Attachment 3
Findings Regarding Clean Water Act Section 316(b) and California Water Code Section 13142.5
Modernized Morro Bay Power Plant
NPDES Permit Order RB3-2004-0028

APPLICABLE LAW

USEPA published revised Clean Water Act Section 316(b) regulations for existing power plants on July 9, 2004 (40 CFR 125.94(a). The new regulations are effective beginning September 7, 2004. The new 316(b) regulations for existing facilities are currently being challenged in court, thus, in the event that the new regulations are stayed in whole or in part, this Order is written to achieve compliance with both the historical 316(b) regulations (pre September 2004) and the new 316(b) regulations for existing facilities.

Section 316(b) states:

> "Any standard established pursuant to section 1311 of this title or section 1316 of this title and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

The legal standards applied here are based an analysis of EPA administrative decisions, opinions, the 1977 draft guidance, federal court opinions and reference to the final 316(b) regulations for existing facilities and their Preamble in the Federal Register.

EPA issued final regulations under Section 316(b) on July 9, 2004. A challenge to the regulations is pending in the Ninth Circuit Court of Appeal. These findings address compliance with Section 316(b) under both the new regulations and prior law and guidance.

COMPLIANCE WITH EPA REGULATIONS

Summary of Findings Regarding Compliance with Section 316(b) Regulations

- To demonstrate that a cooling water intake structure meets the best technology available (BTA) standard for entrainment impacts, a discharger must demonstrate one of the following: installation of closed-cooling or an equivalent flow reduction; implementation of design and construction technologies, operational measures and/or restoration measures that meet the regulatory performance standard or restoration requirements; installation of presumptive technology (to date, this is limited to wedge-wire screens); or satisfaction of site-specific BTA alternatives. The entrainment performance standard is a 60 to 90% reduction in entrainment losses, compared to the baseline entrainment impact. To qualify for a site-specific alternative, the discharger must demonstrate that the cost of meeting the performance standards is "significantly greater than" the costs EPA considered ("EPA costs") when drafting the regulations ("cost-cost test"), or the cost of meeting the performance standards is "significantly greater than" the benefit of meeting the performance standards ("cost-benefit test"). Under the cost-cost test, the cost of the site-specific alternatives cannot be significantly greater than the costs considered by EPA in adopting the regulations. Under the cost-benefit test, the cost of site-specific alternatives cannot be significantly greater than the benefit that would result from meeting the performance standard. EPA has not defined "significantly greater" for either test. Under both tests, the site-specific alternative must achieve results "as close as practicable" to the performance standard. Although the regulations only require the Regional Board to apply one of the two tests, the Regional Board has considered both tests.

- The USEPA's technology cost for a facility like MBPP is $4.34 million (for the cost-cost test). All potential technology costs at MBPP are compared to this cost. This cost ($4.34 million) is based on impingement control only (a fish handling and return system) and does not reflect entrainment technologies such as fine mesh screens. The Regional Board does not agree with the USEPA's approach in establishing technology costs for MBPP based only on impingement control technology. Nevertheless, the Regional Board acknowledges that the USEPA technology cost is established in the 316b regulations for MBPP, and is used as the cost-cost reference.

- The "value" of entrainment losses (for the cost-benefit test) is difficult to estimate directly. There is no direct way to determine the value of entrained larvae. This Order estimates the value of entrainment losses using the Habitat Production Forgone approach, which converts entrained larvae to equivalent habitat acreage. The cost to purchase and/or restore the equivalent acreage is used as a proxy for the value of entrainment losses. Using this approach, the Regional Board considers the total value of the entrainment losses to be approximately $8.5 million (based on Duke Energy's assumption of a 10% larval loss) or $28 million (based on Regional Board staff's assumption of a 33% larval loss). These values are not intended to be exact, but are intended to indicate general values. The new regulations require an entrainment reduction of 60% to 90%. The value of reducing entrainment by 60% is: (0.6)x($8.5 million) = $5.1 million (@10% larval loss) and (0.6)x ($28 million) = $16.8 million (@ 33% larval loss).

- Entrainment losses at MBPP are significant for purposes of Section 316(b). However, the technologies that may reduce entrainment at MBPP (fine mesh screens and filters) are experimental and/or are not available for use at this site. The costs of these technologies ($10 million + range) are also significantly greater than USEPA's national average technology costs ($4.34 million) for a like facility. This conclusion is based <u>costs and performance</u>; since fine mesh screens and filter systems are not established as effective technologies for reducing entrainment mortality. Under these circumstances, site-specific BTA requirements are justified.

- Impingement of adult and juvenile fish and invertebrates on the traveling screens within the intake structure at the <u>existing</u> MBPP is not ecologically significant. The costs of technologies to reduce impingement at MBPP would be significantly greater than the value of the benefits to be gained by installing the technologies. The technology costs are in the millions of dollars and the value of the impingement losses are in the thousands of dollars. Therefore, additional design and construction technologies, operational measures and/or restoration measures to address impingement losses are not justified under Section 316(b). The Discharger may also demonstrate that the through-screen intake velocity is 0.5 feet per second or less.[1] If so, the cooling water intake structure meets the BTA performance standard for impingement. (40 CFR §125.94(a)(1)(ii).)

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[1] As of the date these findings were prepared, the Discharger has only demonstrated that the *approach* velocity is 0.5 fps or less.

- The California Energy Commission's "Commission Adoption Order and Commission Decision" dated August 2, 2004 (hereafter "Commission Decision") incorporating the Third Revised Presiding Members Proposed Decision (PMPD) for MBPP is the "functionally equivalent" environmental document pursuant to the California Environmental Quality Act (CEQA). The Commission Decision concludes that there will be no adverse impact (within the meaning of CEQA) associated with the once-through cooing water system (including impingement, entrainment, and thermal effects) for the modernized Power Plant because the intake flows will be less than the CEQA baseline. Therefore no alternatives to the once-through cooling water system can be required pursuant to CEQA, either by the CEC or the Regional Board. The Commission Decision also evaluates the feasibility of closed cooling systems and concludes these systems are not feasible at Morro Bay due to noise, visual impacts, land use, legal, and cost issues.

- The costs of closed cooling systems at MBPP are significantly greater than the USEPA technology cost for MBPP (cost-cost test) and the benefits of complying with the performance standard (cost-benefit test). The cost estimate for the cheapest closed cooling system (salt water cooling towers) is about $30 million. The cost estimate range for the most expensive system (dry cooling) is $105 million. As noted above, the total value of the entrainment losses is estimated to be $8.5 million or $28 million, depending on the larval loss value assumed (10% or 33%, respectively).

- Duke Energy has proposed a Habitat Enhancement Program fund of $12.5 million as part of the modernization project. The Habitat Enhancement Program will provide benefits the Morro Bay Estuary by preventing the future loss of critical estuarine habitat and possibly recovering critical habitat. The Habitat Enhancement Program will provide benefits that are "as close as practicable" to the performance standards pursuant to the requirements of 316(b), without costs that are "significantly greater" than the benefits that would result from meeting the entrainment performance standard.

- Considering the proposed project with the $12.5 million Habitat Enhancement Program fund, and its performance monitoring, the cooling water intake structure for the modernized Power Plant is best technology available under Clean Water Act section 316(b). Therefore, no changes to the proposed cooling water intake structure location, construction, or design are required by this Order. However, this Order requires minimization of cooling water flows as described in Provision 9, and minimization of intake velocities as described in Provision 10. Taken together with the Habitat Enhancement Plan, these requirements will achieve compliance that is as "close as practicable" to the new 316(b) performance standards.

Summary of Findings Regarding Compliance With Section 316(B) As Interpreted By Prior Law

The legal standards applied here are based an analysis of EPA administrative decisions, opinions, the 1977 draft guidance, and federal court opinions.

Prior law set forth four basic steps in a Best Technology Available (BTA) analysis:

1) Determine whether the facility's cooling water intake structure may result in adverse environmental impact;

2) if so, what alternative technologies involving <u>location, design, construction and capacity</u> of the cooling water intake structure can minimize adverse environmental impact;

3) determine whether alternate technologies are available to minimize the adverse environmental impacts; and

4) determine whether the costs of available technologies are wholly disproportionate to the environmental benefits conferred by such measures.

The following legal principles were applied in this 316(b) analysis:

- Adverse environmental impacts occur whenever there will be entrainment or impingement damage as a result of the operation of a specific cooling water intake structure.

- Minimize does not mean to completely eliminate adverse impacts. EPA also views increases in fish and shellfish as an acceptable alternative to reduction in entrainment.

- Alternatives that must be considered are <u>location, design, construction and capacity</u> of cooling water intake structures that minimize adverse environmental impacts.

- Although closed-cycle cooling systems are not cooling water intake structures they can be required indirectly by limiting the capacity (cooling water flow) of the intake structure.

- A determination on whether a technology is "available" could be made on any number of grounds based on site-specific conditions. The 1977 Draft Guidance states,

  "It is accepted that closed cycle cooling is not necessarily the best technology available, despite the dramatic reduction in rates of water used. The appropriate technology is best determined after careful evaluation of the specific aspects at each site." (1977 Draft Guidance p. 12.)

- The Board must exercise its best professional judgment to reach a reasonable conclusion based on site-specific conditions.

- Entrainment of smaller organisms (like fish larvae) occurs in once-through cooling water systems. Entrainment losses at MBPP are significant and represent an adverse environmental impact under Section 316(b), despite the CEC's finding, as lead agency, that this is not a significant adverse impact for CEQA purposes. However, the technologies that may reduce entrainment at MBPP are either experimental (screens and filters) or are not available for use at this site (closed cooling systems such as saltwater cooling towers, dry cooling, or hybrid systems).

- Regardless of availability or feasibility, the cost estimates for closed cooling systems at MBPP are wholly disproportionate to the benefit to be gained. The cost estimate for the cheapest closed cooling system (salt water cooling towers) is approximately $30 million. The cost estimate for the most expensive system (dry cooling) is $105 million.

- Duke Energy has proposed a Habitat Enhancement Program fund of $12.5 million as part of the modernization project, which includes additional funding for a performance monitoring program.

- The California Energy Commission's Decision is the "functionally equivalent" environmental document pursuant to CEQA. The Commission Decision concludes that there will be no adverse impact (within the meaning of CEQA) associated with the once-through cooing water system (including impingement, entrainment, and thermal effects) for the modernized Power

Plant because the intake flows will be less than the CEQA baseline. Therefore no alternatives to the once-through cooling water system can be required pursuant to CEQA, either by the CEC or the Regional Board. The Commission Decision also evaluates the feasibility of closed cooling systems and concludes these systems are not feasible at Morro Bay due to noise, visual impacts, land use, legal, and cost issues.

- Considering the proposed project with the $12.5 million Habitat Enhancement Program fund, and its performance monitoring program, the cooling water intake structure for the modernized Power Plant is best technology available under the "wholly disproportionate cost" test. Therefore, no changes to the proposed cooling water intake structure location, construction, or design are required by this Order. However, this Order requires minimization of cooling water flows as described in Provision 8, and minimization of intake velocities as described in Provisions 10.

Summary Of Findings of Compliance With California Water Code Section 13142.5

- Porter Cologne Water Quality Control Act, Section 13142.5, states: For each *new or expanded* coastal power plant … using seawater for cooling …, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life. No legal guidance defines whether the modernized power plant is a "new or expanded" facility. Assuming this requirement applies, the cooling water intake structure and Habitat Enhancement Program constitute the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life.

DETAILED ANALYSIS

Under the direction of the Executive Officer, a technical workgroup was formed to oversee entrainment and impingement studies at MBPP for this NPDES permit. Workgroup members included Regional Board staff and independent scientists, the Discharger's staff and consultants, California Department of Fish and Game staff, and Energy Commission staff. Currently, the Regional Board's independent scientists on this project are Dr. Greg Cailliet, Moss Landing Marine Laboratories, and Dr. Pete Raimondi, UC Santa Cruz. These scientists are independent from, and have never worked for, the Discharger. Dr. Cailliet and Dr. Raimondi have extensive experience as independent scientists on several power plant projects in California.

Dr. Cailliet is a professor of ichthyology, marine ecology, population biology, and fisheries biology, with main interests in community and population ecology, biological oceanography, marine plankton and nekton, and estuarine ecology.

Dr. Raimondi is a professor of ecology and evolutionary biology whose research emphasizes nearshore marine communities. He also has substantial experience on the design, evaluation and analysis of marine monitoring programs, with particular expertise on the evaluation of marine discharges. Dr. Raimondi is currently directing the largest intertidal monitoring program in the world (through the Partnership for Interdisciplinary Studies of Coastal Oceans, or PISCO).

The workgroup reviewed and approved each element of the study, as well as the final report. Elements of the study included review and assessment of target organisms, sampling locations, sampling methods, larval identification, and data analysis and presentation.

Regional Board staff hired several additional independent scientists and consultants to help oversee other aspects of the project. The most notable of these are Phillip Williams and Associates (estuarine processes) and Tetra Tech (cooling system alternatives).

Entrainment and Impingement

Duke Energy submitted its *Morro Bay Power Plant Modernization Project 316b Resource Assessment Report* on July 10, 2001. The 316b Demonstration includes an overview of the report process, a description of the results, and an evaluation of alternative technologies to minimize entrainment and impingement. The entrainment and impingement study results are also discussed in Regional Board staff's testimony for this Order.

The purpose of the 316(b) Demonstration study at MBPP was to 1) estimate the number of larvae lost due to the power plant, 2) convert the larval loss to theoretical numbers of adult fish, and 3) estimate the proportion of larvae lost relative to the amount of larvae available in species-specific source water bodies, and 4) estimate impingement losses.

Entrainment

Duke Energy consultants, Tenera, conducted entrainment studies at MBPP for approximately twelve months under the direction of the Regional Board's independent scientists and the technical workgroup. In addition to entrainment sampling in front of the intake structure, the study included sampling in the Morro Bay National Estuary and just outside the Estuary in Estero Bay.

The study used three methods to analyze the data:

1. Empirical Transport Model, or ETM
2. Fecundity hindcasting, or FH
3. Adult Equivalent Loss, or AEL.

Each of these methods has advantages and disadvantages as described in the 316(b) Demonstration report. The ETM approach estimates the proportion of larvae lost relative to the amount of larvae available in a given source water body. Source water bodies are different for different taxa, such as estuarine taxa and coastal taxa. The source water body for estuarine taxa is the Morro Bay Estuary. The source water bodies for coastal taxa vary by species based on the age of entrained larvae and ocean current speed. The FH and AEL approaches convert larvae to adults using survivorship curves and fecundity estimates. The major limiting factor with the FH and AEL approaches, and most fishery impact assessments, is our lack of knowledge about survivorship and fecundity. The lack of available life history information for most species requires us to make assumptions to fill in the gaps. Results from the FH and AEL approaches have very large statistical errors, so there is a great deal of uncertainty associated with these methods. These limitations should be kept in mind when considering the study results and the potential alternatives for addressing impacts. The assumptions used to parameterize the FH, AEL, and ETM approaches were based on literature and the best professional judgment of the technical workgroup members. Regional Board staff and the Regional Board's independent scientists believe that the ETM approach is the most rigorous, robust, and defensible of the three methods. Proportional larval losses based on the ETM approach are discussed below.

The 316(b) report calculates proportional larval losses for select estuarine and coastal taxa. Although the definition of entrainment includes all life stages of fish and shellfish, at MBPP, only larval stages are entrained. "Proportional larval loss" is the number of larvae entrained relative to the number of larvae considered to be at risk (i.e. in a source water body). Larvae are generally at risk of being entrained for a brief period in their developmental stages when they are suspended in the water column (up to several days). Different species are entrained at different rates; possible reasons for this are swimming ability, behavior, and location at birth. The amount of larvae lost to entrainment is directly related to the once-through cooling water flow rate. The following proportional larval losses are from Duke Energy's 316(b) report and are based on a flow rate of 413 MGD. This flow rate was chosen by Discharger's consultant as a maximum value under normal operating conditions. This Order includes a maximum permitted flow rate of 475 MGD, and an annual daily-average flow rate of 370 MGD (proposed by Discharger). It is understood that higher flow rates result in greater entrainment losses, and visa versa. Based on the annual daily-average flow limit in this Order, the results below overstate the entrainment losses, and are therefore considered a conservative estimate of losses (erring on the side of resource protection).

The following proportional larval losses are for taxa that spawn in the Morro Bay Estuary, based on maximum larval duration:

Unidentified Gobies:	43%
Shadow Gobies:	6.2%
Jacksmelt:	44%
Combtooth Blennies:	72%
Pacific Herring:	2%
Simple Average:	**33%**

The following proportional larval loss values are for coastal taxa (non-estuarine taxa):

Staghorn Sculpin:	5%
Northern Lampfish:	2%
Rockfishes:	2%
White Croaker:	2%
Cabezon:	4%
Simple Average:	**3%**

The following proportional loss values are for larval invertebrates:

Brown Rock Crabs:	3%
Hairy Rock Crabs:	0.8%
Yellow Rock Crabs:	3%
Slender Crab:	0.8%
Red Rock Crab:	2%
Dungeness Crab:	5%
Simple Average:	**3%**

Duke Energy considers the best overall estimate of larval loss to be approximately 10% based on averaging estuarine and coastal taxa together, using the mean larval age for all taxa, and using weighted averages. Therefore, the larval loss estimates before the Regional Board range from approximately 10% (Duke Energy's estimate) to 33% (Regional Board staff and independent scientists estimate). These two values are used throughout this analysis. These results do not indicate that 10% or 33% of the fish and invertebrates in Morro Bay Estuary are killed by the Power Plant. The ETM approach is a risk assessment, and the results noted above represent the proportion of larvae that are at risk of being entrained.

The fish and invertebrates listed above were the most abundant taxa in the samples collected. The composition and abundance of taxa collected are determined by sampling methodology. For example, a sampling net with a finer mesh would have collected more species but would have clogged easily and been impractical for sampling very large volumes of water. This subset of taxa is therefore intended to represent the hundreds of larval species actually entrained. The main purpose of the 316(b) study was to determine if the once-through cooling system entrains large proportions of larvae from the Estuary. The results indicate that proportional larval loss is high enough to require consideration of alternative technologies to reduce entrainment. When the flow rate is 413 MGD, and using maximum larval duration in the equations, the modernized Power Plant will entrain 33% of the larvae from those estuarine taxa that are at risk of entrainment (many more species are not at risk of being entrained). The design (maximum) flow rate for the modernized Power Plant is 475 MGD. The annual daily-average flow limit per this Order is 370 MGD. Proportional larval losses will be lower than 33% on an annual daily-average basis due to the annual daily-average flow rate limit of 370 MGD.

The proportional larval loss caused by the modernized Power Plant may result in population or community level impacts in the Morro Bay Estuary, or the maintenance of impacts caused by the existing Power Plant (although such population impacts have never been determined). The problem is determining “cause and effect” with respect to biological changes. It is very difficult if not impossible to detect population and community level impacts caused by a particular source such as a power plant, especially when there have been no baseline (pre power plant) studies and multiple stresses are contributing to potential biological changes. The existing Morro Bay Power Plant began operation in the 1950’s, before environmental laws were enacted. The multiple stressors on Morro Bay include loss of physical habitat due to accelerated sedimentation, and pollutants such as nitrates, metals, pathogens, and pesticides.

There are four possible scenarios with respect to larval productivity impacts in the estuary due to entrainment, as follows:

1. There has been no change in estuarine larval productivity due to entrainment.
2. There has been a steady decline in estuarine larval production over time due to entrainment.
3. A lower equilibrium level of larval production was caused by operation of the existing Power Plant and will be maintained by continued entrainment.
4. With a reduced cooling water flow in the future, impacts (two and three above) will decrease over time.

From a resource protection point of view, the Regional Board assumes that the first scenario is not true. Further, the available evidence and best professional judgment of the independent scientists does <u>not</u> indicate declining larval productivity over time (the second scenario). If larval productivity were in steady decline due to entrainment, larval productivity may have crashed after fifty years of power plant operation. The entrainment study demonstrates that this is not the case. The available evidence and best professional judgment indicates that entrainment most likely causes a lower but fairly stable larval productivity in the Estuary relative to what would occur without entrainment. This is a critical conclusion. If the available evidence and best professional judgment indicated entrainment were causing a steadily declining condition in the Estuary, the Regional Board would consider the impact to be more significant.

The Regional Board finds that the magnitude of proportional larval loss is an adverse impact. However, it is also evident from the empirical data of the 316(b) study that the Morro Bay Estuary continues to support hundreds of species of fish and invertebrates after fifty years of Power Plant operation, and hence there is no evidence that the Power Plant causes increasing larval productivity loss over time (a declining condition over time).

There are uncertainties in this entrainment study (and all other entrainment studies) because several assumptions are made in the data analysis, and the sampling results are highly variable. The major assumptions include:

1. That adequate sampling was done to estimate larval densities in the field.
2. That simple ocean current measurements can be used to estimate the size of source water bodies for coastal taxa.
3. That 100% of entrained larvae are killed.
4. That the ecological system does not respond and make up for the entrainment losses (compensation).

The entrainment results should be considered within the context of the uncertainties, however, the results are the best estimates of the technical workgroup, and are accepted by this Regional Board.

In conclusion, the available data does not indicate a declining condition over time due to entrainment. However, the proportional larval losses for estuarine taxa represent an adverse impact because the larval loss itself, regardless of any resulting population or community level affect, is a loss of resources.

Impingement: The once-through cooling water system for the modernized Power Plant will also cause impingement of adult fish and invertebrates on the traveling screens in front of the intake structure. Duke Energy's 316(b) report includes the results of an impingement study on the existing Power Plant to estimate future impingement rates for the modernized Power Plant.

Based on this study, the modernized Power Plant will impinge approximately 1.2 tons of fish and about 0.44 tons of invertebrates per year. The impingement study was conducted for one year to quantify the number of juvenile and adult fish trapped on the traveling screens. Over one hundred fish taxa were identified and counted in the impingement study. Of these, five taxa comprised the top 90% impinged by number, and seven taxa comprised the top 90% by mass. The most abundantly entrained fish by number and mass were northern anchovy. Northern anchovy comprised 74% of the total fish impinged by number, followed by topsmelt (6%), plainfin midshipman (5%), speckled sanddab (3%), and Pacific staghorn sculpin (2%). The other 95+ taxa comprised the remaining 10% of fish impinged.

These 2001 study results were compared to a previous impingement study conducted in 1978. The 2001 study collected a total of 11,000 fishes over a twelve-month period, while the 1978 study collected a total of 17,000 fishes over a twelve-month period. Although several of the most abundant taxa collected in the 2001 study are similar to the abundant taxa in the 1978 study, abundance of shiner perch and bocaccio are significantly less in the 2001 study. Over 1,100 bocaccio were collected during the 1978 study, and only two were collected during the 2001 study. This is expected because the 1978 results for bocaccio reflect a recruitment event that occurred in 1978. Bocaccio recruitment events occur about every eight to ten years. Also, the bocaccio population along the West Coast has declined significantly over the past decade, and management measures are in effect to regulate the take of this species. The 1978 study collected 5,400 shiner perch, while the new study collected only 45 shiner perch. There has also been a general decline in shiner perch in estuaries along the West Coast over the past several years. The differences between the impingement studies do not indicate impacts due to the Power Plant, as cause and effect cannot be determined.

For comparison, the Huntington Beach Power Plant, with flow volumes similar to MBPP, and with an offshore intake structure, impinges up to 21 tons of fish per year. The El Segundo Power Plant, also with flow volumes similar to MBPP, and using an offshore intake, impinges about 15 tons of fish per year. Both of the offshore intakes noted above are about 2000 feet offshore in about 35 feet of water. The amount of fish impinged at MBPP is about 1.4 tons per year.

The value of impingement losses at MBPP is difficult to determine. Using commercial fishery values and assuming that all impinged taxa have the same value as cabezon, the annual loss would be approximately $10,000. The cost of the least expensive alternative for reducing impingement is probably a barrier net system (a large fish net placed in Morro Bay Harbor near the intake structure). This alternative would cost approximately $2 million (316b report, page 8-34). The cost of this system is significantly greater than the value of the impingement losses.

The permitted peak flow limit for the modernized Power Plant (475 MGD) is significantly less than the permitted flow limit for the existing Power Plant (668 MGD). The permitted annual-daily average flow for the modernized power plant is 370 MGD, compared with a historical average over the five-year period 1997-2001 of 387 MGD (the CEQA baseline selected by the Energy Commission), or an average annual flow of 374 MGD for 1987 through 2003. Pre-1987 flow data are not available. Provision 8 requires Duke Energy to minimize cooling water flows by managing pump operation and effluent temperatures (maintaining effluent temperatures near permit levels). Finally, Provision 9 requires Duke Energy to periodically dredge the area in front of the intake structures to minimize intake structure approach velocities, which may help reduce impingement rates. These Provisions will act to minimize impingement losses, but not enough to meet the 80-to-95%-reduction performance standard.

The Section 316(b) regulations specify that 0.5 ft/sec for the maximum through-screen intake velocity meets the applicable performance standard. (40 CFR §125.94(a)(1)(ii).) The Discharger asserts that the modernized facility will be at or below an intake velocity of 0.5 ft/s. As of September 30, 2004, however, the Discharger has not submitted documentation to support this claim. The analysis that the Discharger cites considers only approach velocity, not through-screen velocity. (See, Morro Bay Power Plant Modernization Project 316(b) Resource Assessment July 10, 2001 Table 2-3.) However, the Discharger's impingement studies demonstrated that impingement losses are not significant. The benefit of complying with the performance standard is negligible. Potential technologies to reduce entrainment losses (see following discussion) would also reduce impingement losses, but would either be ineffective or have a very high cost. Therefore, additional design and construction technologies, operational measures and/or restoration measures to reduce impingement are not justified under Section 316(b).

Alternative Technologies to Reduce Entrainment Losses

There are two potential ways of addressing entrainment losses:

1. Intake Structure Technologies
   a. Screening or filtering systems
   b. Changing the intake location
2. Reduced Cooling Water Volume Withdrawal
   a. Variable speed pumps
   b. Seasonal flow limitations
   c. Closed cooling systems (cooling towers, dry cooling)

The Administrative Record includes several references for this evaluation of alternative technologies, including:

a. Duke Energy's *Morro Bay Power Plant Modernization Project 316b Resource Assessment Report,* July 10, 2001.
b. USEPA's Phase II Technical Development Documents for the new 316(b) regulations.

c. *Preliminary Regulatory Development, Section 316(b) of the Clean Water Act, Background Paper Number 3: Cooling Water Intake Technologies,* 1994 (hereafter Background Paper No. 3).
d. *Fish Protection at Cooling Water System Intakes: Status Report,* Electric Power Research Institute, 1999 (hereafter EPRI 1999).
e. California Energy Commission staff's *Final Staff Assessment*, April 2002.
f. California Energy Commission's Third Revised Presiding Members Proposed Decision, August 2004 (adopted as the Commission Decision).
g. Tetra Tech's (the Regional Board's independent consultant) *Evaluation of Cooling System Alternatives: Proposed Morro Bay Power Plant*, May 2002.
h. Tetra Tech's memo to the Regional Board regarding salt drift from saltwater cooling towers, October 22, 2002.

The following conclusions address the requirements of the Section 316(b) regulations for existing facilities and the best professional judgment standard. The superscript notations "Regs" and "BPJ" are used where it is necessary to distinguish between the two.

Efficacy of Intake Structure Technologies (Screens, Filters)
Intake structure technologies are evaluated in detail in Background Paper No. 3. This report was prepared by Science Applications International Corporation (SAIC), an independent consultant to the EPA. Background Paper No. 3 describes all potential intake structure technologies, including ten types of intake screens and five types of passive intake systems.

Background Paper No. 3 includes a description of each technology and corresponding Fact Sheets that describe where the technology is being used (if it is being used), advantages and disadvantages, research findings, and design considerations. The conclusions of Background Paper No. 3 are summarized below.

Screens: Regarding intake screen systems, Background Paper No. 3 states: "The main finding with regard to intake screen systems is that they are limited in their ability to minimize adverse aquatic impacts." The report also states that "there has also been an interest in the use of fine-mesh mounted on traveling screens for the minimization of entrainment. However, the use of fine-mesh mounted on traveling screens has not been demonstrated as an effective technology for reducing mortality of entrainment losses." This is an important issue. Both once-through cooling and screening technologies cause larval mortality. The net benefit of a screening technology must be measured as a reduction in overall mortality. If the screening technology prevents entrainment of larvae and eggs, but simply replaces entrainment mortality with screening induced mortality, there is no benefit. The screening technologies are currently experimental. Site-specific and species-specific research must be done to determine their potential effectiveness at a particular power plant.

With respect to passive screens, Background Paper No. 3 concludes: "The main findings for passive intake systems are that available technologies that effectively reduce fish eggs and larvae entrainment are extremely limited." Radial wells and wedgewire screens are the only alternatives considered to have potential for reducing entrainment mortality. Radial wells are not used on large-scale systems such as MBPP. Radial wells are literally ground water wells, and are used on small-scale applications. Wedgewire screens are also limited in their application to facilities in rivers systems.

A comprehensive review of intake technologies is also provided in EPRI 1999. EPRI is the Electric Power Research Institute, Inc., of Palo Alto, California. Utility companies fund EPRI, which in turn sponsors research on utility industry issues. The conclusions of EPRI 1999 are similar to the conclusions of Background paper No. 3, that is, more research is needed on the various intake structure technologies before their applicability can be determined.

The Regional Board concurs with the conclusions of Background Paper No. 3 and EPRI 1999. The data collected on intake technologies to date are limited, highly variable, site-specific, and species-specific. The only technologies that may apply to MBPP for the purpose of reducing entrainment mortality are certain screening technologies, such as fine mesh screens, but they are considered experimental. A major problem with fine mesh screens is biofouling and mortality of larvae that are impinged on the screen. It is also difficult to determine the survivability of larvae that are impinged and then washed of the screens. Tetra Tech reports that survival rates for impinged larvae varies greatly based on studies at other facilities. The 316(b) demonstration report also discusses highly variable survivability (or mortality) results from studies done at other facilities. The only way to determine the effectiveness of a screening technology at MBPP is to conduct site-specific research, with independent scientific experts overseeing all aspects of the work. Such research would likely take years to complete, and the total costs are unknown, but would likely be in the millions of dollars range. The Regional Board cannot conclude at this time that installation of fine mesh screen technology would result in an efficacy that is any closer to the entrainment performance standard than the measures required by the permit, and finds that the cost of requiring this measure is not justified because the costs would be significantly greater than either the EPA costs or the benefits.[Regs] Fine mesh screen technology is not a demonstrated "available" technology for MBPP at this time.[BPJ]

The cost of installing fine mesh screens at MBPP is difficult to estimate because they are an experimental technology. Tetra Tech 2002 estimates the cost at approximately $8 million.

Filter Technology: Tetra Tech 2002 concludes that the aquatic filter-barrier technology is experimental at this time. There are no known applications in a marine environment such as Morro Bay, and there are major concerns with biofouling and reliability. There are also major physical restrictions in Morro Bay Harbor that make this technology an unlikely alternative. Regional Board staff met with several other agencies to assess the likelihood of a large filter barrier structure being approved for Morro Bay Harbor, and the response was overwhelmingly negative. As with fine mesh screens, a research project would be necessary to evaluate this technology in Morro Bay. The Regional Board cannot conclude at this time that installation of filter technology would result in an efficacy that is any closer to the entrainment performance standard than the measures required by the permit, and finds that the cost of requiring this measure is not justified because the costs would be significantly greater than either the EPA costs or the benefits.[Regs] Filter technology is not a demonstrated "available" technology for MBPP at this time.[BPJ]

Although a filter-barrier system is not feasible in Morro Bay, the cost to install such a system would be approximately $8 million to $12 million (316b Demonstration), plus pilot study research costs.

Intake Structure Location: The location of the intake structure in the vertical water column is not an issue here because the water is relatively shallow. Changing the vertical location of the intake opening would not minimize the loss of larvae. The location of the intake structure for the proposed Power Plant is the same as for the existing plant, near the mouth of the Morro Bay Estuary. Moving the intake structure further into the Estuary is not a practical option because such a move would likely increase estuarine larval losses. The only other location for the intake structure is several thousand feet offshore. Changing the location of the intake structure to an offshore location would reduce estuarine taxa losses but would increase coastal taxa losses due to entrainment and impingement. In this case there are major problems with offshore fish species, including ground fish populations that are near collapse. An offshore intake location is discussed further under "Other Technologies" below. An offshore intake location would not result in an efficacy that is any closer to the entrainment performance standard than the measures required by the permit, and may result in similar adverse entrainment impacts, and increased impingement impacts, than the current location.[Regs] Filter technology is not a demonstrated "available" technology for MBPP at this time.[BPJ]

Efficacy of Closed Cooling Systems

The new regulations do not require installation of closed cooling or equivalent reductions to demonstrate BTA. Analysis of closed cooling systems is included here to demonstrate that closed cooling is not required as a site-specific requirement and that the modernized facility will constitute BTA under the "best professional judgment" (BPJ) standard if the regulations are successfully challenged and the BPJ standard again becomes applicable. Under BPJ, the Regional Board could require a reduction in capacity of the intake system which would necessitate construction of an alternative cooling system, if such a system is available based on a site-specific analysis and the costs are not wholly disproportionate to the benefit to be gained. [USEPA, General Counsel Opinion No. 41, June 1, 1976, USEPA can limit the capacity of the intake but cannot mandate construction of cooling towers.] The greatest "minimization" of adverse environmental impacts to the Morro Bay Estuary would be obtained by a closed cooling water system. There is no question that closed cooling systems are established technologies for minimizing entrainment impacts.

Closed cooling systems are of two main types: wet and dry. Wet cooling systems recirculate fresh or saltwater through towers. Make-up water is needed to replace losses due to evaporation. Dry cooling systems recirculate fresh water in a truly closed system (like the radiator in an automobile); no evaporation occurs and therefore no makeup water is needed. The typical closed cooling systems are listed below:

Closed Cooling Systems

- I. Wet Cooling (saltwater or freshwater)
    - a. Mechanical Draft Cooling Towers
- II. Dry Cooling
    - a. Air Condensers
- III. Hybrid Cooling (saltwater or freshwater)
    - a. Mechanical Draft Towers and Air Condensers Combined

Availability of Wet Cooling Systems

In a mechanical draft system, heated water from the power plant is pumped to the top of cooling towers where it is then sprayed downward inside the tower. Air is forced upward through the tower by large fans (this makes them "mechanical draft"). The forced air transmits heat from the water to the atmosphere. The cooled water collects at the bottom of the tower where it is recirculated back to the power plant. Some water is lost to evaporation, and "make-up" water is needed to keep the volume constant. Mechanical draft towers using <u>fresh water</u> are the most common cooling systems, and are being installed on the majority of new power plants in California (Staff Report, July 1, 2001). Mechanical draft cooling towers can be designed to handle all or part of the cooling load.

Mechanical draft towers using <u>fresh water</u> could theoretically reduce cooling water withdrawal from the Estuary to zero; however, there is very little fresh water available in the Morro Bay area. Regional Board staff estimates that approximately 8 to 10 MGD of make-up water would be needed based on the reports referenced above. The potential sources of fresh water would be the Morro Bay wastewater treatment plant (1.6 MGD average flow) and desalination plant (0.6 MGD). The amount of fresh water <u>potentially</u> available is therefore approximately 1.6 to 2.2 MGD (City of Morro Bay NPDES permit Order Nos. 94-03 and 98-15). Further, the City of Morro Bay would have to upgrade its wastewater treatment plant to tertiary level treatment, and then be willing to provide the fresh water to Duke Energy instead of using the water for other purposes. The City of Morro Bay would also have to be willing to provide desalinated water to Duke Energy instead of using it for other municipal purposes. This is highly unlikely in an area where fresh water supplies are very limited, and considering that the City of Morro Bay has adopted Resolution 20-02 prohibiting the use of closed cooling systems for this facility due to visual, noise, and land use regulations. In any case, the amount of freshwater <u>potentially</u> available is not adequate to operate fresh water wet cooling towers for the proposed Power Plant. Therefore, fresh water mechanical draft cooling towers are not currently available for use in Morro Bay for the proposed Power Plant. In addition, use of fresh water for cooling would be inconsistent with State Water Resources Control Board (State Board) Resolution No. 75-58, Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling.

Mechanical draft towers that use saltwater could reduce cooling water withdrawals from the Estuary by up to about 90%, depending on the design of the system. The Power Plant is located in the town of Morro Bay, just upwind of the downtown area (prevailing winds are from the northwest and the downtown area is to the southeast). With drift abatement technology installed, salt water cooling towers would produce about 60 pounds of salt drift per hour (about five tons per week, or 262 tons per year), which would settle out over the community of Morro Bay directly downwind of the Power Plant (Tetra Tech memo to the Regional Board, October 30, 2002). Unlike nitrogen oxide and sulfur oxide or other gasses emitted from the Power Plant that spread out over thousands of square miles, salt drift is heavier and settles within a short distance of the cooling tower structure. The San Luis Obispo County Air Pollution Control District submitted a letter to the Regional Board dated March 4, 2004, which states that salt-water cooling towers would not be permitted in Morro Bay due to the salt drift discharge. The City of Morro Bay also adopted a resolution prohibiting closed cooling systems for this facility. The City of Morro Bay's resolution determines that closed cycle cooling systems would violate various laws, regulations, and City ordinances (Note: The resolution specifically addresses closed cooling systems proposed by Energy Commission staff, not salt water towers per se, but the land use, noise, and visual issues are the same). Accordingly, mechanical draft towers that use saltwater are not available at this location.

Tetra Tech 2002 estimates the costs of saltwater cooling towers at approximately $30 million.

Availability of Dry Cooling Systems
Dry cooling technology is similar to the cooling system in an automobile. Heated water is pumped from the power plant to a large external "radiator" or condenser. Large fans force air over the condensers and heat is thereby transferred from the condenser to the atmosphere. Dry cooling systems can be totally closed, requiring no make-up water. Dry cooling systems are currently in use at several power plants in the United States and are being included in plans for future power plant projects (Energy Commission Final Staff Assessment, April 2002). In California and elsewhere, dry cooling is used where fresh water supplies are very limited.

Energy Commission staff concluded that dry cooling is feasible at Morro Bay (Energy Commission's Final Staff Assessment, April 2002). However, Duke Energy maintains that Energy Commission staff's conclusion is based on design parameters that do not support the proposed project. Duke Energy's proposed project would produce 1,200 MW across an ambient temperature range of 35^0 F to 85^0 F. The power plant analyzed by Energy Commission staff cannot achieve a power output of 1200 MW above an ambient temperature of 56^0 F (Duke Energy, February 15, 2002). This results in major differences between the size of the dry cooling units designed by Energy Commission staff and Duke Energy.

The dry cooling system for Duke Energy's proposed project would be twice the size of a dry cooling system for Energy Commission staff's design. The size of a dry cooling system is directly related to the cooling capacity needed, and Duke Energy's proposed design requires twice as much cooling capacity as Energy Commission staff's design. Energy Commission staff's dry cooling system would be 320 feet long x 206 feet wide x 100 feet high. Duke Energy's dry cooling system would be 640 feet long x 185 feet wide x 110 feet high. Duke Energy maintains that either of these systems are too large to fit on the property they own that is available for the modernized Power Plant.

Further, the City of Morro Bay adopted Resolution No. 20-02, finding that Energy Commission staff's proposed closed cooling systems would cause visual, noise, cultural, and land use impacts, and would not comply with many laws, ordinances, regulations, and standards, and that an Energy Commission override is not possible. For this reason alone, a dry cooling system is not currently available for the proposed project.[2]

Either of these dry cooling systems (Duke Energy's or Energy Commission staff's) could add major noise, visual and land use impacts to the proposed project. Duke Energy, CEC staff, the Coastal Alliance on Plant Expansion, and the City of Morro Bay have established an extensive record regarding these issues.

The Energy Commission's Decision concludes that Energy Commission staff's design does not meet the objectives of the project, and after reviewing all the available evidence, concludes that dry cooling is not physically feasible or legal for the proposed project. The Commission Decision states the following (Page 354):

1. The specific dry-cooling alternatives of Staff and CAPE, fail to satisfy the requirement of CEQA that an alternative meet most of the key objectives of the project.

2. Closed-cycle cooling, including dry-cooling as proposed by Staff and CAPE or adjusted in size to meet the objectives of the project, is not feasible at the Morro Bay site within the meaning of CEQA or the Clean Water Act.

3. For the purposes of exercising our responsibilities under the Warren-Alquist Act, we conclude that closed-cycle cooling does not constitute the "best technology available" for this power plant within the meaning of Clean Water Act section 316(b) because it is not feasible at this site and because the costs are wholly disproportionate to the benefits.

Tetra Tech 2002 estimates the total present value of costs associated with a dry cooling system (for the Power Plant proposed by Duke Energy) at approximately $105 million.

Availability of Hybrid Systems
Hybrid systems are simply a combination of dry and wet cooling technologies. The proportion of cooling assigned to each technology depends on site-specific conditions, such as the amount of make-up water available. A hybrid system that uses both dry cooling and fresh water mechanical draft towers would reduce cooling water withdrawals from Morro Bay to zero. A hybrid system that uses dry cooling and saltwater mechanical draft towers could reduce cooling water flows from Morro Bay by 95% or greater. However, hybrid systems use the same technologies discussed above (wet and dry systems), and therefore are not currently available in Morro Bay for the reasons noted above.

Tetra Tech 2002 estimates the total present value of costs associated with a hybrid cooling system (for the Power Plant proposed by Duke Energy) to be approximately $98 million.

Closed cooling systems would meet the entrainment performance standard. (40 CFR § 125.94(a)(1).) However, the Discharger has not selected this compliance option. The cost of closed cooling would be significantly greater than either EPA costs or the benefits of meeting the entrainment performance standard. The Regional Board therefore cannot require this option as a site-specific requirement.[Regs] Closed cooling is not "available" technology at MBPP for the reasons discussed in the alternatives analysis, above.[BPJ]

Other Technologies

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[2] The Energy Commission has limited authority to override local laws. They can do so if they make a determination that a power plant that violates local laws is required for public convenience and necessity and that there are not more prudent and feasible means of achieving such public convenience and necessity. (Pub. Res. C. § 25525.)

Natural Draft Cooling Towers: Natural draft cooling towers are discussed in the 316b Demonstration report. These towers work on the same principle as "mechanical" draft towers discussed above, except without "mechanical" fans. Without the mechanical fans, the natural draft towers must be much larger than the mechanical draft type towers. Natural draft towers would be so large (about 250 feet in diameter x 400 tall) that they cannot be seriously considered for the Morro Bay site. All the other obstacles mentioned above for other closed cooling systems also apply. This alternative is not an option at MBPP. The cost of installing natural draft cooling towers, even if possible, would be an additional $64 million capital cost and incremental energy cost (loss of productivity) of $8 million per year. Annual O&M costs would be $400,000 (316b Demonstration).

Variable Speed Pumps: Cooling water pumps can be "single" speed or "variable" speed. Single speed pumps may use more cooling water than a system using variable speed pumps if there is significant fluctuation in electricity output at the power plant. Single speed pumps come on-line in series as necessary to increase cooling water flow when power output increases. This results in an incremental stepwise increase in cooling water flow (316b Demonstration, page 6-94). Variable speed pumps may reduce cooling water flows in some cases by eliminating the stepwise incremental increase caused by an additional single speed pump coming on-line. The modernized power plan will use a multiple pump system. The two combined-cycle units will have four fixed-speed pumps each (a total of eight pumps). The Discharger will reduce cooling water flow by minimizing the number of pumps operating at any given time (as required by this Order). Installing variable speed pumps would cost approximately $3 million (316b Demonstration), but there is no compelling evidence that variable speed pumps would reduce cooling flows significantly more than this requirement.

Offshore Intake Structure: The benefit of an offshore intake structure would be to decrease the impact to estuarine species. The disadvantage would be greater impingement and entrainment of nearshore (non-estuarine) fish species. The current Morro Bay Power Plant intake structure impinges about 1.4 tons of fish per year. For comparison, the Huntington Beach Power Plant, with flow volumes similar to the Morro Bay Power Plant, and with an offshore intake structure, impinges up to 21 tons of fish per year. The El Segundo Power Plant, also with flow values similar to Morro Bay Power Plant and using an offshore intake, impinges about 15 tons of fish per year. Both of the offshore intakes noted above are about 2000 feet offshore in about 35 feet of water. This information is from documents filed with the Energy Commission by the utility companies. It should be noted that fish return systems are available, such as the system used at the San Onofre Nuclear Generating Station (SONGS). A fish return system is a mechanical system that attempts to return impinged fish to their source water via a sluiceway. Overall, the SONGS fish return system results in a survival rate of about 68% for impinged fish, making the offshore intake structure more favorable. However, entrainment of offshore or coastal larvae cannot be reduced in an offshore intake system. Some of the offshore taxa that would be impinged and entrained in an offshore intake for the Morro Bay Power Plant are currently heavily impacted to the point of near collapse. The National Marine Fisheries Service recently implemented emergency "no-take" measures for certain species of rock fish, which may apply to an offshore intake structure. Entrainment of fish larvae is a major impact at SONGS; where modeling efforts predict substantial impacts on regional fish stocks due to entrainment of larvae in the offshore structure. In addition, the physical construction of an offshore intake system would cause major impacts to marine habitat. Therefore, an offshore intake is not a realistic alternative for minimizing adverse impacts because it would simply move the impacts offshore.[Regs, BPJ]

Tetra Tech 2002 does not estimate the cost of an offshore intake structure, but does estimate the cost of an offshore outfall structure at approximately $22 million. The cost of an outfall structure would be similar to the cost of an intake structure.

Seasonal Flow Limitations: Seasonal flow limitations are applicable in cases where one or more particularly important species (such as endangered or threatened species) are being entrained during specific times of the year. This is not the case at MBPP, where no threatened or endangered species were identified in the entrainment sampling program. At MBPP, larvae are available and entrained throughout different seasons, and seasonal flow limits would require choosing some species over others for protection. This alternative is not required because there is no practical way to choose certain taxa as being more important than others unless there are threatened or endangered species present. The cost (lost revenue) of seasonal flow restrictions depends on the duration and magnitude of the seasonal limitation and energy prices. The costs could range into the millions per year depending on these factors. As noted above, there is no biological argument for seasonal flow limitations based on the species entrained. Therefore, this alternative is not reasonable at MBPP for reducing adverse impacts.[Regs, BPJ]

The cost of seasonal flow reduction is the lost revenue resulting from decreased power output. Tetra Tech 2002 estimates total revenue at the modernized MBPP at approximately $329 million per year. If seasonal reductions were to reduce power output by 10%, the revenue loss would be approximately $30 million per year. A twenty percent reduction would cost approximately $60 million per year in lost revenue.

Cooling Ponds: There are two types of cooling ponds: "passive" and "spray." Passive cooling ponds and spray ponds work on the same principle as mechanical and natural draft cooling towers. Warm water is exposed to the atmosphere and cooled, thereby releasing heat to the atmosphere. These systems are unconventional and no known application exists for a facility like MBPP, which is adjacent to the City of Morro Bay. Three circular "spray" type ponds would be necessary, measuring 620 feet in diameter [Duke Energy's 316(b) Demonstration Report, 2001]. This amounts to about 20 acres of surface area. For "passive" type ponds, a surface area of 300 acres would be necessary. According to the Energy Commission's Commission Decision, the available acreage for the entire modernized project is about 20 acres, so this alternative is not feasible.[Regs, BPJ] In addition, the lack of fresh water, and saltwater drift if saltwater were used, preclude these alternatives at MBPP.

The estimated capital cost of installing spray cooling ponds is $30 million (316b Demonstration).

Application of EPA 316(b) Regulations

The USEPA published revised Clean Water Act Section 316(b) regulations for existing power plants on July 9, 2004. (40 CFR§§ 122.21(r); 122.44(b)(3); 122.25(a)(4), (36); 124.10(d)(1)(ix); and Part 125 Subpart J.). The regulations are effective beginning September 7, 2004. The regulations provide the Discharger with five options for achieving compliance. The first four options require the discharger to demonstrate that a combination of design and construction technologies, operational measures, and/or restoration measures will achieve applicable performance standards. The fifth option allows the Discharger to request a site-specific standard from the implementing agency. In this case, the Discharger has chosen the fifth option, and has proposed that a reduced design-maximum cooling water flow combined with a habitat restoration/enhancement plan will provide greater benefit at less cost than the other potential alternatives. The performance standards for reduction of entrainment (60 to 90% reduction from baseline) and impingement (80 to 95% reduction from baseline). The determination of the appropriate baseline is discussed below.

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Technology Requirements

The new regulations do not require closed cooling systems or equivalent entrainment reductions in order to meet the BTA standard due to high costs (Preamble, 69 Fed. Reg. page 41605). The regulations for existing facilities are based on intake structure technologies (fine mesh screens, filters, etc.) and power plant operational changes (seasonal flow reductions, etc.), and habitat restoration.

The new 316(b) performance standards call for a reduction in entrainment of 60% to 90% from a "baseline." The performance standards also call for a reduction in impingement of 80% to 95% from a baseline. The range of the performance standards (i.e., 60 to 90%) is due to uncertainty associated with the efficacy of cooling water intake technologies (Preamble, 69 Fed. Reg. page 41600) and Chapter 4 of: "Efficacy of Cooling Water Intake Structure Technologies" from the Phase II Existing Facility Technical Development Document. USEPA states that the basis for these performance standards is their review of intake structure technologies, including fine mesh screens with fish return systems, filter barriers, and wedgewire screens (Preamble, 69 Fed. Reg. pp. 41598-41599). These technologies are discussed in detail in the sections above, and are mentioned only briefly here.

Wedgwire screens are only applicable to intake structures located on rivers with the necessary hydrological, site-specific conditions. Fine mesh screens have not been demonstrated as an effective technology for the many taxa that are entrained in marine cooling water systems. The few studies that have been done for fine mesh screens focused on a limited number of taxa, and the results are highly variable (Background Paper #3; EPRI 1999). Aquatic filter systems have not been demonstrated as available technologies for a marine setting such as Morro Bay, and it is highly unlikely that such a large structure would fit within the confines of Morro Bay Harbor.

The Preamble to the regulations specifies the particular technologies and costs EPA considered for many existing power plants. For MBPP, EPA considered addition of fish handling and return system to an existing traveling screen system, which only applies toward impingement reduction. EPA considered these costs only for *impingement* impacts, and did not provide technology cost estimates for reducing entrainment (Preamble, 69 Fed. Reg. 41646, 41672, 41681.) The Regional Board does not agree with the USEPA's approach in establishing technology costs for MBPP based only on impingement control technology. Nevertheless, the Regional Board acknowledges that the USEPA technology cost for MBPP is established in the 316b regulations, and is used as the cost-cost reference.

Therefore, the USEPA performance standard for entrainment (60% to 90% reduction) is based on technologies (screens, filters) that are either not feasible at Morro Bay or have not been demonstrated as effective in a setting like Morro Bay. Further consideration of these intake structure technologies in Morro Bay could only be done as research projects.

316(b) Baseline

The regulations generally describe the "baseline" for measuring the entrainment performance standard as an estimate of the entrainment that would result assuming: a once-through cooling system; the opening of the intake structure has a standard 3/8-inch mesh traveling screen oriented at the shoreline near the surface, and parallel to the shoreline; and no structural controls are implemented for the purpose of reducing entrainment. The discharger may elect to calculate the baseline using current or historical facility-specific data, or historic data from a comparable facility. (40 CFR 125.93.) The impingement baseline is calculated in the same manner.

Entrainment and impingement rates are directly related to cooling water flow. Therefore, cooling water flow is a proxy for entrainment and impingement rates (increased cooling water flow directly increases entrainment and impingement, and visa versa). The two most practical definitions for baseline are: 1) existing design maximum flow and 2) existing average annual flow. The design maximum is equal to the permitted peak (daily) flow maximum. The existing design maximum flow is 668 MGD. The average annual flow over the past seventeen years was 374 MGD (1987 through 2003). The Regional Board does not have flow data records prior to 1987. The CEQA baseline used by the CEC is 387 MGD. MBPP cooling water flows in 2004 were low due to limited Power Plant operation. Two units were taken offline during 2004, but remain available to for power generation if necessary.

The purpose of establishing a baseline is to define a reference point from which entrainment and impingement reductions are measured. Establishing an appropriate baseline requires a basic understanding of how the existing Power Plant operated over time. The existing Morro Bay Power Plant is designed to produce power in response to demand, where demand can fluctuate on an hourly basis. As power demand and output increases, additional pumps are brought on-line to increase cooling water flow. The cooling water flow rate data from the Discharger's monitoring reports show that the existing Power Plant used its design maximum cooling water flow on a regular, daily basis between 1987 and 2002 (historical records prior to 1987 are unavailable but are assumed to be similar). During 2000 and 2001 the existing Power Plant operated at relatively high levels. During 2002 and 2003, operation of the existing Power Plant declined significantly. During 2004, two units were taken off-line, but have been maintained so that they can be brought on-line again if necessary. The Regional Board does not consider the high flow years of 2000 and 2001, or the low flow years of 2003 and 2004, to be representative of the fifty-year historical operations. Baseline should be defined by normal Power Plant operation, not abnormal conditions, including additional years of low flow or zero flow if the permitting and certification processes are drawn out further.

The historical design maximum flow (668 MGD) can be compared to the future design maximum flow (475 MGD). This represents a maximum design flow reduction of 29%. The existing Power Plant is permitted to use its design maximum flow at any time, for any duration of time. We note that operation of the existing Power Plant is subject to demand, market conditions, weather, and availability of power from other sources, all of which can change dramatically from year to year. The modernized Power Plant will be limited to a lower design maximum flow, and in addition, will be limited to an annual average flow of 370 MGD (the existing Power Plant has no annual average flow limit). With the annual average flow limit, the modernized Power Plant will not be able to operate at the permitted level of the existing Power Plant. This represents a significant, more limiting operational change in the future. If existing design maximum flow is used as the baseline, the result is a credit to the discharger (for entrainment and impingement reduction) of 29%. However, this approach overstates the actual reduction since it only considers the reduction in peak-flow impacts, and not average daily annual flows.

A more conservative approach is to use the historical (actual) annual average flow (between 1987 and 2003) as baseline and compares it to the annual average flow permit limit for the modernized Power Plant. This results in "no change" scenario, and the Discharger receives no credit for entrainment and impingement reductions. This approach is more conservative because it does not represent permit conditions, or the fact that maximum design flow will be significantly reduced in the future. This appears to be the approach intended by EPA. The Preamble (69 Fed. Reg. 41614) notes the rule is intended to provide permit-writers flexibility in applying the performance standard, but averaging over longer periods is generally appropriate:

> "…[The permitting agency] is given considerable discretion to determine, based on the facility's Comprehensive Demonstration Study, the appropriate averaging period and precise metric for determining impingement mortality and entrainment reductions. Generally, averaging over longer time periods (*i.e.*, a full five year permit term) can substantially reduce the impact of natural variability on the determination of whether permit standards are being met."

A third approach would be to use the default definition of baseline, i.e., the assumed rate of impingement that would occur absent any controls to reduce entrainment. Since this definition refers to entrainment that *would occur* at the site absent any controls, and the permit is for the modernized (not historical) facility, this approach requires the use of the new design capacity (475 MGD) as the baseline. This would be compared against the permitted daily-average annual flow (370 MGD), resulting in a 22% reduction from baseline. However, this is an "apples-to-oranges" comparison that assumes that the facility would operate at full capacity at all times absent the flow reductions required by this Order and the CEC certification.

Therefore, baseline is defined as the average annual historical flow, which, when compared to the future annual average flow, essentially results in a "no change" scenario. Under this scenario, no credit is given for reducing cooling water flows or for meeting the entrainment reduction standard (the standard is to achieve a 60% to 90% reduction in entrainment). As discussed below, even using this baseline definition, the proposed design, operation and restoration measures satisfy the performance standard.

Consideration of Technology Costs and Benefit Values

The new 316(b) regulations state that the cost of achieving the new entrainment and impingement standards shall not be significantly greater than:

1. The USEPA's national average compliance cost estimates for a like facility (facility similar to MBPP)
2. The value of the entrained/impinged losses at MBPP.

As part of the new regulations, the USEPA has determined national average costs for retrofitting facilities with intake structure technologies. The USEPA compliance cost for MBPP is $4.34 million. The Regional Board cannot include site-specific requirements that cost significantly greater than USEPA's technology cost for MBPP. USEPA does not define the term "significantly greater," USEPA also states (Preamble, 69 Fed. Reg. page 41626):

> "In addition, EPA notes that—contrary to some commenter assertions—the rule does not in fact authorize permitting authorities to consider a facilities "ability to pay" in its site-specific assessment of BTA. It [the new rule] only allows consideration of whether the facility has unusual or disproportionate compliance costs relative to those considered in establishing the performance standards—not whether the facility has the financial resources to pay for the technology."

Estimating the Value of Entrainment and Impingement Losses

The regulations include very limited provisions on benefit valuation. In order to qualify for site-specific requirements based on the cost-benefit test, a discharger must provide a Benefits Valuation Study using a "comprehensive methodology to fully value the impacts of … entrainment … and the benefits achievable by meeting the applicable performance standards." (40 CFR 124.95(b)(6)(ii).) The Study must either provide a monetized valuation, or a narrative description of any non-monetized benefits of the performance standard and a qualitative assessment of their magnitude and significance. The permitting agency may require a peer review.

Estimating the dollar (monetized) "value" of entrainment and impingement losses is very difficult, if not impossible in a reasonable sense, for several reasons, including:

1. Entrainment studies are imprecise. The results are characterized by many assumptions, large statistical errors, and professional debate among experts regarding the ecological importance of entrainment losses.
2. Entrainment studies cannot accurately quantify a discrete loss of tangible resources, such as a reduction in fisheries, or secondary (food web) impacts.
3. The conversion of larvae to adult fish is the most imprecise part of entrainment studies due to the paucity of life history information for most species.
4. There is no direct way to place a dollar value on larvae.

The most common approach is to convert larval losses to adult fish, which is a highly imprecise approach. A dollar value can be estimated for commercial and recreational fish losses based on market values, but market values do not reflect "non-use" values. Non-use organisms are those that are not commercially or recreationally harvested but nevertheless have ecological value. There are no established methods for estimating the "true" dollar value of "non-use" organisms lost to entrainment and impingement. USEPA struggled with this issue in development of the new 316(b) regulations and considered several potential methods for estimating the value of non-use organisms lost to entrainment and impingement in preparing its required analysis of the national costs of the rule. After reviewing potential valuation methods and considering many public comments, USEPA states (Preamble, 69 Fed. Reg. 41624):

> "EPA has determined that none of the methods it considered for assessing non-use benefits provided results that were appropriate to include in this final rule, and has thus decided to rely on a qualitative discussion of non-use benefits."

USEPA's discussion of the non-use valuation methods it considered in adopting the rule provides some guidance on how a permitting agency should perform this type of valuation in applying the rule.

Regional Board staff and the Board's independent scientists used a monetized method for estimating the ecological value and importance of entrainment losses, called the Habitat Production Foregone (HPF) method. HPF attempts to estimate the value and ecological importance of all entrainment losses based on physical habitat, as discussed below. However, we consider this a qualitative approach because it provides an <u>indication</u> of value within the context of habitat restoration, not an absolute value in an economic sense.

Resource economists have accepted this approach in similar contexts. In a January 22, 2003 peer review prepared for the pending Diablo Canyon Power Plant permit renewal, Stratus Consulting, Inc. stated:

> 2.4.2 Habitat-based replacement cost analysis
>
> Dr. Pete Raimondi of UC Santa Cruz notes that, in the absence of direct information on nonuse values, it is useful to consider the habitat that would be required to offset entrainment losses. The habitat-based replacement (HRC) method estimates the cost of restoring habitat to the level necessary to offset losses. The method is related to Habitat Equivalency Analysis, which is used by federal and state agencies to monetize damages in cases where resource injuries are otherwise difficult to value.
>
> As ASA (2002) notes, replacement cost methods like the HRC [Habitat Recovery Cost] are not true benefits "valuation" methods, and therefore replacement cost estimates cannot be taken as measures of economic benefits. However, replacement costs can be used in a policy context or in permit negotiations as a point of reference for evaluating technology costs.
>
> Replacement costs based on fish hatchery and stocking costs are used routinely to estimate the economic damages associated with fish kills, including fish losses resulting from impingement and entrainment (e.g., by the Maryland Power Plant Program). While all parties acknowledge that these hatchery-based replacement "costs" are not true "benefits values" per se, in the absence of information on public values, these are accepted and used as the only available alternative for monetizing damages. In fact, in its publication presenting estimates of fish replacement costs, the American Fisheries Society states that such costs can be considered a "proxy for value."

> Moreover, although ASA (2002) asserts that "the costs of habitat replacement . . . have little relationship to actual value," there are certain conditions under which replacement or avoidance costs can be appropriately used as a lower bound measure of value, such as when actions are undertaken voluntarily. In fact, many habitat restoration programs are voluntary actions and therefore indicate "value."

Habitat Production Foregone

The HPF approach converts the proportional larval loss values to habitat acreage. HPF is simply the amount of habitat it would take to replace the larval losses caused by entrainment. The acreage values can then be converted to a dollar value for the purpose of valuing non-use benefits. This approach is not intended to imply a loss of habitat (the Power Plant does not cause a loss of habitat). The acreage is estimated by using the entrainment loss estimates from Duke Energy (10% loss) and Regional Board staff (33% loss). Assuming the Morro Bay Estuary is 2300 acres in size, the equivalent habitat acreages are calculated as: 0.10 x 2300 = 230 acres, and 0.33 x 2300 = 759 acres. The equivalent habitat acreage values are then 230 acres (based on Duke Energy's larval loss estimate) or 759 acres (based on Regional Board staff's larval loss estimate). This approach covers all entrained species across all estuarine habitat types.

We convert the acreage to dollar values by using land cost and restoration cost estimates relevant to the Morro Bay Estuary area. Regional Board staff worked with the Morro Bay National Estuary Program office to obtain these estimates.

1. Based on actual costs of a riparian area restoration project conducted by the Resource Conservation District (restoration of a floodplain for sediment capture and revegetation), a rough estimate for similar work would be approximately $20,000 per acre. This does not include land purchase costs. This estimate is for the Chorro Flats project, which was conducted over a period of several years during the 1990's. Assuming an inflation rate of 3% over a ten-year period, the present restoration costs may be in the range of $26,000 per acre.
2. An appraisal performed for the MBNEP in April 2003 determined a value of $15,000 to $21,000 per acre for irrigated row-crop lands in the Morro Bay watershed. Low-lying floodplains suitable for restoration fall almost exclusively into this land type. A specific parcel along Chorro Creek with excellent floodplain restoration potential was appraised at $20,000 per acre for the agricultural land, and $1,500 per acre for the creek and riparian area. The value of grazing land is somewhere between these two values ($1,500 and $20,000 per acre). These estimates are for purchases only, not restoration. Assuming purchase costs for "ideal" flood plain type habitat range between $1,500 and $21,000, the average purchase cost would be (1,500 + 21,000)/2 = $11,250. We note that the purchase price for estuarine habitat may be significantly less because such habitat cannot be utilized.

These estimates do not include the very high value of shoreline residential real estate, which can be several hundred thousand dollars or more per acre. Obviously, there is a great deal of variability in costs for acquisition and restoration of habitat. The Army Corps of Engineers recommends using $100,000 per acre for restoration and purchase costs based on projects in Southern California where costs are very high. The Regional Board considers recent estimates based on local projects to be more realistic and reasonable.

Assuming restoration costs of $26,000 per acre, and an average purchase cost for ideal floodplain habitat of $11,000 per acre, the total cost would be $37,000 per acre. Using this estimated total cost, the dollar value range from the HPF valuation approach is calculated as: 230 acres x $37,000/acre = $8.5 million (based on Duke Energy's larval loss estimate of 10%), and 759 acres x $37,000/acre = $28 million (based on staff's larval loss estimate of 33%). The dollar values are then $8.5 million or

$28 million depending on assumed larval loss. These values are not intended to be exact, but are intended to indicate general values. The new regulations require a minimum entrainment reduction of 60%. The value of reducing entrainment by 60% is then: (0.6)x($8.5 million) = $5.1 million (@10% larval loss) and (0.6)x ($28 million) = $16.8 million (@ 33% larval loss).

Discharger's Non-Use Benefit Valuation

The Discharger analyzed the benefits of the entrained non-use species by the USEPA method of converting the estimated total number of entrained goby larvae, which constituted 85% of the total number of entrained larvae fish, into total biomass of the total adult equivalent Age 1 fish extrapolated from the number of larval gobies entrained. The Discharger also estimated the biomass of entrained fish taxa. The biomass of all entrained taxa of larval fish was converted to the equivalent biomass produced by eelgrass, a primary base of Morro Bay's food web reasoned to support the species of entrained fish. This value was then used to estimate the welfare benefits of Duke's proposed restoration program to offset intake effects of the MBPP. The Discharger concluded that a 45% reduction in entrainment is of equivalent value to 40 acres of eelgrass. Thus, a 60% reduction is equivalent to 53 acres.

The Discharger calculated a production value of entrained gobies based on their use as halibut forage. This value was negligible: $11,000 for the value of 45% of entrained gobies, or $14,667 for the value of 65% of entrained gobies.

The Discharger estimated the non-use benefits based on the USEPA willingness-to-pay value for California of $3.55 per household. A $12.5 million Habitat Enhancement Plan equates to $129 per household, or nine times the willingness-to-pay value.

The Discharger's biomass conversion approach results in a much lower amount of acreage than Regional Board staff's HPF approach described above. Regional Board staff and the Regional Board's independent scientists consider the HPF method to be a more scientifically valid approach. Nevertheless, the Discharger proposed a Habitat Enhancement Program fund of $12.5 million, plus performance monitoring at $160.000/year). This value ($12.5 million) is within the range noted above for the HPF method ($5.1 million to $16.8 million).

Sedimentation Reduction Valuation

Another approach is to consider the condition of the Morro Bay Estuary and costs associated with protecting the Estuary over the long term. It is well established that accelerated sedimentation in the Morro Bay watershed is causing a high rate of estuarine habitat loss over time. The Morro Bay National Estuary Program's Comprehensive Conservation Plan for the Morro Bay watershed describes sedimentation as the primary threat to the Morro Bay Estuary. In addition, the sedimentation problem is described in the Regional Board's Sedimentation Total Maximum Daily Load (TMDL) Order for the Morro Bay watershed. (Order No. R3-2002-0051, adopted May 16, 2003; see 23 Cal. Code of Regs. §3925.). The TMDL Order estimates sediment loading from various land categories (ranchland, irrigated agriculture, brushland, etc.), sets a sediment load reduction goal of 50%, estimates the cost of achieving the goal at approximately $13 million using best land management practices, and includes a monitoring program to measure sedimentation reduction success.

As part of the preparation for this Order, the Regional Board retained an independent expert in physical estuarine dynamics, Jeff Haltiner of Philip Williams and Associates (PWA), to review the existing information on sedimentation and estuarine longevity and provide an independent analysis to the Regional Board. The PWA report to the Regional Board is titled *Morro Bay Sedimentation: Historical Changes and Sediment Management Opportunities to Extend the Life of the Bay,* August 2002. The PWA report verifies that estuarine volume is being lost at an unnaturally high rate due to accelerated upland erosion. Overall, the majority of estuarine volume will be lost within about 400 years. The back Bay volume will be lost within 100 years.

PWA estimates that a 50% reduction in sedimentation will double the life of the estuary. This is equivalent to a gain of several hundred thousand acre-years of habitat productivity. “Acre-years” is a unit that represents estuarine productivity over time, which can be compared to the benefit of entrainment reduction in like units. New habitat is not created with sedimentation reduction, but existing estuarine habitat (or wetland habitat) is prevented form being lost, thereby extending the life of the Estuary. Note that estimating the life of the Estuary depends on the reference elevation chosen, as discussed in the PWA report. The higher the reference elevation chosen to represent the “full” level, the longer it takes for the Estuary to fill in. In a previous staff report to the Regional Board (May 2002), the benefit of sedimentation reduction was presented in acres-years. Using PWA’s estimate that a 50% percent sedimentation rate reduction doubles the overall life of the Estuary from 400 to 800 years, the gain in habitat productivity for all habits would be approximately (400 years x 1,725 acres)/2 = 345,000 acre-years of additional estuarine productivity. Note that the Estuary is 2,300 acres in size, but an area of 1,725 aces is used in this calculation because the harbor area (Zone 1 in the PWA report) is excluded due to regular dredging. This overall gain of about 345,000 acre-years of estuarine productivity occurs over an 800-year period (doubling the life of the Estuary from 400 to 800 years, but benefits occur from zero to 800 years).

Similar to the Regional Board’s sediment TMDL for the Morro Bay watershed, PWA identifies the sources of erosion, land treatments that would reduce erosion, and costs. PWA’s October 24, 2002 memo to the Regional Board estimates costs for sedimentation reduction efforts (referred to as “treatments” in the PWA report). PWA provides sediment trapping capacity and cost estimates for the following sediment reduction practices throughout the Morro Bay watershed, listed in order of their effectiveness in reducing sedimentation:

Vegetative Buffers
Sediment Traps
Stream Channel Restoration
Floodplain Restoration
Grazing Management
Crop Management
Road Decommissioning
Prescribed Burns
Post Fire Management
Construction Best Management Practices

PWA estimates that a sediment reduction of 42% to 52% could be achieved by implementing these actions, at a cost range of $12 million (@ 42% sediment reduction) to $25 million (@ 52% sediment reduction). These costs illustrate significantly diminishing returns per dollar spent as sediment reduction increases from 42% to 52%. Approximately 80% of the costs are for the first four sediment reduction practices listed above. Therefore, for a cost range of $12 to $25 million, the benefit is 345,000 acre-years of productivity over 800 years.

Assuming the modernized Power Plant operates for 50 years (based on the longevity of the existing Power Plant), the larval productivity loss over the operational life of the modernized Power Plant is (230 acres x 50 years) or (759 acres x 50 years) = 11,500 acre-years or 37,950 acre-years of lost larval productivity. Reducing entrainment by 60% would create a benefit of 11,500 x 0.6 or 37,950 x 0.6 = 6,900 acre-years or 22,770 acre-years over 50 years. The following is a comparison of the benefit of sedimentation reduction to the benefit of entrainment reduction:

Action	**Benefit**

	(acre-years of larval productivity)
Sedimentation Reduction	345,000 acre-years
Entrainment Reduction	6,900 acre-years or 22,770 acre-years

Since sediment reduction will result in significant benefits to the taxa entrained by preserving habitat critical to these species, a Habitat Enhancement Program is a viable alternative for the modernized Power Plant project under section 316(b).

Duke Energy also submitted a Habitat Enhancement Program report to the Regional Board (Duke Energy, August 2002). Duke Energy's proposal has four main objectives:

1. Offset and minimize the effects of entrainment of the modernized plant;
2. Improve the quality and quantity of aquatic habitat in Morro Bay;
3. Reduce sediment transport into Morro Bay; and
4. Complement ongoing Bay protection and enhancement programs overseen by the Regional Board, the Morro Bay National Estuary Program (MBNEP), and the Army Corps of Engineers (ACOE).

Duke Energy proposes a funding level of $12.5 million for implementing sediment reduction and estuarine habitat restoration projects. Duke Energy's report evaluates the benefits of projects differently than the Regional Board staff analysis. Duke Energy's approach is based on biomass production and transfer. However, the project examples evaluated by Duke Energy are from PWA's report to the Regional Board and the funding level proposed is within the dollar range estimated by Regional Board staff. Regardless of the method used to evaluate the benefit of certain projects (Duke Energy's method or Regional Board's method), the projects that need to be implemented to protect and preserve the Morro Bay Estuary remain the same, as defined in the PWA report.

Feasibility of Sediment Reduction Projects

The PWA report discusses sediment reduction projects that could be implemented in the Morro Bay watershed, the relative degree of sediment reduction that could be achieved for different types of projects, and their relative costs. The Regional Board's TMDL order for the Morro Bay watershed and the National estuary Program's Comprehensive Conservation Plan also define sedimentation control projects that can be implemented in the Morro Bay watershed.

Restoration or Recovery of Critical Estuarine Habitat

In addition to sediment reduction projects that reduce the loss of critical estuarine habitat, the most beneficial type of project for entrained estuarine taxa would be the recovery of critical habitat. The Morro Bay National Estuary Program, Army Corps of Engineers, and County of San Luis Obispo are currently exploring this option. It is physically possible to recover critical habitat that has been lost to excessive sedimentation through dredging and perhaps other more non-invasive techniques. However, the effort must first be evaluated through a CEQA process, and the approval of several agencies would be required for any final dredging-type projects. The process would take several years. Restoring or recovering estuarine habitat would be the most direct method of "replacing" entrainment losses because it would "create" additional estuarine larval productivity. It is not possible to quantify the amount of estuarine habitat acreage that may be recovered or restored in the future, however, this type of project is listed as a goal in Finding 33 of this Order.

Site Specific Standard

As described above, a facility may demonstrate BTA by seeking a site-specific determination of BTA. The Regional Board must follow these steps to make this determination (see 40 CFR § 125.94(a)(5)):

Cost-Cost Test

1. Calculate the costs EPA considered for similar facilities when it adopted the regulation ("EPA costs"). To do so, the Regional Board must:
   a. Determine which technology EPA modeled as the most appropriate compliance technology for the facility;
   b. Using EPA's costing equations, calculate the annualized capital and net operation and maintenance costs for a facility with the same design intake flow using this technology;
   c. Determine the annualized net revenue loss associated with net construction downtime that EPA modeled for the facility to install this technology;
   d. Determine the annualized pilot study costs that EPA modeled for the facility to test and optimize this technology;
   e. Sum the cost items in paragraphs (a)(5)(i)(B), (C), and (D) of this section;
   f. Determine if the performance standards that form the basis of these estimates (i.e., impingement mortality reduction only or impingement mortality and entrainment reduction) are applicable to the facility, and if necessary, adjust the estimates to correspond to the applicable performance standards.

2. Determine that facility-specific data demonstrate that the cost of meeting the performance standard would be "significantly greater" than EPA costs.

3. Make a site-specific determination of BTA based on reliable, scientifically valid cost and performance data.

   a. The site-specific requirements must include new or existing design and construction technologies, operational measures and/or restoration measures that achieve an efficacy that the Regional Board determines is "as close as practicable" to the performance standard.
   b. The site-specific requirements cannot have costs "significantly greater" than EPA costs.

Cost-Benefit Test

1. Determine that facility-specific data demonstrate that the cost of meeting the performance standard would be "significantly greater" than the benefits of meeting the performance standard.
2. Make a site-specific determination of BTA based on reliable, scientifically valid cost and performance data.
   a. The site-specific requirements must include new or existing design and construction technologies, operational measures and/or restoration measures that achieve an efficacy that the Regional Board determines is "as close as practicable" to the performance standard.
   b. The site-specific requirements cannot have costs "significantly greater" than the benefits of meeting the performance standard.

The regulations only require a facility to satisfy either the cost-cost test or the cost-benefit test; a facility is not required to satisfy both. Each of the potential alternatives for reducing entrainment and impingement at MBPP satisfy one of the tests, as described in this Attachment. Site-specific requirements are therefore applicable in this case. The new regulations allow flexibility in applying performance standards. USEPA states (Preamble, Fed. 69 Fed. Reg. page 41614):

> "…although the performance standards address all life stages of fish and shellfish, the Director has significant discretion as to how the performance standards are applied in the permit. For example, the Director may determine that all species must be considered or that only representative species are considered."

Demonstrating that restoration or enhancement projects will produce ecological benefits that are substantially similar to what would be achieved by reducing entrainment may not be possible in Morro Bay. It is not possible to estimate the population level decrease in fish and shellfish caused by entrainment, so there is no way to determine how many organisms should be replaced to make up for entrainment losses. In an ideal situation, new estuarine habitat could be "created" that would produce the requisite organisms. The amount of new estuarine habitat needed could be determined by the Habitat Production Forgone method discussed above. It may be possible to create new estuarine habitat in Morro Bay by dredging areas that have filled in due to sedimentation, however, major review would be necessary by several agencies and the process would take several years. It is not possible to predict whether these habitat creation efforts would be approved, especially since a different type of habitat, such as salt-marsh, would have to be converted subtidal estuarine habitat.

USEPA also states (Preamble, 69 Fed. Reg. page 41609),

> "While the species makeup of the replacement fish and shellfish may not be exactly the same as that of the impingement mortality and entrainment losses, the Director must make a determination that the net effect is to produce a level of fish and shellfish in the waterbody that is 'substantially similar' to that which would result from meeting the performance standards through design and construction technologies and/or operational measures alone."

A site-specific standard for Morro Bay, where habitat restoration is the only available alternative, cannot be specifically identified as a numeric value. The efficacy of future restoration, enhancement, or preservation efforts is unknown. Consistent with the regulations, this Order requires a performance monitoring plan, adaptive management, and annual reports to the Regional Board to verify implementation and performance of the Habitat Enhancement Plan. Upon implementation, and over time, the Regional Board will be able to evaluate the success of the Habitat Enhancement Program. The Regional Board must review the verification monitoring data during permit renewals, and must require any revision to the Habitat Enhancement Plan necessary to meet site-specific requirements. (40 CFR § 125.98(b)(1)(v).)

CALIFORNIA WATER CODE SECTION 13142.5

The Porter Cologne Water Quality Control Act, Section 13142.5, states: For each new or expanded coastal power plant … using seawater for cooling …, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life.

This section was enacted as part of the California Coastal Act. Neither Porter-Cologne, the Coastal Act or State Board orders define what is a "new or expanded" coastal power plant. The modernized MBPP is an existing facility for purposes of the Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (Thermal Plan) and the Section 316(b) regulations. It is a new source, however, under other NPDES regulations. (40 CFR §122.29(b).) The Regional Board makes no finding whether Section 13142.5 applies to the modernized facility. However, the Regional Board finds that if the modernized facility is a "new or expanded" power plant, the Order satisfies Section 13142.5.

Section 13142.5 does not require consideration of cooling by other means than the intake of seawater. (State Board Order No. WQ 79-23.) This section does not allow the Regional Board to order a change in the plant itself, since the Regional Board cannot specify "the design, location, type of construction, or particular manner" for compliance with waste discharge requirements. (Water Code §13360.) As in the 316(b) analysis, the Regional Board's role is limited to determining whether the proposed project, together with any proposed mitigation measures, satisfies Section 13142.5.

The State Board has only considered Section 13142.5(b) in two orders, both involving the same offshore liquid natural gas facility. (State Board Orders Nos. WQ 79-23, 79-34.) In the first order, the State Board ruled that the discharger could not commence construction of the seawater intake system until it presented sufficient evidence on which the Regional Board could base the Section 13142.5(b) findings. The State Board did not condition construction of other parts of the facility on this finding. In the second order, the State Board found that changes to proposed intake system were adequate under Section 13142.5(b), without considering alternatives for the *facility*. Although the State Board did not directly address this question, the orders suggest that Section 13142.5 findings should address whether the intake structure (not the facility itself, or any restoration plan) includes the best available site, design, technology, and mitigation measures feasible.[3] Under that approach, Section 13142.5 provides authority for the Regional Board to require changes (mitigation measures) to the intake structure, but not to require mitigation for unavoidable impacts of the intake.

The requirement to use the best available site, design, and technology feasible to minimize intake and mortality closely parallels the language of Section 316(b), which was enacted four years before Section 13142.5. The analysis and findings that the site-specific requirements, including the Habitat Enhancement Plan, satisfy Section 316(b) also supports a conclusion that those measures satisfy Section 13142.5.

No other available technologies involving the location, construction or capacity of the cooling water intake structure for the proposed project would minimize environmental impacts, intake or mortality. The cooling water intake structure and Habitat Enhancement Program constitute the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life.

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[3] Mitigation measures are discussed above.