low capacity fossil units.

One of the major components of currently available technologies is either being able to exclude or collect the organisms. This is extremely difficult with a 500 micron (0.5 mm) screen size but is considered to be infeasible for a 200 micron (0.2 mm) screen size. In the absence of a technically feasible Track 2 alternative, the bottom line is that, as written, this would be a single track Policy.

Assuming that the requirement for a 200 micron screen size was deleted and facilities were only required to protect fish and shellfish eggs and larvae Track II would still be problematic. EPRI participated in preparation of two CDS documents to satisfy regional Water Board NPDES Permit requirements for SONGS and Huntington Beach. Each of these facilities has offshore intake structures with velocity caps. A variety of alternative fish protection technologies were evaluated. For both facilities narrow-slot wedgewire screens, other than closed-cycle cooling, was identified as the best performing technology. The estimated performance for narrow-slot wedgewire was estimated to be approximately 61% for Huntington Beach and approximately 75% for

SONGS. The difference was due to the size of the dominant larvae entrained. At Huntington Beach very small gobies (2-4 mm) predominated while for SONGS larger anchovies (9 mm and larger) dominated. While the level of performance was estimated to be within the range of the Rule and previous draft Policy for technologies, they are not expected to achieve a level of performance within 90% of Track I.

It is also important to point out that actual performance could vary from the preliminary estimates and pilot studies would be required to provide more accurate performance estimates. To the extent that such technologies are allowed in the Policy, it would be important to allow time for such pilot studies. In order to construct the pilot study test device and allow for two years of testing to capture some of the expected annual variability for dominant species and life stages, two and a half to three years would be required to verify actual performance.

- Technically there is no reason why facilities should not receive credit for existing technologies and operational measures and/or restoration measures under the Policy. However there are a number of considerations in terms of setting the baseline. The Rule used a "calculation baseline" approach based on factors that included:

    - 3/8 inch mesh traveling screens;
    - cooling water intake structure at the shoreline;
    - screens oriented parallel to the shoreline and
    - opening of the intake structure at or near the surface of the water.

  The calculation baseline assumed no fish return and therefore complete mortality of all impinged organisms. There were additional factors discussed in the definition of the "calculation baseline". One of the topics not explicitly clarified in the Rule was whether or not the calculation baseline was based on design or actual flow. The Scoping Document currently proposes reductions from actual flow. This was a topic discussed at the meeting with the Board Staff on April 9th. There are a number of technical points that can be considered for using design flow as the calculation baseline that include:

1. There is a direct relationship between flow and entrainment. Facilities/units that operate at low capacity factors use significantly less once through cooling water and therefore entrain significantly fewer organisms. Therefore a Policy based on design flow would create a level playing field in terms of the current level of entrainment and the amount of impingement mortality and entrainment that is necessary to achieve the a level of performance commensurate with wet closed-cycle cooling. However as cautioned at the meeting, to be technically correct, the Policy would need to consider the period of the year when the cooling water pumps are operating, since densities of entrainable life stages vary over the course of the year.

2. The facilities/units with low capacity utilization tend to be old and less economical (i.e., the reason for low capacity utilization) and are therefore least likely to be able to bear the cost of retrofitting (i.e., comply with Track 1) and, therefore, are at high risk of early retirement under the current proposed Policy. While they operate infrequently, their generation is critical to maintain adequate reserve margin and ensure peak power demands are met. Use of a design flow calculation baseline for these low capacity facilities would preserve this low capacity generation for use when needed to maintain electric generation reliability and recognize the relatively low level of entrainment. Note that the Phase II Rule exempted facilities with capacity utilization less than 15% from meeting the entrainment performance standard due to the significantly lower impact and the uneconomical nature of such facilities in terms of being able to bear the cost of compliance with the entrainment reduction standard.

3. For California's facilities with higher capacity utilization, but not baseloaded, use of design flow would make it possible for many of these facilities to consider use of Track II, if Track II did not require protection of zooplankton 200 microns in size. However, the baseloaded nuclear facilities would still not be able to comply using Track II.

- Another technical consideration relative to the calculation baseline is the method to be used to quantify the credit for technologies and/or operational measures. For the six facilities with offshore intakes, all have installed velocity caps for the purpose of fish protection. Performance was previously quantified using reverse flow studies in which cooling water was withdrawn using the discharge pipe with no velocity cap and discharging through the intake pipe. These studies, conducted at several

facilities generally indicated that the velocity cap could achieve a level of performance within the 80% to 95% range required by the Rule. A recent reverse flow study at Scattergood was quickly terminated due to the large number of fish being lost during the tests without the velocity cap. However, enough data was collected to verify a high level of performance for dominant species. For SONGS it would not be feasible to do a reverse flow study due to use of thermal diffusers on the end of the discharge pipe. However, SONGS also deploys a fish collection and return system in addition to the velocity cap and between the combined technologies a level of performance in the upper end of the Rule's impingement mortality range is indicated. The bottom line is that continuing reverse flow velocity cap studies could result in high levels of impingement mortality and, therefore, the Board Staff may want to consider options allowed in the Phase II Rule that included the option of estimating the calculation baseline credit using:

- historical studies
- studies conducted at other similar facilities
- estimates based on source waterbody fish data or
- new studies.

2. Have current, statewide and individual power plant impingement and entrainment impacts been correctly estimated?

Response – There are technical deficiencies in the presentation of impingement and entrainment estimates. Specific deficiencies are as follows:

1. Basis of estimates – It is not clear from Tables 8 and 9 what numbers are being presented. Is it the number of organisms collected during the study, annual estimates based on design flow or annual estimates based on actual flow. Presenting the annual estimates based on actual flows using the most current data would be extremely informative. It would make estimates transparent and it would demonstrate the relationship between current facility operations and the level of impingement and entrainment. This would also help support whether or not a Policy based on design versus actual flow was technically supportable as well as the timing of expected benefits under the schedule.

2. Presentation of Impingement versus Entrainment – Tables 8 and 9 are not very helpful to the public in terms of understanding the differences between impingement

and entrainment numbers and the estimates are best presented separately. Impingement numbers represent juvenile and adult fish with relatively low naturally mortality rates. Presenting results in the number of individuals and biomass makes sense for impingeable size organisms. Presenting annual entrainment estimates is somewhat misleading, since it counts the earliest larval stages the same as the largest larval stages that have significantly lower natural mortality rates. The point is that the vast majority of the early larvae stages will suffer natural mortality regardless of entrainment and, therefore, protection of that larval life stage will not provide the same benefit as protecting the largest larvae. I realize that data is not currently available to estimate equivalent adults or production foregone estimates for many key species; however, some explanation of this in the text would be helpful in putting the numbers in perspective for the public.

3. Zooplankton – The Scoping Document is particularly deficient on the topic of zooplankton. While the draft document attempts to summarize fish and shellfish impingement and entrainment, no information is presented for zooplankton. None of the PICs submitted to Regional Water Boards included provisions for sampling zooplankton and I am not aware of any Regional Water Boards that suggested zooplankton should be monitored. Protection of zooplankton was not included in the federal rule and EPA commented this was due in part to their relatively short reproductive life cycle. EPRI is aware of a number of studies that indicate high survival rates for zooplankton. Since this is a major factor in rendering alternative fish protection technologies infeasible under Track II, the technical basis for supporting their inclusion in the Scoping Document should be provided. This should include the technical basis for specifying zooplankton 200 microns in size. r

3. Are the proposed interim controls effective and feasible to prevent mortality and reduce takes of wildlife?

a. Tetrapod exclusion screens?
b. Flow reduction?
c. Restoration?

Response - Three interim control measures are proposed. Each is discussed separately:

Screening for Offshore Intakes – In order to prevent ocean or source waterbody debris in the form of trash, vegetation, etc. from clogging condenser tubes, all power plants use screens and a mechanism to remove the material collected on those screens. All of California's generating facilities accomplish this through use of traveling water screens. The problem with stationary screens is that unless there is some mechanism to remove the debris from the intake, over time the intake will become clogged preventing adequate cooling water from reaching condensers. The result would be either damage to facility systems or shutting down the facility until the debris can be removed. The

frequency of clogging is not known, but is likely to be relatively frequent for a facility such as San Onofre that is located in close proximity to large kelp beds. This could also result in a nuclear safety issue for SONGS.

One option could be manual cleaning using divers. However, there are safety issues with this option, since debris loading is often most severe during storm events when hydraulic forces uproot aquatic vegetation or re-suspend debris that has settled out of the water column. Since it would not be possible to safely remove such debris manually during such events, these periods in particular could result in plant shutdowns.

It is also noted that the Staff have specified use of 4 inch mesh screens. Does the Staff have a basis for specifying 4 in mesh and does the Staff have a basis for specifying this as the only method for reducing entrainment of marine mammals and turtles in the cooling system? At the meeting in Sacramento it was stated that Seabrook, on the east cost, had installed screens to exclude marine mammals. I have been able to determine they are not screens but rather steel bars spaced 5 inches apart. Seabrook's intake is located 7,000 ft offshore, 10 ft off the bottom in 60 ft of water which is significantly further offshore and in much deeper water than California's offshore intakes. Additionally there are no significant debris problems in the form of kelp beds and therefore, use of the bars to exclude marine mammals is possible for this facility.

Flow Reduction after 48 hrs of No Power Generation – It is likely that under a Policy based on use of design flow as the calculation baseline there would be a strong incentive for installation of variable speed drives, regardless of whether it was a requirement in order to meet the Track II standard to reduce entrainment within 10% of what would be achieved with closed-cycle cooling.

Interim Restoration Measures – A few questions/comments are offered relative to the Draft Proposal:

- Use of restoration measures are referred to as an interim requirement. However, for fossil facilities, based on a Final Policy at the end of 2008, allowing a year to submit the implementation plan specifying the restoration measures, allowing time to identify and scale a project, obtain necessary permits, construct the project and have it be ecologically productive is not likely to occur before the 2015-2018 time frame when full compliance is required. Therefore, this would be more appropriately identified as a requirement in addition to Track 1 or Track 2 for these facilities rather than as an interim measure.

- Use of the term "interim" restoration measures also suggests compensation of impingement and entrainment losses between the time the Rule goes into effect

and the period when full compliance is achieved. However, the examples given in the preamble of the Policy suggest that restoration projects would be scaled to fully offset annual losses that would occur well into the future. If that is the case, the draft Policy is requiring facilities to offset losses both through technologies and through use of restoration.

4. For Track I, are adverse impacts associated with conversion to closed-cycle cooling adequately considered?

Response - EPRI is in the process of completing a major research project to identify and quantify the adverse environmental and social impacts associated with closed-cycle cooling. This report will be available at the end of April and will be submitted to EPA to inform the Phase II Rulemaking. The interim report, being submitted to EPA by May 1st, provides a strong focus on California facilities as a result of the recent work on closed-cycle cooling done by EPRI and Tetra Tech. This report should be informative to Board Staff in discussing some additional impacts not covered in the current analysis and quantification of impacts for a number of important parameters.

There are some technical deficiencies in the current Scoping Document relative to closed-cycle cooling as follows:

- Energy Penalties – Table 13 presents energy penalties associated with wet and dry closed-cycle cooling systems as national averages. The mean-annual fuel percent plant output reduction is presented as 1.7%. However, in terms of human health impacts as a result of the increased fuel that will have to be used, this number will be significantly higher (i.e., up to ~5%) during hot summer periods. The reason this is important is that the energy penalty is greatest during the hottest times of the year which is when air quality is at its worst. Also, no estimate of the actual increase in air emissions as a result of the draft Policy is provided. Rather, results from hypothetical facilities for wet and dry cooling are shown and they are from different sized facilities.

- Dry Cooling – Dry cooling is required for re-powering under Track 1. However, the discussion of dry cooling impacts appears limited to the discussion of the energy penalty and the fact that they would require no make-up water for cooling. It should be mentioned that dry cooling generates more noise due to the use of fans and has a much larger footprint than wet closed-cycle cooling in addition to being more inefficient.

5. For Track II, should the proposed policies require monitoring appropriate to determine actual percent reductions in mortality?

Response - I would deter to other panel members regarding background biological performance monitoring.

However, the Board should be aware that *a priori* baseline studies may or may not be useful for evaluating technology performance. Examples of this point are as follows:

- For fish collection and handling technologies, any baseline study information would not be useful. Performance is based on percent survival. Therefore, performance monitoring for this technology would focus on verification that the impingeable and entrainable fish and shellfish are being collected and surviving at the point of return to the source waterbody. As a result, any information collected prior to installation would serve no useful purpose in the performance analysis.

- For exclusion technologies such as narrow-slot wedgewire screens or aquatic filter barriers, performance would be based on the level of exclusion achieved. This would best be measured based on the densities of organisms outside versus/inside of the exclusion device. Further, due to the difficulty inherent in quantification of impingement on the screens in the field, such questions would be best addressed in pilot studies prior to technology deployment.

- For flow reduction, performance could be based on percent flow reduction using the assumption of proportionality.

The bottom line is that the nature of the monitoring for technologies does not necessarily involve use of pre-technology deployment impingement and entrainment data. One of the primary reasons is that the inter-annual variability for species is so large. This is true both for the ratios of dominant species as well as changes in the presence of dominant species.The primary use of such data is to help inform the technology selection and design. However, as stated previously, the issue of Track II monitoring is moot with the current requirement to protect 200 micron zooplankton, since there are no currently available technologies that can achieve a level of performance within 90% of wet closed-cycle cooling.

6. Should restoration projects be monitored to determine compliance?

Currently, the most common form of restoration to offset entrainment losses is creation of coastal wetlands. However monitoring of such projects can be somewhat problematic. The problem is that the wetlands do not necessarily produce the same species or quantity of those species as may be entrained. Therefore, any consideration of wetlands or other forms of habitat creation must recognize this problem at the outset. The current approach to scaling identifies larval densities in coastal wetlands in close proximity to the proposed project and assumes that if similar wetlands are created then similar larval densities will be generated by the new wetlands. It is recognized that there is a lot of uncertainty regarding actual production, however, it is also recognized that the wetlands will provide significant other water quality and wildlife benefits that help offset this uncertainty. Therefore, the Policy may want to consider focusing on ensuring the amount and kind of wetlands that are produced, similar to Federal wetland mitigation monitoring requirements. Further, by the time these projects are in place and function properly the facilities will likely be in compliance with Tracks I or Track II (assuming Track II is modified to be feasible).

7. Should there be remediation if restoration does not comply?

This is a policy decision and no comments are provided.

Comments on Other Scientific Issues

Benefit of Once Through Cooling – At some facilities once through cooling is providing a water quality benefit by circulating water through wetlands that would otherwise become stagnant. Such examples include Alamitos, Encina and South Bay. A recent engineering study at Alamitos reported that reducing flow in the Las Cerritos is likely to cause additional fecal coliform problems.

Comments on Policy

Economic Impacts – Based on the age and economic efficiency of California's once through cooling facilities it is important to consider the implications of the proposed Policy to energy production and supply.

- **Economic Feasibility of Retrofits** – An important feasibility issue not addressed in a quantitative manner in either the EPRI or Tetra Tech study was the economic feasibility of closed-cycle cooling retrofits. Both studies focused primarily on documenting retrofit costs and engineering feasibility. Economic feasibility, however, is likely to be a significant issue for many if not most OTC generating units due to their age, current operating costs, and dispatch characteristics. This is particularly true for merchant generators that own the majority of the OTC units. California's facilities are generally older units and, as noted in

Table 19 (Issue Paper), have generally low capacity utilization due to current operational costs. A requirement to retrofit with closed-cycle cooling will result in higher operating costs and a further reduction in efficiency. In the Second Circuit Court's Riverkeeper II decision, one of the factors the Court said could be considered by EPA in determining BTA is whether or not the industry can bear the cost. EPRI is currently engaged in a national study to help answer that question.

Because of the availability of EPRI and Tetra Tech retrofit cost estimates for California's once through cooling facilities, the EPRI Phase I report to be provided to EPA by May 1st focuses on the financial impacts to California once-through cooling facilities. That report will be provided to the Board when it is completed. While still in draft, the analysis indicates ~20 units that generate ~6,300 MW are highly likely to shut down and an additional ~20 units that generate ~MW are somewhat likely to shut down. This outcome would also result in the loss of between 400 to 700 jobs.

In order for the once-through cooling units to install once through cooling they need to be able to recover the large capital investment. For the regulated companies (SCE, PGE and LADWP), approval to recover costs would come through regulatory action. For the independent power producers, a [new or revised] contract with the regulated companies or California ISO would be required. In granting cost recovery, approvals would consider the remaining life of the facilities/units and the additional decreased efficiency resulting from the retrofit. It is also important to consider that if approved, these companies will need to borrow significant funds up front to cover the costs of construction and lenders will also consider these same factors. Just as individuals vary in their ability to afford a major investment such as a house or car, so do the merchant power producers as a result of existing debt load and other financial commitments. Since there is no reason to assume a significant increase in energy demand, the capacity utilization for the retrofitted units would not be likely to change.

- Repowering versus Retrofitting - The Scoping Document seems to suggest that because a number of facilities and/or units are planning to re-power, including Humbolt Bay, El Segundo and South Bay, that all of the OTC units could do this. All of the same economic considerations apply to re-powering as discussed for wet-closed cycle retrofits. However, the capital investment required is much more significant and the time to recover the capital investment is more extended due to the variety of permitting approval required. While the re-powered units would be much more efficient, the cost to operate those units in the market would be significantly higher due to the need to recover the capital investment. The result is that there is no reason to assume that capacity utilization of the new units would significantly increase.

- Schedule – The proposed schedule seems somewhat problematic in terms of the overall objectives and the Board's directive to implement the Policy in a manner that will not affect energy production and supply. This observation is based on the following:

- The peaking facilities are required to comply first. However, these facilities are the most uneconomical and are least likely to be able to bear the cost of retrofitting. Therefore, their only other option would be re-powering. As noted in the Scoping Document, re-powering will require considerably longer than retrofitting and, therefore, those peak MWs would not likely to be available for more than five years. Additionally, the environmental benefit that would be achieved would be extremely small since these units operate least frequently.
- The facilities/units with capacity utilization greater than 20% will contain a mix of those that would have to retire as a result of not being able to bear the cost of retrofitting and those that could. The facilities/units that could not bear that cost, have the option of considering re-powering. However, these units would require a longer time to complete re-powering and would tend to have the smallest benefit in terms of entrainment reductions.
- The baseloaded nuclear facilities are provided the longest compliance schedule due to nuclear safety considerations.
- The Board has formed a taskforce with other key state agencies to help ensure that the Policy would not impact energy production and supply. However, by providing a compliance schedule in the Policy, prior to the Task Force being able to evaluate whether or not it is feasible without affecting energy supply puts a major constraint on their ability to aid the Board toward achieving this important goal.

The bottom line is that the draft Policy outlined in the Scoping Document could result in a significant loss of peak power generation and/or create electric system reliability issues.