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*M. Johnson*

May 6, 2005

Hand Delivery

PG&E Letter DCL-2005-527

Roger W. Briggs, Executive Officer  
California Regional Water Quality Control Board  
Central Coast Region  
895 Aerovista, Suite #101  
San Luis Obispo, CA 93401-7906

Pacific Gas & Electric Company (PG&E) Comments on Technical Working Group Draft  
Paper Regarding Mitigation Recommendations for Diablo Canyon Power Plant

Dear Mr. Briggs:

Enclosed please find PG&E's comments on the Independent Scientists' Draft  
Recommendations to the Regional Board Regarding Mitigation for Cooling Water  
Impacts at Diablo Canyon Power Plant presented to the Diablo Canyon Technical Work  
Group in February 2005.

If you have any questions regarding the comments, please contact either Kathy Jones  
of the PG&E Law Department at 415-973-4297, or Bryan Cunningham of my staff at  
805-545-4439.

Sincerely,

James R. Becker  
*Vice President - Diablo Canyon Operations and Station Director*

Enclosure

2005527/bkc/kmo

Item No. 15 Attachment 2  
September 9, 2005 Meeting  
PG&E Diablo Canyon Power Plant

PG&E Letter DCL-2005-527  
Mr. Roger W. Briggs, CCRWQCB  
May 6, 2005  
Page 2

cc: w/attachment      Michael Thomas  
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**Pacific Gas & Electric Company Comments On  
Independent Scientists' Draft Recommendations Regarding  
Mitigation for Cooling Water Impacts  
At Diablo Canyon Power Plant  
Dated January 20, 2005  
Presented at DCPP Technical Work Group Meeting  
February 1, 2005**

Thank you for providing Pacific Gas & Electric Company ("PG&E" or the "Company") the opportunities to: (1) review the January 20, 2005 Draft Report of the Independent Scientists' ("IS") Recommendations to the Regional Board Regarding Mitigation for Cooling Water Impacts at the Diablo Canyon Power Plant ("DCPP") (the "Draft Report" or "Report"), and; (2) participate in the February 1, 2005 Technical Work Group meeting at which the Draft Report was presented. We have organized our comments into two sections. First, we provide specific comments on the Draft Report itself. Second, we provide our perspective on the Draft Report within the context of EPA's Phase II Section 316(b) regulations. While we understand that the Draft Report may not be revised to address our second set of comments, the resolution of these issues will nevertheless greatly influence our on-going discussions and the final NPDES permitting decision. We therefore thought it best to bring these issues to your attention now, in conjunction with our specific comments on the Report itself.

**A. Specific Comments on the Draft Report**

1. Resource Valuation: The Draft Report states that "the costing of an artificial reef represents the most relevant value of the resources lost to entrainment." DR. at 18.<sup>1</sup> With due respect to the IS, they are not economists, and lack the expertise necessary to opine on the issue of resource valuation. In fact, their views on resource valuation are contrary to accepted economic theory and relevant regulatory requirements. As explained in Section B below, EPA and Stratus Consulting, the Board's own economic consultant on the DCPP, have specifically rejected the ETM-based valuation approach advocated by the IS in the Report as a methodology for valuing the benefits of I&E reductions. This fact highlights the reason why all discussions of resource valuation by the IS should be deleted.

2. Policy and Legal Issues: Although the Draft Report states that the IS "will not address policy or legal issues," the fact is that they frequently do. DR at 3. For example, since the document does not discuss other alternatives, it is apparent that the Draft Report is premised on the policy assumption that the correct compensation for larval losses by entrainment is increased, in-kind larval replacement. This is different from EPA's policy for restoration in the Phase II regulations, which instead requires that such efforts achieve "a level of fish and shellfish substantially similar to that which would result from meeting the applicable performance standards . . . or . . . will satisfy site-specific standards." 40 CFR §125.95(b)(5)(iv). Larval

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<sup>1</sup> Also see DR at 5: "The cost associated with the construction of a scaled artificial reef is the single best estimate of the value of the lost resources." On the same page, the Draft Report asserts that its approach "provides a robust method to value the lost resources." Also see DR at 19 (discussion of Valuation).

production and fish production are very different end points. Another policy assumption implicit in the document is that only direct, in-kind mitigation measures should be considered. The Phase II regulations, however, allow for both "in-kind" and "out-of-kind" restoration projects in appropriate circumstances. 40 CFR §125.95(b)(5)(iv). We suggest the Report's statement that the IS do not address legal or policy issues be deleted, and that the Report's differences from existing EPA regulations and policies as set forth in the Phase II Regulations be specifically identified. If this is not done, the Report could easily mislead the Board members.

3. Revised Pm's and Use of Mean and Maximum Days at Risk and Source Water Bodies: Table 2 of the Draft Report does not completely reflect the most recent revisions to the corrected Pm calculations already agreed to by the TWG. John Steinbeck has forwarded to the IS the correct information, which should be incorporated. Additionally, Table 2 only identifies the Duration Risk and Source Water Body as calculated on the basis of maximum larval duration. The 316(b) Demonstration Study, however, reports these items for both maximum and mean larval durations. To be consistent with past practice, we suggest that the Draft Report also include the estimates based on both the mean and maximum periods of larval risk and the source water bodies associated with each value.

4. The Replacement Goal: The Draft Report presumes that all larval losses must be compensated. Under the Phase II regulations, however, the actual performance standard is a reduction in entrainment by 60 % to 90 % from the facility's calculation baseline. In DCP's case, the correct entrainment reduction objective is at the bottom of the range because of the low ETM values relative to source populations, the absence of any significant effects on commercially or recreationally important species, etc. Accordingly, the Draft Report materially overstates the amount of compensation necessary to achieve compliance with Section 316(b).

5. Accounting for Time and Other Benefits: Entrainment impacts at DCP are temporary, whereas artificial reef benefits would be permanent. The size of the reef should be reduced to account for the fact that its benefits over time will exceed the temporary impacts of the DCP's cooling water system. Moreover, artificial reefs would produce benefits in addition to the production of additional larvae. These additional benefits should also serve to reduce the size of the project needed to compensate for entrainment effects.

6. Reef Construction Cost Estimates: We do not have any data on this issue, but wonder whether the cost of reef construction in Southern California is a valid comparison for reef construction costs off the Central Coast. We are concerned that the Southern California projects might understate the actual costs of constructing reefs on the Central Coast, and would like to see confirmation of the IS cost analysis.<sup>2</sup>

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<sup>2</sup> The fact that reef construction costs could vary from place to place highlights the reason why habitat replacement costs are not a true proxy for the value of a resource. If it costs more to construct reefs on the Central Coast than in Southern California, does that really mean that the Central Coast larvae are more valuable than their southern counterparts (and vice versa)?

7. The Process for Approval of Artificial Reefs: At this juncture, we have not researched the steps necessary for approving the construction of artificial reefs in California coastal waters. Since submerged lands are owned by the California State Lands Commission, however, it is probable that the Commission's approval (at least) would be needed. Since such approval would probably be discretionary, it is almost certain that CEQA compliance would be necessary. At the February 1 TWG meeting, for example, a Department of Fish & Game representative indicated that its approval might be necessary, and that a full environmental impact report would be required. The Report should disclose any required approval processes, the costs of obtaining such approvals (including any relevant, supporting studies), and the impact they may have on the Report's recommendation regarding reefs.

8. The Draft Report's Background Section: This section would benefit from a more complete and objective description of the 316(b) Demonstration Study. As drafted, the section suggests that the entrainment study was poorly designed and incapable of providing for an accurate assessment of entrainment losses. This is ironic given that several of the IS were members of the Technical Work Group that designed the study, and given Dr. Raimondi's prior testimony that "[i]n my opinion the work done at DCPD was the finest entrainment sampling ever done for a power plant permit in the state of California and likely in the world."<sup>3</sup> The TWG's control/approval of the study should be described, together with the rationale why the TWG consciously excluded from evaluation many species which the Draft Report implies should have been studied for valuation purposes. For example, the TWG decided that zooplankton, phytoplankton and algal spores should not be evaluated due to their large populations, and in the case of phytoplankton and zooplankton, also because of their short generation times. In short, there is limited value to these resources, and we are aware of no entrainment study or benefit valuation study under 316(b) that has evaluated such resources. This is also consistent with EPA's views, as expressed in the Phase II rulemaking. EPA itself did not value zooplankton, phytoplankton and algal spores when evaluating the benefits of the Phase II regulatory program.

We have not been able to identify the source of the Draft Report's statement that 30 billion planktonic forms are entrained each year. If this is right, it would also help to place the rate of entrainment into context by disclosing the total number of planktonic forms present in the source water body.

9. Other Specific Comments: At two places in the "Approach" section on page 6, the Report states that it analyzes the amount of new reef necessary to produce the "juveniles" lost to entrainment. In fact, the Draft Report focuses on the production of larvae, not juveniles. On page 7, the Draft Report states that "not all larval stages" of crabs were evaluated. In fact, all five zoeal stages and the megalops stage of two species of rock crabs were evaluated. On the same page, the Report states that only three of the species studied were non-reef fishes. In fact,

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<sup>3</sup> See Cooling Water System Findings Regarding Clean Water Act Section 316(b) Diablo Canyon Power Plant NPDES Permit Order RB3-2003-0009, Dr. Pete Raimondi (2003) (sworn, written testimony submitted for the RWQCB's hearing on the DCPD Permit Renewal on July 10, 2003). See also Dr. Raimondi's sworn live testimony at the July 10, 2003 hearing: "I have to say, and I'll say it again, this is the most comprehensive study of nearshore plankton and certain invertebrate larvae that has ever been done anywhere in the world for any purpose." July 10, 2003 hearing transcript at 37: 5 - 9.

there were five such species, including northern anchovy and Pacific sardines which were omitted from this discussion.

10. Uncertainty Analysis: One of the Board's charges to the IS was to perform an uncertainty analysis with respect to their recommendations. See July 10, 2003 Hearing Transcript 358:16 to 359:4.<sup>4</sup> The Draft Report does not do so, suggesting instead that uncertainties in these types of analyses are so great that the results would be meaningless. We think this is incorrect, and indeed that this is precisely the type of circumstance where uncertainty analysis should be performed. EPA requires that uncertainty analysis be included as part of any benefits valuation study. 40 CFR §125.95(b)(6)(ii)(C).

## **B. The Draft Report and EPA's Phase II Regulations**

1. EPA Expressly Rejected the Draft Report's ETM Valuation Approach During the Phase II Rulemaking: Dr. Raimondi served as a peer reviewer for EPA's proposed (and subsequently final) approach to assessing the benefits of I&E reductions at Phase II facilities. He objected to the methodology presented by EPA in Chapter A5 of EPA's 316(b) Phase II Final Rule – Regional Studies, and proposed instead that EPA adopt the ETM approach advocated by the IS in the Draft Report. Dr. Raimondi's written comments stated that EPA's valuation approach was too "fisheries dependent," reflected a "fisheries bias," and that EPA had ignored "ecosystem function." See Attachment 1.

EPA's consultant, Stratus Consulting,<sup>5</sup> issued a February 13, 2004 Memorandum to EPA responding to these and other peer-review comments on Chapter A5. Stratus stated that:

Despite Professor Raimondi's claim that EPA's approach is "at least one generation behind" current I&E assessment methods, EPA disagrees with his assertion that ETM is a preferable method for conducting the benefits assessment. . . . The advantages of ETM that Professor Raimondi alleges have no apparent bearing on the benefits assessment because the results of an ETM assessment, as Professor Raimondi spells out, are in terms of foregone equivalent reproductive effort expressed as acreage, mileage or a proportion of the aerial extent of spawning for fishes exposed to I&E at a particular facility. EPA

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<sup>4</sup> Statement of Dr. Press: "So to put that in plain English, Michael Thomas and the technical working group would get together. And they would say, 'All right. We have a couple of tasks. One is to come up with what sorts of mitigations for entrainment, especially for entrainment, would be right at the nexus of the impact.' So you'd have a menu of different mitigation measures. But there would be uncertainty with those mitigation measures. And so the second charge would be for the group to give information about how much or how or how feasible it would be to reduce that uncertainty to find out what mitigation measures would be effective and feasible."

<sup>5</sup> Stratus Consulting has also advised the Board regarding DCP, and in particular, reviewed the benefits valuation assessment prepared by ASA Communications Inc. and Professor Ivar Strand regarding the benefits of reduced entrainment at the DCP. Two of the Stratus employees who worked for the Board wrote the response to Dr. Raimondi's comments.

maintains that losses expressed in this manner are much less amendable to monetization than the direct approach to estimate foregone yield. . . . The large information requirements of ETM modeling combined with the off-point nature of the results of the modeling are clear reasons why EPA did not elect to use ETM modeling in the assessment.

See Attachment 2 at p.3. While we recognize that Dr. Raimondi and the Staff have previously endeavored to use a similar approach at other Central Coast power plants, we respectfully submit that to do so again at the DCPD would be in error given its general inconsistency with economic valuation principles and the specific rejection of this approach by EPA for 316(b) purposes. This is especially the case since the approach advocated in the Report is itself inconsistent with, or at least not fully in accord with, standard approaches to habitat replacement/habitat equivalency analysis.

2. The Phase II Regulations and Supporting Material Clearly Establish the Requirements for Benefits Valuation Studies: We have heard some suggest that EPA's Phase II regulations provide little guidance on what should be included in a benefits valuation study, implying that there is much room for creativity in this area. The fact of the matter, however, is that the Final Phase II Regulations and preamble are quite specific as to what is required. For example, 40 CFR §125.95(b)(6)(ii) provides that a benefits valuation study must include the following:

- (A) A description of the methodology(ies) used to value commercial, recreational, and ecological benefits (including any non-use benefits, if applicable);
- (B) Documentation of the basis for any assumptions and quantitative estimates. . .
- (C) An analysis of the effects of significant sources of uncertainty on the results of the study; and
- (D) If requested by the Director, a peer review of the items you submit in the Benefits Valuation Study. . .
- (E) A narrative description of any non-monetized benefits that would be realized at your site if you were to meet the applicable performance standards and a qualitative assessment of their magnitude and significance.

The Preamble to the Final Phase II Rule provides further guidance. Specifically, the preamble states that:

The benefits assessment should include a qualitative and/or quantitative description of the benefits that would be produced by compliance with the applicable performance standards at the facility site and, to the extent feasible, monetized (dollar) estimates of all significant benefits categories using well established and generally accepted valuation methodologies. The first benefit category to consider is use benefits, which includes such benefits as those to commercial and recreational fishermen. Well-established revealed

preference and market proxy methods exist for valuing use benefits, and these should be used in all cases where the impingement and entrainment mortality study identifies substantial impacts to harvested or other relevant species.

The second benefit category to consider is non-use benefits. Non-use benefits may arise from reduced impacts to ecological resources that the public considers important, such as threatened or endangered species. Non-use benefits can generally only be monetized through the use of stated preference methods. When determining whether or not to monetize non-use benefits, permittees and permit writers should consider the magnitude and character of the ecological impacts implied by the results of the impingement and entrainment mortality study and any other relevant information.

In cases where an impingement mortality and entrainment characterization study identifies substantial harm to a threatened or endangered species, to the sustainability of populations of important species of fish, shellfish or wildlife, or to the maintenance of community structure and function in a facility's waterbody or watershed, non-use benefits should be monetized. [Footnote 50: In cases where harm cannot be clearly explained to the public, monetization is not feasible because stated preference methods are not reliable when the environmental improvement being valued cannot be characterized in a meaningful way for survey respondents.]

In cases where an impingement mortality and entrainment characterization study does not identify any substantial harm to a threatened or endangered species, to the sustainability of populations of important species of fish, shellfish or wildlife, or to the maintenance of community structure and function in a facility's waterbody or watershed, monetization is not necessary.

69 Fed. Reg.41647 – 8 (July 9, 2004).

Chapter A5 of EPA's Regional Studies performed in support of the Phase II rule specifically describes the process that should be used for valuing commercial, recreational and forage species. Chapter B of the Regional Studies specifically applies those methodologies to value the benefits of I&E reductions in California, and includes species life history tables directly relevant to species entrained at the DCPD.

The Draft Report does not address commercial or recreational fishing in any meaningful manner, and thus does not comply with EPA requirements. Instead, the Report attempts to value "ecological function," which Stratus Consulting correctly interpreted to be a proxy for non-use values. As clearly indicated by EPA in the preamble quoted above, however, non-use values need not and should not be monetized in this case because the resources at issue are not unique, and therefore could not be the subject of a meaningful stated preference survey. Activities having only marginal impacts to non-unique resources cannot, by definition have a significant non-use value, and certainly not a non-use value that greatly exceeds the combined commercial, recreational and forage species value of the resources impacted. As demonstrated by the benefit valuation studies that have been conducted for the DCPD and for California by EPA (discussed



below), however, that is exactly what the Draft Report implies, i.e., that the alleged "ecological function values" are many times greater than the impacted use values.

During the development of the Phase II Rule, EPA experimented with a number of different approaches for valuing the non-use benefits of its Phase II regulations. Among others, EPA evaluated habitat replacement costs, societal revealed preference methodologies, the Fisher-Raucher Approximation (i.e., non-use value is 50 percent of recreational values), a revised habitat replacement costs methodology that attempted to define willingness-to-pay for habitat replacement as opposed to replacement costs alone, and a production foregone analysis. In the final rule, however, EPA rejected all of the forgoing (except for production foregone) because of the limitations and uncertainties inherent in all of those approaches. Instead, the Agency provided the non-use value guidance quoted above in the Final Rule.

3. Applying EPA's Benefits Valuation Approach Yields Resource Values Significantly Below Those Estimated in the Draft Report: We asked Triangle Economic Research, a highly respected resource economics consulting firm, to perform a new benefits valuation study of the DCP's I&E impacts based on EPA's methodologies as expressed in the Final Phase II Regulations and associated Regional Studies, including Chapter A5. We have previously provided this report to you. This study evaluates commercial, recreational and forage species losses, including a production foregone analysis for all forage species, and an uncertainty analysis. The following table summarizes the results of that analysis.

**Table 3**  
**Results of Uncertainty Analysis for Diablo Canyon Using Monte Carlo Simulation**

| Estimate                                     | Mean      | Standard Deviation | Lower Bound | Upper Bound |
|--|-----------|--------------------|-------------|-------------|
| Baseline I&E (RIS species)                   | \$26,412  | \$4,732            | \$18,635    | \$34,206    |
| Baseline I&E (all species)                   | \$37,731  | \$6,760            | \$26,621    | \$48,866    |
| Benefits of Compliance (RIS species)         | \$19,863  | \$4,207            | \$13,280    | \$27,220    |
| Benefits of Compliance (all species)         | \$28,376  | \$6,010            | \$18,971    | \$38,886    |
| Benefits of Compliance in 2023 (RIS species) | \$250,772 | \$53,114           | \$167,661   | \$343,655   |
| Benefits of Compliance in 2023 (all species) | \$358,246 | \$75,877           | \$239,516   | \$490,936   |
| Benefits of Compliance in 2053 (RIS species) | \$420,806 | \$89,127           | \$281,342   | \$576,667   |
| Benefits of Compliance in 2053 (all species) | \$601,151 | \$127,324          | \$401,917   | \$823,809   |

Based on EPA's guidance, TER's report does not monetize non-use values. In TER's opinion, however, these values are likely to be low at the DCP because its I&E does not affect any unique species or unique environment. As is readily apparent, the IS' estimate of the "value" of I&E losses at DCP is grossly out of proportion with benefits valuation performed by TER using EPA's methodologies.

4. The Draft Report's Benefit Valuation Estimate Is Completely Out of Proportion with EPA's Own Valuations of I&E Losses in Northern California and Throughout All California: EPA conducted its own regional benefits valuation studies in conjunction with the Phase II Rule. In EPA's estimation, the annual benefits of reducing I&E at the eight Phase II power plants located in the Northern California Region (which includes the DCPD) would be \$663,965 in recreational benefits and \$19,514 in commercial benefits. In a subsequent, separate study, EPA estimated the benefits of I&E reductions at all twenty (20) California Phase II power plants to be from \$0 to \$520,000 in commercial benefits, and \$2.45 million in recreational benefits. The EPA estimates did not monetize non-use benefits, because it had not found a non-use methodology of suitable reliability, including the proposed but rejected habitat replacement cost methodology.<sup>6</sup> Once again, the Draft Report's estimate of \$15 to \$25 million for DCPD I&E effects alone is completely out of touch with EPA's far lower benefits estimates for much broader regions.

5. The Draft Report's Proposed Restoration Remedy May Be Invalidated on Judicial Review, and in any Event Is Inconsistent with the Restoration Provisions of the Phase II Rule: The Phase II Rule for existing facilities authorizes the use of restoration measures as a means of compliance, provided that a facility can demonstrate that other compliance methods are less feasible, cost-effective or environmentally desirable than meeting the performance standards through other means. The United States Court of Appeals for the Second Circuit previously concluded with respect to the Phase I Rule for New Facilities that a similar restoration provision was invalid as a matter of law. Environmental groups and the six northeastern states that have challenged the Phase II rule are contesting the validity of the Phase II Rule's restoration provisions in a new case also being decided by the Second Circuit.

The Phase II Rule's restoration provisions are also voluntary. If pursued and allowed, however, the costs of the restoration methods employed may not be significantly greater than the benefits of additional fish and shellfish production, which obviously are quite limited in this case. Based on the several benefits valuation studies performed specifically for the DCPD (TER's 2005 Study, and ASA Communication, Inc.'s and Ivar Strand's 2003 study) as well as EPA's two regional studies in California, it is readily apparent that the Draft Report's recommendation of \$15 - \$25 million in habitat replacement costs is significantly greater than the value of the added benefits. At most, the Draft Report demonstrates that its proposed reef restoration measures are not worth the limited benefits they would produce, and thus would be prohibited by the Phase II Regulations. This follows from the fact that, in the case of a site-specific determination based on a cost-benefit variance, the Regulations require a permitting agency to mandate additional measures to bring the facility as close as practicable to compliance with the national standards, provided, however, that the cost of such measures may not be significantly greater than their benefits. Here, the benefits of compliance until 2023 are in the range of \$240,000 to \$491,000, and the cost of reefs (\$15 to \$30 million) is significantly greater than those benefits.

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<sup>6</sup> EPA has suggested that habitat replacement costs might be a proxy for non-use values in certain limited circumstances that are not present here.

### **C. Conclusions**

Despite statements to the contrary, the Draft Report ventures well beyond the realm of science into the regions of law, economics and public policy. It is apparent from the record that at least one member of the IS expressly disagrees with the legal, policy, and economic determinations made by EPA in the Phase II Rule, and has knowingly advanced concepts in the Draft Report that have already been rejected by EPA for Phase II regulatory purposes. The resource valuation discussions should be removed from the Report since they concern issues beyond the expertise of the IS. At a minimum, the Report should disclose more fully and objectively its significant deviations from EPA's established policies and standards.

In its present form, the Draft Report cannot constitute substantial evidence on which the Board could reasonably rely in reaching Section 316(b) decisions about the Plant. As they correctly admit, none of the authors has any expertise in the field of resource economics. Their views with respect to resource valuation are based on the rejection of controlling economic and regulatory principles, with which they apparently disagree. This is especially obvious given EPA's prior, express rejection of the specific methodology advanced by the IS in the Report, and the degree to which the IS estimates of resource value so grossly exceed the several estimates prepared according to the accepted economic procedures adopted by EPA for Phase II purposes, including the application of those procedures by EPA itself in two regional benefit valuation studies of California.

Not surprisingly, the Report is fundamentally inconsistent with the regulatory requirements and policies set forth in the Phase II Regulations. Even if the Report had been prepared by qualified experts, its ultimate conclusion – that \$15 - \$25 Million should be spent on habitat replacement – only proves the proposition that such an effort would not be worth its far more limited benefits.

We hope that the Draft Report will be appropriately modified, and that the Staff's report will place the revised Report in the appropriate regulatory context. We would be happy to answer any questions you may have.

Attachment 1: Review of Chapter A5: Methods used to evaluate I&E by Pete Raimondi, US EPA Document OW-2002-0049-1404.

Attachment 2: Memorandum to Debbi Hart and Lynne Tudor, U.S. EPA, from Dave Cacula and Liz Strange, Stratus Consulting Inc. dated 2/13/2004, US EPA Document OW-2002-0049-0985.

**Pacific Gas & Electric Company Comments On  
Independent Scientists' Draft Recommendations Regarding  
Mitigation for Cooling Water Impacts  
At Diablo Canyon Power Plant  
Dated January 20, 2005  
Presented at DCPD Technical Work Group Meeting  
February 1, 2005**

Attachment 1:

Review of Chapter A5: Methods used to evaluate I&E by Pete Raimondi,  
US EPA Document OW-2002-0049-1404



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**Agency Docket Number:** W-00-32

**Agency Document Number:**

**Document ID:** OW-2002-0049-1404

**Docket ID:** OW-2002-0049

**Title:** Review of Chapter A5: Methods Used to Evaluate I&E (Impingement and Entrainment) [DCN 6-5007B R2]

Peer review response document by Pete Raimondi, Center for Ocean Health, Long Marine Lab, UC Santa Cruz

**Description:** Center for Ocean Health, Long Marine Lab, UC Santa Cruz

**Type:** Support-Background

**Phase:** Final Rule

**Company/Group/Association Name:**

**Author Date (mm/dd/yyyy):**

**Effective Date:**

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| <a href="#">OW-2002-0049-1397</a> | Draft Peer Review Charge: Review of Supporting Document for the Section 316(b) Rulemaking for Cooling Water Intake Structures at Existing Facilities [DCN 6-5007 A R1]     | Preceding |
| <a href="#">OW-2002-0049-1398</a> | External Peer Review of Chapter A7: Review of Entrainment Survival of Case Study Analysis for Section 316 (b) Phase II Existing Facilities Rule Document [DCN 6-5007 A R2] | Preceding |
| <a href="#">OW-2002-0049-1399</a> | Review Of Chapter A7 [DCN 6-5007 A R3]   | Preceding |
| <a href="#">OW-2002-0049-1400</a> | Review of Chapter A7: Entrainment Survival 316(b) Existing Facilities Benefits Case Studies, Part A: Evaluation Methods [DCN 6-5007A R4]                                   | Preceding |

EPA's (USEPA) Response to Peer Review on Chapter A7:

|                                   |  |            |
|-----------------------------------|--|------------|
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| <a href="#">OW-2002-0049-1402</a> | Chapter A5: Methods Used to Evaluate I&E (Impingement and Entrainment) [DCN 6-5007B]   | Preceding  |
| <a href="#">OW-2002-0049-1403</a> | TASK 2: Conduct Peer Review of Impingement & Entrainment (I&E) Methods-Draft Peer Review Charge Information [DCN 6-5007B R1] | Preceding  |
| <a href="#">OW-2002-0049-1405</a> | Review of Chapter A5; Methods Used to Evaluate I&E (Impingement and Entrainment) [DCN 6-5007B R3]                            | Supplement |
| <a href="#">OW-2002-0049-1406</a> | Review of Chapter A5 - Methods Used to Evaluate I and E (Impingement and Entrainment) [DCN 6-5007B R4]                       | Supplement |

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Docket OY-2002-0049 DCNH: 6-5007B-RZ  
Raimondi, P., UC Santa Cruz  
Review of Chapter A5: Methods used to evaluate I&E

Review of A-5 by Pete Raimondi, page 1

Review of Chapter A5: Methods used to evaluate I&E  
By Pete Raimondi  
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I have completed my review of chapter A5 and have two classes of comments. First, think that the models and methodology presented are at least one generation behind current estimation of effects resulting from entrainment. That they are presented as being the models used by EPA and hence are likely to be those advocated by industry is extremely troubling to me -- see my comments below. Second, I will make comments relative to the methodology presented in the Chapter.

**Comments regarding the appropriateness of models and methodology presented (mainly with respect to entrainment)**

I am extremely concerned that the entire chapter is built around the idea that impact can be best measured using what is essentially an adult equivalent loss (AEL) / Fecundity Hindcast (FH) model. There are minor modification made for non-harvested species (production foregone) that I will not note here. Here are some features associated with the approaches:

| Approach                    | Data Required  | Assumptions   | Output  |
|-----------------------------|--|---|---|
| Adult Equivalent Loss (AEL) | <ol style="list-style-type: none"> <li>1. Taxon-specific estimates of entrainment and impingement losses</li> <li>2. Age-specific mortality schedules for selected taxa from entrainment to some predetermined life stage</li> <li>3. Fishery resource abundance estimates for relative impact assessments</li> </ol>  | <ol style="list-style-type: none"> <li>1. Age specific mortality rates are constant for the populations</li> <li>2. Populations are in long-term equilibrium for relative impact assessment</li> <li>3. Entrainment estimates are representative of all organisms entrained in cooling water</li> </ol> | <ol style="list-style-type: none"> <li>1. Number of animals that would have survived to adulthood had they not been entrained or impinged by the intake</li> <li>2. Relative impact measured by proportion of stock lost (if calculated)</li> </ol>             |
| Fecundity Hindcast (FH)     | <ol style="list-style-type: none"> <li>1. Taxon-specific estimates of entrainment and impingement losses</li> <li>2. Age-specific mortality schedules for selected taxa from parturition /hatch to entrainment /impingement</li> <li>3. Species and age specific adult fecundity</li> <li>4. Fishery resource abundance estimates for relative impact assessments</li> </ol> | <ol style="list-style-type: none"> <li>1. Age specific mortality rates are constant for the populations</li> <li>2. Populations are in long-term equilibrium for relative impact assessment</li> <li>3. Entrainment estimates are representative of all organisms entrained in cooling water</li> </ol> | <ol style="list-style-type: none"> <li>1. Number of sexually mature females represented by the losses of reproductive output due to entrainment and or impingement.</li> <li>2. Relative impact measured by proportion of stock lost (if calculated)</li> </ol> |

In bold are shown the most problematic of the data requirements and assumptions. In my opinion these are insurmountable at least for marine organisms. In addition there are other more implicit assumptions with the approach advocated:

- 1) There is clear linkage to harvestable fish rather than to ecosystem function. This is inexcusable given alternative models that are available. It seems inconceivable that EPA has such a fisheries dependent mindset rather than one that recognizes the potential value of all affected species (and not just as food for the harvested ones).

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- 2) Since there are so often limited data (or none at all) concerning age specific mortality rates untested proxy estimates (lab estimates or estimates for other species) are typically used.
- 3) Given the reliance on equilibrium conditions (population attractors) there is the implicit assumption of compensation.
- 4) There is no accounting (or even an obvious way to account for) cumulative effects).

In my opinion the problems associated with this approach make it inappropriate for use. Moreover, I believe that its use can vastly under-estimate the likely effects on affected populations of entrained organisms of all species. The approach recently adopted in many California 316B cases is to use an Empirical Transport Model (ETM) that yields estimates of the proportion of organisms of risk to entrainment that are actually lost to entrainment. This value "proportional mortality": or  $P_m$  is species specific and is usually given as something like : "X percent of the larval population of species y that is at risk is lost due to the operations of the power plant. The source water body (the region from where the larval population is at risk) is an area that extends 110 miles to the north and from the shore to 3 miles offshore" . The source water body is calculated by determining age at entrainment, which is quantifiable and then using coastal oceanographic models estimating the distance from which the individual may have come from (for river systems it is much more straight forward). In the end you develop a matrix of  $P_m$  values and source water values. If you have selected the target species carefully (typically to include species with representative life histories) then the average  $P_m$  coupled with the average source water body represents a currency of ecosystem impact. An example might be something like: "On average 30% of all reproduction (across all species that are entrained from fish to algae) is lost due to entrainment from an area 100 miles long by 4 miles wide (from coast out to 4 miles). Another way to represent this impact is that the impact is comparable to the loss of all production of new individuals from an area 30 miles (long shore) by 4 miles (cross shore)." [This can work for all systems not just marine - we have used it for open coast and estuarine systems]. Some of the advantages of this approach are:

- 1) there is no need to use age specific mortality schedules
- 2) there is no need to estimate standing stock of adults or to make assumptions about degree of compensation or equilibrial state
- 3) many more species can be used in the analysis because mortality schedules are not required
- 4) the currency of impact can be expressed as the area from which reproduction is foregone

Completing the table from above for ETM gives:

| Approach                        | Data Required   | Assumptions  | Output  |
|---------------------------------|---|--|---|
| Empirical Transport Model (ETM) | 1. Taxon-specific estimates of entrainment and impingement losses<br>2. Estimates of species concentration in the source water body | 1. Source water samples are representative of composition and abundance of larvae (propagules) in the study areas<br>2. Entrainment samples are representative of the organisms entrained in the cooling water | 1. Estimated fraction of reproduction removed from source water by entrainment. |

**Comments relative to the methodology presented in the Chapter**

Any areas where I do not make comment are those that I think are ok, but all are subject to my first set of comments (about appropriateness of the model).

- 1) page 3 – time spent before entrainment can and has been determined and needs not be unknown
- 2) page 4
  - i. – it is silly to assume that fishing mortality stays the same – this is certainly not true
  - ii. compensatory mortality can act to both increase or decrease estimates of loss depending on if there is some sort of Alle effect at small pop sizes
- 3) page 5
  - i. I and E losses are not always a minor source of mortality
  - ii. Changes may cause stocks to go up or down – and sometimes dramatically in the SONGS case it was estimated that >11 percent of the stock of certain species would be lost from the entire Southern Ca Bight as a result of entrainment – this is dramatic
  - iii. There is no accounting for cumulative effects
  - iv. The use of production foregone to estimate mass of harvested fish is fraught with assumptions like transfer efficiency =.2 and of structure of trophic relationships.
- 4) Figure 1 page 6 what is difference between fishery species and harvested species – I can't figure this out.
- 5) Page 7 – the use of foregone production is in my opinion an incredibly indirect way to incorporate other non-harvested species that may be affected. Moreover it leaves out any species not sampled
- 6) Page 8 – the statement that foregone production may be considered a reduction in aquatic food supply reveals the fishery bias here
  - i. As does valuation as hatchery replacement costs

Review of A-5 by Pete Raimondi, page 5

- 7) Page 9 the model in Figure 2 is much too simple and exclusionary – only counts a species importance as it affects harvest.
  - i. Reed et al is not in Refs

I will add comments about uncertainty in the next draft – I wanted to get this to you today

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**Pacific Gas & Electric Company Comments On  
Independent Scientists' Draft Recommendations Regarding  
Mitigation for Cooling Water Impacts  
At Diablo Canyon Power Plant  
Dated January 20, 2005  
Presented at DCPD Technical Work Group Meeting  
February 1, 2005**

Attachment 2:

Memorandum to Debbi Hart and Lynne Tudor, U.S. EPA,  
from Dave Cacula and Liz Strange, Stratus Consulting Inc. dated 2/13/2004,

US EPA Document OW-2002-0049-0985



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**Document Detail: OW-2002-0049-0985**

**Agency Docket Number:** W-00-32  
**Agency Document Number:**

**Document ID:** OW-2002-0049-0985  
**Docket ID:** OW-2002-0049



**Title:** Memorandum to Debbi Hart and Lynne Tudor, USEPA, from Dave Cacela and Liz Strange, Stratus Consulting Inc., re: Summary of Peer Reviews of I&E methods Chapter A5 [DCN 6-2094]

**Description:** Memorandum Regarding: Summary and Response of Reviewer's [reviewer] Comments

**Type:** Memorandum  
**Phase:** Final Rule

**Company/Group/Association Name:**  
**Author Date (mm/dd/yyyy):** 02-13-2004  
**Effective Date:**  
**Comment:**  
**Page Count:** 5  
**Media:** ELECTRONIC FILE


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# Memorandum

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To: Debbi Hart and Lynne Tudor, U.S. EPA

From: Dave Cacela and Liz Strange, Stratus Consulting Inc.

Date: 2/13/2004

Subject: Summary of Peer Reviews of I&E Methods Chapter A5

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## 1. Introduction

Chapter A5 describes the methods used by EPA to evaluate I&E. Professor Gary Grossman, Professor Pete Raimondi, and Dr. Shuter are fisheries scientists who were contracted by EPA (through Versar, Inc.) to critique the chapter with respect to several specific topic areas. This memorandum summarizes the reviewers' main comments and provides responses to those comments. Some of the reviewers' criticisms are no longer pertinent to the rulemaking because EPA has made changes to Chapter A5 since the time that the three reviews were conducted.

## 2. Critique by Professor Gary Grossman

A criticism expressed by Professor Grossman concerns the possibility of incorporating stochasticity in the survival modeling that informs the estimation of foregone fishery yield. Professor Grossman suggests that the assessment would be improved if environmental stochasticity was explicitly included in the model. He does not suggest exactly how it should be included, so it is not possible to comment on the feasibility or utility of adding a particular kind of stochasticity. EPA acknowledges that fish populations are affected by ecological processes that cannot be well-described except in stochastic terms. However, EPA maintains that an adequate assessment of the economic benefits of the 316(b) rulemaking does not require a highly detailed, highly realistic ecological model. The practical requirements of developing models along the lines suggested by Professor Grossman are quite substantial, even for modeling the dynamics of a single fish stock. Inclusion of stochasticity in a model does not automatically make the model better or more useful unless the nature of the stochasticity is correctly formulated. The limitations in this regard are not simply computing power, as Professor Grossman suggests, but sufficient understanding of the systems in question. The benefits assessment is addressed at estimating effects on hundreds of stocks nationwide and inclusion of the stochastic details specific to each of these stocks is not a realistic goal.

Although EPA has not included stochasticity within the I&E model itself, EPA has employed stochasticity in a parallel investigation of uncertainty associated with the I&E modeling procedure (see Chapter A6 of the Regional Analysis Document). The investigation uses Monte Carlo methods to handle plausible degrees of uncertainty associated with all of the numerous parameters in the model. The investigation is not complete, due in part to uncertainty about selection of probability distributions.

Professor Grossman states that the absence of reporting about stock sizes is a problem. The concern is apparently motivated by a belief that estimating population impacts is the objective of the assessment, but that is not the case. EPA's core I&E modeling approach is to use a static set of population parameters to generate simple point estimates of foregone yield. EPA has intentionally generated benefits estimates that are linked directly to the estimates of I&E losses, not indirectly through estimates of population level impacts. This approach is intended to provide reasonable estimates of the general magnitude of losses associated with I&E mortality, and not to develop realistic population dynamic models. Projections of future fish population dynamics is simply out of the scope of the benefits assessment.

Another criticism expressed by Professor Grossman concerns the regional extrapolation of loss estimates at model facilities to other facilities. Professor Grossman indicates that extrapolations are invalid unless conditions at unmodeled facilities are identical to conditions at model facilities. EPA acknowledges that the extrapolations introduce additional uncertainty into the aggregate estimates. However, EPA maintains that this is unavoidable unless every in-scope facility were modeled independently. In order to avoid the most significant sources of bias, EPA applied extrapolations within particular regions prior to aggregation on a national scale.

Professor Grossman expresses valid concerns about the methods used to generate annualized I&E loss estimates at individual model facilities. EPA acknowledges that numerous facility-specific details, including details about the I&E sampling programs and regional ecological conditions, affect the validity of the annualized loss estimates. However, EPA's benefits assessment did not include development of the original I&E monitoring procedures. EPA relied upon the loss estimates as reported by the facilities, based on the premise that the original investigators had the necessary understanding of the facility and the local ecological conditions to develop appropriate sampling procedures and interpretations of the I&E data.

Professor Grossman questions EPA's treatment of I&E losses with respect to the presence of older fish (>1 year old) among the I&E losses. This concern has been raised by other commenters, and EPA has revised the modeling procedures by eliminating the assumption that impinged fish are all age 1. The revised procedure uses an assumption that impinged fish include individuals ranging from age 0 to age 5.

### 3. Critique by Professor Pete Raimondi

Professor Raimondi has criticized EPA's model in very general terms that relate to his beliefs that (a) the benefits assessment has too much of a "fisheries dependent mindset" and a "fisheries bias," and (b) the correct approach to the assessment employs an empirical transport model (ETM), rather than the foregone yield model that EPA used.

EPA acknowledges that the benefits assessment focuses on foregone use values of fish killed by I&E. Professor Raimondi indicates that EPA has ignored values associated with "ecosystem function." EPA interprets this class of values to be among those commonly known as non-use values, which include a variety of other societal values in addition to roles in ecosystem functioning. EPA has had difficulty incorporating non-use values into the assessment due to a lack of relevant information about how to monetize the non-use values of I&E losses.

Despite Professor Raimondi's claim that EPA's approach is "at least one generation behind" current I&E assessment methods, EPA disagrees with his assertion that ETM is a preferable method for conducting the benefits assessment. The ETM method enjoys certain aspects of ecological realism and significance for highly site specific ecological assessments, but it is not well suited to the purpose of the 316(b) national benefits assessment. The advantages of ETM that Professor Raimondi alleges have no apparent bearing on the benefits assessment because the results of an ETM assessment, as Professor Raimondi spells out, are in terms of foregone equivalent reproductive effort expressed as acreage, mileage, or a proportion of the areal extent of spawning for fishes exposed to I&E at a particular facility. EPA maintains that losses expressed in this manner are much less amenable to monetization than the direct approach to estimate foregone yield. Moreover, implementation of an ETM is a highly site-specific exercise that requires intimate knowledge of both (a) the hydrology of a particular system, and (b) the actual spawning habits of every species exposed to I&E. The large information requirements of ETM modeling combined with the off-point nature of the results of the modeling are clear reasons why EPA did not elect to use ETM modeling in the assessment.

### 4. Critique by Dr. Shuter

Dr. Shuter's comments were generally favorable with respect to the appropriateness of EPA's modeling. EPA agrees with Dr. Shuter's suggestion that the chapter would benefit from a clearer statement about the objectives of the modeling and expectations about how the results of the model can be interpreted, and revised the chapter accordingly. A large part of his criticisms



concern the actual structure of the chapter and the fact that a number of relevant facts required to implement the model are physically located in inconvenient places, such as in an unattached appendix. EPA believes that some of the practical difficulties noted by Dr. Shuter would be absent for readers that have the complete assessment in hand, rather than simply Chapter A5 in isolation.

Another general concern expressed by Dr. Shuter concerns the level of detail provided about the modeling procedures, which he perceived as being too general for rigorous assessment. EPA has revised Chapter A5 in response to these comments, and believes that the current version of the chapter is now more complete.

Dr. Shuter expresses concern about how life history parameters (e.g., survival rates) were identified and/or generated. The majority of the survival rates that EPA employed were derived from literature sources that are fully referenced in the assessment report. EPA acknowledges that there are numerous difficulties associated with applying survival rates reported in published records to novel situations, some of which may be quite influential in the benefits assessment. However, EPA believes that it has been completely transparent in this regard by publishing all of the values that were used and their original sources. Part of Dr. Shuter's concern in this regard may relate to the wording used in earlier versions of the chapter that unfortunately overstated the role of the "Fa method" in identifying survival rates. This wording made it appear that the Fa method was used as a primary tool and that reference values for the majority of survival rates could not be identified. In fact, EPA identified reference values for the vast majority of survival rates employed, and used the Fa method only as a last resort. EPA acknowledges that substantial uncertainties remain about proper survival rates (with respect to both M and F) and that uncertainty in these values causes significant portion of the uncertainty in the benefits assessment.

Dr. Shuter raises some interesting conceptual questions about the relationships among I&E losses, the mortality rates M and F, and the possible decomposition of M into components that explicitly describe M attributable to I&E. Dr. Shuter also identifies relationships between interpretation of these concepts and EPA's use of static rather than dynamic values for these parameters. In particular, Dr. Shuter questions the implications of a preconceived notion that the relative magnitude of I&E mortality is small compared to other forces of mortality. EPA acknowledges that these are valid concerns. However, EPA's statements that I&E mortality is minor are not intended to be a value judgement, nor a presumption that they can be ignored out of hand. Rather, they are intended to indicate that, as a general rule, I&E losses are not expected to be dominant driving forces in the dynamics of most populations. If this presumption is valid, then the commonly perceived need to proceed directly to sophisticated, population-specific fisheries models that include compensation and other kinds of dynamics may be discounted. EPA's philosophy in this regard is that it is legitimate to use the direct foregone yield approach because

these losses are "minor" enough to be considered simply as incremental differences that occur concurrently and additively with other more dramatic forces that drive large scale population changes. Thus, conceiving of these losses as "relatively minor" refers only to importance within the suite of other population drivers, but not necessarily to importance in economic terms. The value of fisheries on a national scale is tremendous, so a (possibly) "minor" reduction of that resource could actually be very large in absolute terms.

Dr. Shuter noted some inconsistencies in notation with regard to the terms "ages" and stages." EPA regrets the inconsistency and possible confusion resulting from it. In fact, EPA's models are best described as "stage specific" throughout the assessment. The confusion arose because the actual stages that EPA employed correspond directly to "ages" for all fish age 1 and older, i.e., adulthood was not modeled as a single stage but as multiple stages corresponding to years.