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Power by Association℠

Edison Electric Institute

July 12, 2012

Ms. Nancy K. Stoner
Acting Assistant Administrator for the Office of Water
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Stated Preference Survey Notice of Data Availability (NODA), 77 Fed. Reg. 34,927 (June 12, 2012), Docket No. EPA-HQ-OW-2008-0667

Dear Assistant Administrator Stoner:

The Edison Electric Institute (EEI) appreciates the opportunity to submit the attached joint comments of EEI and the Utility Water Act Group (UWAG) on the U.S. Environmental Protection Agency's (EPA) Notice of Data Availability Related to EPA's Stated Preference Survey, 77 *Fed. Reg.* 34,927 (June 12, 2012) (the NODA). In the NODA, EPA is proposing to use public opinion surveys with hypothetical scenarios and questions to recalculate the alleged benefits of prior proposed regulations under Section 316(b) of the Clean Water Act. This approach—unprecedented for a major rulemaking—increases by over 13,000% (from $16.3 million to over $2.275 billion) EPA's prior calculation of benefits using well-established methods. Proposed Rule on NPDES-Cooling Water Intake Structures at Existing Facilities and Phase I Facilities, 76 *Fed. Reg.* 22,174 (Apr. 20, 2011) (Proposed Rule or the Proposal).

EEI is the association of U.S. shareholder-owned electric companies and has international electric company affiliate members and industry supplier associate members. Our U.S. electric company members serve 95 percent of the ultimate customers in the shareholder-owned segment of the industry and represent approximately 70 percent of the U.S. electric power industry.

This rule will affect more than 1,000 coal, nuclear and natural gas power plants and manufacturing facilities. It has the potential to impose enormous costs on consumers without providing human health benefits or significant improvements to fish populations. This is a key factor underlying the consensus-based, active engagement by the electric power sector's CEO community to ensure EPA promulgates an appropriate and defensible final rule.

EEI is very concerned with the proposed use of a public opinion survey as a surrogate for well-established biological and economic analyses that have long been used by the Agency and others to determine the benefits and costs of regulation. This is especially true here because the survey reflects wholly unrealistic and, in some instances, inaccurate information on fish losses

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associated with cooling water intake structures, the relationship of losses to current biological conditions, and the potential improvements that could be expected to result from the rule. In addition, the survey does not even place the environmental benefits expected to be achieved in the context of the need and cost of achieving other environmental goals.

This unprecedented application of stated preference methodology would have broad and long-term negative implications. For example, using a benefits calculation methodology based on public opinion surveys would directly and materially jeopardize prospects for a reasonable final EPA rule and subsequent site-specific compliance decisions. Any decision by EPA to advance questionable assumptions and unreliable methodologies that yield benefit calculations so grossly disproportionate to more traditional estimates (*e.g.*, the benefits calculation in the NODA that is 13,000% greater than those calculated by EPA using widely accepted and proven methodologies) would inevitably lead to stricter national technological requirements that, in fact, are not scientifically or cost justified.

Equally troubling is the possibility that if such inflated numbers were used, they would affect state permitting decisions by putting a "thumb on the scale" on the benefits side of the equation, thereby skewing cost benefits decisions that are made regarding site-specific entrainment decisions. Specifically, using unreliable benefits estimates that are based on questionable assumptions instead of true estimates of expected benefits of regulation would provide states the misguided directive to require controls that are neither necessary nor cost beneficial. Such an approach would not deliver the anticipated benefits, but would materially drive up compliance and consumer costs.

Moreover, this approach could precipitate the reliability and cost implications discussed in the October 2010 North American Electric Reliability Corporation (NERC) study, which concluded that a one-size-fits-all 316(b) approach could have economic impacts nearly three times greater than the combination of the Cross State Air Pollution Rule and the Mercury and Air Toxics Standards. *See* NERC, 2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations (October 2010).

EPA's decision to reject a one-size-fits-all approach for entrainment was an important action by the Agency to reduce unnecessary compliance costs and to ensure that cost/benefit analyses would be conducted by local permitting officials. 76 *Fed. Reg.* 22,205. It also avoids the sobering reliability and cost implications alluded to in the NERC report. Accordingly, EEI supported the Agency's decision to reject a one-size-fits-all approach in the use of closed cycle cooling for entrainment compliance and has advocated a comparable approach regarding impingement.

EEI is mindful that EPA has been criticized because its original cost/benefit analysis concluded that the impingement feature of the proposed rule produce only $1 of benefits for every $21 in costs. But supplanting science-based methodologies with public opinion surveys based on questionable assumptions and methodologies and yielding radically different results is not the answer to this criticism. On the contrary, regulation by public opinion survey will serve only to raise additional questions as to the legitimacy of EPA's other findings and assumptions that

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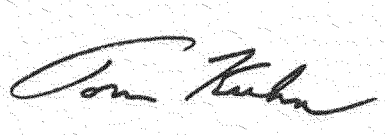
provide the underlying biological foundation and legal justification for the rule itself. The fact that EPA has now published two benefits analyses in the span of less than 14 months—with conclusions that are orders of magnitude different—could lead some to call into question EPA's analyses generally. This distraction is unnecessary and compromises progress made on the technical aspects of the rule. EPA should rely on traditional methodologies that are based on biological science and economic principle, and not on a survey methodology premised on hypothetical scenarios and questions.

For these reasons and those described in the EEI-UWAG comments, EEI respectfully urges EPA to discard as unreliable the stated preference survey results and to focus instead on appropriate changes to the technical requirements and definitions contained in the proposed rule in order to achieve a more scientifically justifiable rule that ensures compliance costs are commensurate with benefits. Note that EEI also has filed separate comments on the Notice of Data Availability Related to Impingement Mortality Control Requirements, 77 *Fed. Reg.* 34,315 (June 11, 2012) (IM NODA), where many of these technical issues are addressed.

Please don't hesitate to contact either of us if you would like to discuss this matter further. Should your staff want additional information, please have them contact Rich Bozek (rbozek@eei.org, 202-508-5641) or Henri Bartholomot (hbartholomot@eei.org, 202-508-5622).

Sincerely,



Thomas R. Kuhn
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Attachments (7)

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UWAG
Utility Water Act Group©

EEI Edison Electric Institute

July 12, 2012

Ms. Nancy K. Stoner
Acting Assistant Administrator for the Office of Water
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Assistant Administrator Stoner:

The Utility Water Act Group (UWAG) and the Edison Electric Institute (EEI) appreciate the opportunity to provide the attached joint comments on the U.S. Environmental Protection Agency's (EPA) Notice of Data Availability Related to EPA's Stated Preference Survey, 77 Fed. Reg. 34,927 (June 12, 2012) (the NODA).

UWAG is a voluntary, *ad hoc*, non-profit, unincorporated group of 183 individual energy companies and three national trade associations of energy companies: the Edison Electric Institute, the National Rural Electric Cooperative Association, and the American Public Power Association. EEI is the association of U.S. shareholder-owned electric companies and has international electric company affiliate members and industry supplier associate members. Our U.S. electric company members serve 95 percent of the ultimate customers in the shareholder-owned segment of the industry and represent approximately 70 percent of the U.S. electric power industry.

For the reasons described in our comments, UWAG and EEI respectfully urge EPA to discard as unreliable the stated preference survey results and to focus instead on appropriate changes to the technical requirements and definitions contained in the proposed rule in order to achieve a more scientifically justifiable rule that ensures compliance costs are commensurate with benefits.

We strongly believe that the results of EPA's stated preference survey should not be used to justify the proposed 316(b) rule for the following reasons: 1) a stated preference survey is inappropriate to assess non-use benefits; 2) EPA's survey design was fundamentally flawed and contained misleading and inaccurate information; and 3) the method used to analyze the survey results was inappropriate and deficient.

Based on the problems with the survey itself and EPA's analysis of its results, and the fact that all the relevant information was not available or completed prior to the end of the comment period, its use in this rulemaking would violate the Information Quality Act; the Administrative Procedure Act; the Administration's Regulatory Improvement initiatives, including EO 13565 and OMB Guidance; and EPA's own Data Quality and Scientific Integrity policies.

Both UWAG and EEI also have filed comments separately on the Notice of Data Availability Related to Impingement Mortality Control Requirements, 77 Fed. Reg. 34,315 (June 11, 2012) (NODA).

If you have any questions or would like to discuss these issues further, please contact any of us, UWAG Counsel Kristy Bulleit (kbulleit@hunton.com , 202-955-1547) or EEI Counsel Henri Bartholomot (hbartholomot@eei.org 202-508-5622).

Sincerely,

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Attachments (6)

cc: (w/atts):
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UWAG
Utility Water Act Group©

EEI Edison Electric Institute

COMMENTS OF
THE UTILITY WATER ACT GROUP
AND THE EDISON ELECTRIC INSTITUTE
ON THE NOTICE OF DATA AVAILABILITY
RELATED TO EPA'S
STATED PREFERENCE SURVEY
Docket ID No. EPA-HQ-OW-2008-0667
FRL-9681-5
RIN 2040-AE95
77 Fed. Reg. 34,927 (June 12, 2012)

July 12, 2012

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Lawrence W. Barnthouse, LWB Environmental Services, Inc., *Review of Attribute Calculations Within EPA § 316(b) Stated Preference Survey* (July 11, 2012)

NERA Economic Consulting & W.H. Desvousges & Associates, Inc., *Comments on EPA's Notice of Data Availability for § 316(b) Stated Preference Survey* (July 2012)

UWAG, *Green Energy: The Difference Between Stated Intentions and Actual Behavior* (July 2012)

Richard B. Stewart, *Statement by Richard B. Stewart on EPA Use of Stated Preference Survey to Justify 316(b) Phase II Cooling Water Intake Structure Regulation* (July 2012)

EXECUTIVE SUMMARY

The Utility Water Act Group (UWAG)[1] and the Edison Electric Institute (EEI) are submitting these comments in response to the Notice of Data Availability (NODA) Related to EPA's Stated Preference Survey. 77 Fed. Reg. 34,927 (June 12, 2012). In the NODA, EPA is considering whether or not to use the results of a stated preference survey (sometimes referred to as a "willingness to pay" survey) to measure the potential benefits of the Agency's proposed rule under Clean Water Act § 316(b) for cooling water intake structures at existing facilities. 76 Fed. Reg. 22,173 (April 20, 2011).

UWAG and EEI have a direct and substantial interest in this NODA and the underlying § 316(b) rulemaking. Our members own the vast majority of the electric generating facilities that will be directly affected by the rulemaking. They face the prospect of spending millions of dollars per facility, and in some cases hundreds of millions, and suffering substantial disruption to facility operations in order to comply. As a result, we have been working with EPA to develop a rule that is reasonable and workable and will produce benefits commensurate with its costs.

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[1] UWAG is a voluntary, *ad hoc*, non-profit, unincorporated group of 183 individual energy companies and three national trade associations of energy companies: the Edison Electric Institute, the National Rural Electric Cooperative Association, and the American Public Power Association. The individual energy companies operate power plants and other facilities that generate, transmit, and distribute electricity to residential, commercial, industrial, and institutional customers. The Edison Electric Institute is the association of U.S. shareholder-owned energy companies, international affiliates, and industry associates. EEI's U.S. members serve ninety-five percent of the ultimate customers in the shareholder-owned segment of the industry and represent approximately seventy percent of the U.S. electric power industry. The National Rural Electric Cooperative Association is the association of nonprofit energy cooperatives supplying central station service through generation, transmission, and distribution of electricity to rural areas of the United States. The American Public Power Association is the national trade association that represents publicly-owned (units of state and local government) energy utilities in 49 states representing 16 percent of the market. UWAG's purpose is to participate on behalf of its members in EPA's rulemakings under the CWA and in litigation arising from those rulemakings.

In the NODA, EPA asks whether or not it should use the results of a survey asking people how much they are "willing to pay" for potential reductions in fish losses from cooling water intake structures and improvements in fisheries and aquatic ecosystems. 77 Fed. Reg. 34,929 col. 2; 34,931 col. 1. Our comments will demonstrate why EPA should not use the survey results and, indeed, why doing so would jeopardize the underlying rule, leaving it susceptible to challenge. As our comments will show, use of this survey methodology to assess the value of potential regulatory changes was unnecessary and inappropriate, given the nature of the resources at issue in this rulemaking. Equally important, both the survey instrument and the econometric models and methods used to analyze responses are seriously deficient, producing results that are wildly inconsistent with other, far more reliable economic assessments EPA already has performed. As a result, the survey results EPA has compiled to date and the benefits implied by those results cannot be taken as credible estimates of potential benefits and certainly cannot be used to justify a federal regulation.

Specifically, EPA's decision to use a stated preference survey in an attempt to measure "non-use" benefits (which are purely subjective values that individuals place on knowing that a resource is protected, even if they do not use it or even see it) was ill-conceived from the outset. The same literature that describes and supports how stated preference surveys can be appropriately used in some cases counsels against their use where, as here, the resources are not unique or limited and the impacts are not substantial or irreversible. In this case, where EPA's justification for the survey focused on its desire to better assess the potential non-use benefits of reducing losses of abundant, widely available forage species, attempting to quantify non-use benefits using a survey of this kind was misguided and inappropriate.

In addition, EPA's survey was deeply flawed, reflecting wholly unrealistic and, in some regards, flatly inaccurate information on fish losses associated with cooling water intake structures, the relationship of losses to current biological conditions, and the potential improvements that could be expected to result from the rule. The survey also provided misleading or inadequate information on consequences associated with EPA's regulatory options, for example telling respondents that the effects on employment will be close to zero when that is unlikely to be the case and omitting any information on potential increases in the prices of other commodities or negative environmental effects of some options, notably cooling towers. Moreover, the complexity of biological relationships underlying the survey questions and the lack of any widespread appreciation or knowledge of those complexities among the general population vastly increased the potential for the survey results to reflect confusion and "hypothetical bias" (a well-established phenomenon, symptomatic of such surveys, by which people's actual behavior differs, often radically, from their stated choices). See 77 Fed. Reg. 34,930 col. 1.

Equally important, EPA's econometric analysis has substantial problems that further highlight the inadequacies of the survey instrument and other flaws in its approach. For example, EPA estimation results cannot be replicated; EPA's method for selecting the appropriate model does not conform to statistical best practices; and there is strong evidence that the model suffers from "false convergence," which invalidates the empirical results. Furthermore, an analysis of the survey data reveals irrational behavior by the respondents and implausible results, which are consistent with the limitations of the survey instrument. The flaws in the survey instrument lead respondents to use decision short-cuts rather than making rational decisions consistent with basic economic principles. As a result, UWAG and EEI believe that

any use of the survey or the resulting data would be contrary to the Information Quality Act (see note to 44 U.S.C. § 3516), the purpose of which is to ensure and maximize the "quality, objectivity, utility, and integrity" of information disseminated by federal agencies.

A comparison of the preliminary survey results to EPA's prior economic analysis shows just how unreliable EPA's survey and the resulting data are. The benefit and benefit-cost calculations resulting from the survey are so far out of line with EPA's prior economic estimates as to be totally implausible. The survey purports to measure both "use" benefits (for commercial and recreational fishing) and "non-use" benefits held by those who do not use the affected resource. Yet the total use and non-use benefits suggested by the survey are vastly greater than the more reliable "use" benefits EPA previously estimated using market data.

For example, assuming EPA's earlier use benefits are reasonably accurate, the balance of the survey results would constitute non-use benefits, which in turn would be 140 to 200 times larger than the use benefits. This is highly implausible because, by EPA's own estimation, most of the fish affected are forage fish that are abundant and widely distributed and thus would not be expected to have high non-use value. Where natural resources are concerned, substantial non-use values would be expected only for unique, endangered, or otherwise iconic resources, such as the Grand Canyon, that people value because they are rare. Or, considered another way, the majority of the survey results actually might be "use" benefits, in which case they would be 70 to 100 times higher than EPA's market-based use benefits. Under either scenario, the survey results are wholly implausible.

For these reasons and others addressed in greater detail in these comments and the supporting analyses provided with them, UWAG and EEI strongly urge EPA to withdraw the proposed survey and to make no further use of the survey or its results in this rulemaking. We

also urge EPA to make it clear that state and federal regulators should not use the survey or its results for any purpose, including making site-specific permit decisions pursuant to any final rule.

In support of these comments, we are attaching expert analyses addressing the biological, economic, and legal issues raised by EPA's survey. Each analysis was prepared by a nationally recognized expert with many years of experience in the relevant field. Dr. Lawrence W. Barnthouse, a nationally known fisheries biologist, prepared the attached *Review of attribute calculations within EPA § 316(b) Stated Preference Survey* (July 11, 2012) ("LWB Analysis"). NERA Economic Consulting and W.H. Desvousges & Associates, Inc., both of which have extensive experience in natural resource economics, prepared the report entitled *Comments on EPA's Notice of Data Availability for § 316(b) Stated Preference Survey* (July 2012) ("NERA-Desvousges Analysis"). And Professor Richard B. Stewart, an internationally recognized scholar on environmental and administrative law and policy, prepared the attached *Statement by Richard B. Stewart on EPA Use of Stated Preference Survey to Justify 316(b) Phase II Cooling Water Intake Structure Regulation* (July 2012) ("Stewart Analysis"). These analyses are hereby incorporated by reference.

In addition, UWAG and EEI (in many cases joined by other interested parties) have submitted consistent prior comments to EPA on earlier proposals by the Agency to develop and use the stated preference survey to estimate benefits for the § 316(b) rulemaking:

- Comments of the Utility Water Act Group on EPA's Proposed § 316(b) Rule for Cooling Water Intake Structures at Existing Facilities and New Units (Doc. ID No. EPA-HQ-OW-2008-0667-2210), including NERA, Comments on Economic Issues Related to EPA's Proposed Regulations for Cooling Water Intake Structures at Existing Facilities (July 2011)

- Comments of the Edison Electric Institute on the Information Collection Request for the Willingness to Pay Survey for § 316(b) Existing Facilities Cooling Water Intake

Structures. (February 22, 2011) (Docket ID No. EPA-HQ-OW-2010-0595, EPA ICR No. 2402.1, OMB Control No. 2040-NEW, 76 Fed. Reg. 3,883).

- Comments of American Chemistry Council, et al. on ICR for Willingness to Pay Survey for § 316(b) Existing Facilities Cooling Water Intake Structures (February 22, 2011) (Doc. ID No. EPA-HQ-OW-2010-0595-0020)

- Comments of American Chemistry Council, et al. on ICR for Willingness to Pay Survey for § 316(b) Existing Facilities Cooling Water Intake Structures (September 20, 2010) (Doc. ID No. EPA-HQ-OW-2010-0595-0006)

- Comments of the Utility Water Act Group on EPA's Information Collection Request to the Office of Management and Budget, "Focus Groups as Used by EPA for Economics Projects" (February 12, 2007) (Doc. ID No. EPA-HQ-OA-2005-0004)

- Coalition Comments on ICR 21552: Willingness to Pay Survey for 316(b) Cooling Water Intake Structures: Instrument, Pre-Test, and Implementation (December 28, 2005) (Doc. ID No. OW-2005-2006-0003)

- Comments of American Chemistry Council et al. on EPA's Proposed Information Collection Request on Willingness to Pay Survey for § 316(b) Phase III Cooling Water Intake Structures (August 8, 2005) (Docket No. OW-2005-0006)

- UWAG, et al. Comments on EPA's Proposed Information Collection Request (April 25, 2005) (Docket No. OW-2004-0020)

- Comments of American Chemistry Council et al. on EPA's Proposed Information Collection Request (January 24, 2005) (Docket No. OW-2004-0020)

- UWAG Comments on the Benefit Estimates of EPA's Proposed Phase II 316(b) Rule (August 6, 2002) (Docket No. OW-2004-0049)

- Comments of UWAG on EPA's Proposed § 316(b) Rule for Phase II Existing Facilities and ICR No. 2060.01 (Robert N. Stavins) (July 19, 2002) (RIN 2040-AD62)

- NERA, Economic Evaluation of EPA's Proposed Rules for Cooling Water Intake Structures for New Facilities (November 2000) (Docket No. OW-2004-0049)

Most of those comments are still relevant to EPA's latest survey, and we hereby incorporate them by reference.

For the reasons provided in these comments and the many others submitted to date, EPA should abandon the survey and its results for purposes of this rulemaking and should not promote

their use for any other purpose, including permitting facilities under the final rule. Instead, EPA should complete the rulemaking promptly, incorporating changes in the areas covered by the Agency's separate impingement mortality control NODA, 77 Fed. Reg. 34,315 (June 11, 2012), on which UWAG and EEI submitted comments on July 11, 2012. Doing so will streamline the rule and bring its benefits more in line with its costs, obviating any perceived need for further benefit assessment efforts.

COMMENTS

EPA asks for comment on the "stated preference" survey and results (77 Fed. Reg. 34,928 col. 3, 34,929 col. 1). According to EPA, the results are "preliminary," and EPA is still fielding the non-response studies for the national and three regional versions of the survey (77 Fed. Reg. 34,931 col. 1). EPA also plans to review public comment, and conduct scope and validity testing, after which EPA says it will present a "more complete" set of materials for external peer review (*id.*).

In these comments and the attached reports, UWAG and EEI, and the experts they commissioned to review the materials EPA provided, critique the survey and survey results, demonstrating that both are unsuitable for use in this rulemaking. We summarize those detailed comments here.

I. The Stated Preference Survey Suffers from Fundamental Flaws

The economists at NERA and Desvousges find at least three compelling reasons why EPA's survey should not be used to evaluate the benefits of the pending rule on cooling water intake structures.[2] NERA-Desvousges Analysis sections III, IV, and V.

[2] It is important to note that NERA and Desvousges do not argue that stated preference surveys should never be used, or even that such an approach should never be used to assess non-use values. NERA-Desvousges Analysis 58. Instead, their comments focus on the compelling

First, the EPA survey instrument itself has "fundamental flaws" that make it unreliable for estimating the public's willingness to pay for regional and national benefits from regulating entrainment and impingement at cooling water intake structures. NERA-Desvousges Analysis E-3 to E-5, E-11. Many of those flaws are the logical outgrowth of EPA's misguided attempt to use a survey tool of this type to quantify the value of reducing losses of organisms that are abundant, non-imperiled, widely available, and largely not of commercial or recreational use, and where such reductions are unlikely to cause the changes in other environmental endpoints the survey projects.

Second, NERA and Desvousges have found that EPA's econometric analysis was also flawed. Among their findings: EPA's estimation results could not be replicated when EPA's analysis was applied to the survey results; EPA did not use statistical best practices when it selected the model to be used; and based on an analysis of the survey data, respondents were answering in economically irrational ways. NERA-Desvousges Analysis E-5 to E-6. As would be expected from the nature of the survey questions, analysis of the data suggests that respondents were confused or used "heuristic" methods to choose among the alternatives offered by the survey. NERA-Desvousges Analysis 22. In particular:

- Respondents did not differentiate among environmental attributes.
- Respondents were more concerned about cost when the costs of the policy options were equal than when costs were not equal, an illogical result.
- Respondents in many cases effectively preferred lower levels of environmental attributes and higher costs, an entirely counter-intuitive result.

NERA-Desvousges Analysis 44.

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reasons why EPA should not have used such a survey in this context and why the results are unreliable for use in this rulemaking or any related context.

NERA and Desvousges therefore conclude that a large portion of respondents are not answering the choice experiments rationally, raising serious questions about the resulting willingness-to-pay estimates. NERA-Desvousges Analysis 44, 47, 48.

Third, when EPA previously estimated the "use" values of its "preferred" policy options for the rule using more conventional market-based methods, it found use benefits (for commercial and recreational fishing) of approximately $16 million per year for its preferred rulemaking option. Now, using the survey to estimate both use and non-use benefits (for the value of fish and environment in the abstract), total benefits of that option would amount to almost $2.3 billion dollars per year, an increase of about 14,000%. NERA-Desvousges Analysis E-7 to E-10, 52-57.

Clearly, the total benefits calculated using the survey are enormous compared to the use benefits calculated using conventional methods. Assuming that "use" benefits make up 50 percent of the total benefits, these benefits would total between $1.1 and $3.7 billion as compared to between $16 and $38 million from the § 316(b) proposed rule, or 70 to 100 times larger than those calculated using well-established and relatively uncontroversial market-based methods. This conclusion goes against common sense.

UWAG and EEI support the conclusion in the NERA-Desvousges Analysis that the EPA survey "should not be used" as the basis for calculating national benefits. NERA-Desvousges Analysis 49, 58.

II. The Environmental Benefits that Respondents Were Asked to Value Bear No Relationship to the Benefits of the Proposed § 316(b) Rule

The validity of EPA's stated preference survey depends on the accuracy of the "options" the respondents were offered. These options were a combination of effects on four attributes: fish saved, percent increase in populations of "all fish," percent increase in populations of

commercial fish, and increased "condition of aquatic ecosystems." The following discussion demonstrates how unsupported and unreliable EPA's options are.

A. Results of LWB Analysis

Dr. Lawrence W. Barnthouse of LWB Environmental Services, an aquatic ecologist with over 35 years of experience in the field, including 19 years as a research staff member with Oak Ridge National Laboratories Environmental Services Division, was asked to review the data and the reasoning EPA used to derive the numbers for each attribute used in the survey. Dr. Barnthouse focused on the attribute "fish saved" because it was the only one for which EPA provided relatively clear and complete information. See the attached *Review of Attribute Calculations within EPA § 316(b) Stated Preference Survey*.

Dr. Barnthouse's analysis concludes that none of the four attributes used in the survey provides scientifically valid information concerning the potential benefits to the public of reducing fish mortality due to entrainment and impingement. LWB Analysis 12. Only the "fish saved" attribute has even a general causal connection to entrainment and impingement. Moreover, the survey materials do not convey the very large uncertainties surrounding the magnitude of entrainment and impingement losses or the effects of these losses on fish populations. LWB Analysis 12.

These uncertainties are not generally understood by the public or disclosed by EPA's survey. LWB Analysis 12. Yet by prominently announcing in the survey that the information provided therein was developed by a number of federal agencies, all of which are treated as experts on scientific issues, EPA created an appearance of scientific certainty that it knew to be false and that was likely to have been affirmatively misleading. See *id.*

Indeed, documents provided to UWAG by EPA as recently as July 2, 2012,[3] show that EPA's own consultants knew that the assumptions underlying the survey were unrealistic. For example:

- The model's assumptions that the underlying transition matrix does not change through time and the stock of fish begins at a stable age distribution "are not a [sic] realistic assumptions." Memo, Abt to EPA, *WA 2-09 Task 4 - Matrix models of I & E effects on fish populations* (December 19, 2009) at 6.

- "Field-based estimates of natural mortality rates in early life history stages often result in such a low yield of marked fish . . . that variance surrounding these estimates are large" (*id.*).

- "[T]here may be a fundamental disconnect between I & E loss data and fish population data" (*id.* 6-7).

- "Perhaps the biggest limitation to the model runs described is the attempt to estimate regional-scale effects of I & E losses, which are by their nature inherently localized" (*id.* 7).

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[3] At the time of publication, EPA's Supporting Statement and other documents supporting the NODA contained little information about how the Agency developed the estimates of baseline condition and estimated rates of change associated with regulatory alternatives. This crucial information was not made available until the eleventh hour, and only after UWAG requested them, creating a serious procedural problem. After UWAG requested the information, an EPA staff member assembled this information for us, but she was not able to produce it until the evening of July 2, barely more than a week before the comment deadline. The documents EPA provided July 2 are the following: Abt Associates, Inc., 316(b) SP survey - design values_11.09.11.xls, DCN 11-4523, EPA-HQ-OW-2008-0667-2757 (updated 11/09/11) (posted June 11, 2012); Memorandum, E. Helm to Record, "Overview of Preliminary Modeling Exercises for Attribute Values," DCN 11-4534, EPA-HQ-OW-2008-0667-2932 (July 2, 2012); Memorandum, E. Helm to Record, "Documentation for Survey Design Values Spreadsheet," DCN 11-4535, EPA-HQ-OW-2008-0667- 2933 (July 2, 2012); Memorandum, J. Palardy et al. (Abt) to T. Born et al. (EPA), "WA 2-09 Task 4: Ecopath simulations of Chesapeake Bay," DCN 11-4542, EPA-HQ-OW-2008- 0667-2934 (November 18, 2009); Memorandum, J. Palardy et al. (Abt) to T. Born et al. (EPA), "WA 2-09 Task 4 - Matrix models of I & E effects on fish populations," DCN 11-4543, EPA-HQ-OW-2008 -0667-2935 (December 16, 2009). Thus, we were not able to review thoroughly what amounts to a fundamental underpinning of the choices offered by the stated preference survey. Of the five, the first was posted to EPA's electronic docket June 11, the day before the NODA was published. The other four were posted July 12, 2012, the day these comments are due. The last two, dated July 2, 2012, are explanations of the survey that were written well after the survey had already been composed and administered to the public.

- "On a regional scale, the effects of I & E losses on fish populations is small, with substantial model variability" *(id.)*.

- "The accuracy of projecting I & E effects on fish populations is strongly limited by data availability, most notably a meaningful understanding of the effects of density dependence on early life history, and accurate estimates of fish stocks. Consequently, overcoming these shortcomings may not be possible using any regional-scale modeling approach for many species" (*id.*).

Although these statements appear out of context, they nevertheless demonstrate that EPA's method for producing the numbers (for example, that a policy option would change the "condition of aquatic ecosystems" from 50% to 51% or 52%) is fraught with uncertainty. It is unlikely that the environmental benefits that people were asked to choose from would result from the rule EPA has proposed.

Thus, as Dr. Barnthouse concludes, the survey presented "highly misleading information" about the benefits of reducing entrainment and impingement. LWB Analysis 12.

B. Additional Evaluation of Aquatic Ecosystem Attribute

In addition to the analysis provided by Dr. Barnthouse, UWAG and EEI members with extensive experience in developing and applying biological indices, which underpin EPA's Aquatic Ecosystem attribute, reviewed the information the Agency provided on its development of that attribute and the estimated range of change expected to occur as a result of various regulatory options. This attribute was described in the survey as a score "determined by many factors including water quality and temperature, the health of aquatic species, and habitat conditions." Northeast SP Survey All Versions, DCN 11-4500, EPA-HQ-OW-2008-0667-2741, Ver. 24, at 7. Survey respondents were given choices in which the "condition" ranged from 50% (half of "pristine") to 54%. Our review yielded the following critique.

1. Losses from Impingement and Entrainment Are Unlikely to Cause Ecological Effects

EPA's theoretical basis for presenting overall ecological condition as depending on impingement and entrainment is that "organisms at high trophic levels in aquatic systems require diverse ecosystem functions to survive in, grow, and reproduce." Memorandum, J. Palardy (Abt) to E. Helm et al., EPA-HQ-OW-2008-0667- 2005, DCN 11-4533 (April 16, 2012) (April 16, 2012 Abt Memorandum) at. 6. EPA assumes that "information on the structure, diversity and functional properties of resident ecological communities provides a better long-term, event-integrated evaluation of whether habitat quality is suitable for aquatic organisms than do water quality samples or other single-measurement datasets." *Id.*

The "quality" of the ecosystem at the community level is a manifestation of all the biotic and abiotic variables interacting on the sum of populations in a given space and time. The traditional measures of community health (diversity indices, multivariate analyses, and multi-metric comparisons to "reference" sites) seek to reduce data on the abundance and biomass of specific populations to a single community health value.

One problem is that EPA's stated preference survey does not reflect the fact that impingement and entrainment are unlike natural and anthropogenic stressors such as pollution, adverse hydraulic or hydrologic modification, or others that affect the ecosystem as a whole.

Most site-specific impingement and entrainment studies show that individual fish removal is highly selective (discriminatory) in terms of species selected; that the selectivity is strongly influenced by life histories of affected species; that there is very high stochasticity (low levels of removal punctuated by brief episodes of high removal, again, of a few vulnerable species); and that rates of removal are more closely associated with environmental variables

(*e.g.*, low temperatures, seasonal floods) than with plant operating variables like cooling water intake flow.

The survey should not have been written to suggest that "ecosystem condition" is sensitive to impingement and entrainment losses. Healthy and sustainable ecological communities have a high inherent resistance to temporary shifts in temporary stressors, such as a winter die-off of forage fish that causes dead or moribund fish to accumulate on cooling water intake screens. Community balance and resiliency, measured on long-term temporal scales, do not reflect selective, stochastic losses of some individuals of a few species. Put another way, the "detection limit" for detecting significant changes in community structure and function is so high that stochastic "removal" of vulnerable individuals within a few species is indistinguishable from normal variability (seasonal and temporal). Thus, EPA erroneously characterized fish losses stemming from impingement and entrainment as a stressor that would be seen in measurable changes to community structure and function above and beyond normal variability "noise." Asking the public to assess willingness to pay for an environmental outcome that is unrealistic (measurable changes in ecosystem condition) was bound to mislead.

2. EPA's Calculation of the Baseline Ecosystem Condition Was Fundamentally Flawed

To assess "baseline" ecosystem conditions for the survey, EPA obtained community index scores (many of them multi-metric) for each region. Because different states and agencies use different indices, EPA encountered some index-rich and some index-poor regions.

EPA provides only an incomplete description of its overall method for selecting the indices used to establish the baseline ecosystem attributes for the survey. It also provides little information on the data it considered and used or rejected, and the time-frame covered by the data it used. Page 7 of the April 16, 2012 Abt Memorandum (cited above) lists several indices

that apparently were selected to provide underlying data to define a baseline ecosystem condition.

To define a baseline condition, EPA stratified the index data by region and specific index. Average scores of each index were obtained (EPA says the sample sizes ranged from 4 to more than 200), and the baseline condition was determined by a ratio of the average index score to the maximum index score possible. For example, the maximum possible score for the Index of Biotic Integrity is 60. An average regional score (across all locations, years, habitat scores, etc. – an averaging approach that has problems of its own) was determined. For example, if the average IBI score was 44, the baseline condition would be 44/60 or 73%.

The raw data (individual index values) reported in DCN 11-4523 (316(b) SP survey – design values,[4] Abt, Nov. 9, 2011), present (as expected) a wide range of index scores in each geographic region. Only one data point, for example, is provided for the Pacific geographic region. It appears that the principal source of the index scores was the primary scientific literature (peer-reviewed journals). Only one state agency report is identified (Maryland Department of Natural Resources). EPA appears to have largely ignored data maintained by other state agencies.

Despite the high variation in index score sample size per region, EPA gave equal weight to an index score of N=1 as to an index score of N=hundreds. A weighted average approach should have been considered instead.

There are other technical flaws in and unanswered questions raised by EPA's selection of index values as well:

[4] 316(b) SP survey - design values_11.09.11.xls, DCN 11-4523, EPA-HQ-OW-2008-0667-2757 (updated 11/09/11).

- All of the index scores may not truly represent ambient conditions. EPA makes no attempt to discuss this issue, leaving a significant flaw in the analysis.

- Is comparing average index scores to the maximum possible score appropriate and realistic? How many (if any) "best site" index scores actually attain the maximum possible score?

- How many index scores are from waterbodies on which facilities with cooling water intake structures are located?

- EPA apparently made no attempt to stratify the index data by habitat type, not even between lotic and lentic habitats, nor is there any discussion about why stratification by habitat type was not performed.

- What is the rationale and justification for assuming that eliminating impingement and entrainment entirely would have a measurable effect on any index score? No analysis or discussion of the specific indices is provided.

- How was habitat quality standardized? Were any of the index scores sensitive to habitat quality, as would be expected?

The regional baseline average ecosystem condition scores varied between 42 and 68%. Abt memo of April 16, 2012, p. 7. What these numbers actually represent is not explained in the survey, and the public is unlikely to have any independent basis for understanding the difference between a region having a baseline condition of 42% and a region having a baseline of 68%.

3. EPA's Preliminary Modeling of Potential Ecosystem Condition Benefits Does Not Support the Agency's Estimated Range of Ecosystem Improvement

To estimate the regulatory effects of impingement and entrainment control options on ecosystem conditions, EPA conducted a preliminary modeling study using the Ecopath with Ecosism (EwE) software and the Chesapeake Bay Fisheries Ecosytem Model (CBFEM). The description of this model, the model design and outputs, and an interpretation of model results is provided in a November 18, 2009 Abt memorandum to EPA (one of the documents provided to UWAG on July 2, 2012). Memorandum, WA 2-09 Task 4: Ecopath simulations of Chesapeake

Bay, J. Palardy et al. (Abt) to T. Born et al. (EPA), DCN 11-4542, EPA-HQ-OW-2008-0667-2934 (November 18, 2009) (CBFEM Modeling Report).

The model, which was developed by NOAA's Chesapeake Bay office, is a trophic-based algorithm that simulates the responses of selected food web organisms to shifts in the abundance of other food web organisms. The model can translate between numerical abundance and biomass for any species selected. The basic ecological structure of the model is patterned after long-term empirical monitoring data from the Chesapeake Bay. The model does not explicitly predict food web changes due to impingement and entrainment. As a surrogate, the model uses fishing mortality to represent loss due to impingement and entrainment.

In order to get impingement and entrainment information for the model, "estimates of lost biomass within the mid-Atlantic region were obtained from model output (Stratus Consulting, 2009). These regional-scale I&E estimates were converted to Chesapeake Bay I&E estimates by scaling regional losses by the proportion of regional CWIS average intake flow (AIF) occurring within the Chesapeake Bay (27.75%)" (CBFEM Modeling Report 3). Neither the full reference for "Stratus 2009," nor any description of the Stratus 2009 model or model output was provided in the CBFEM Modeling Report. Based on the methodology EPA used to estimate impingement and entrainment losses elsewhere in the rule, however, we assume that EPA used information on impingement and entrainment losses taken from a small set of plants within the mid-Atlantic region and used them to project impingement and entrainment for all plants within the region based on flow. *See* LWB Analysis 2-3. This was, for the reasons Dr. Barnthouse explains in his analysis, wholly inappropriate. *Id.* Here, EPA apparently compounded the problem by taking those extrapolated numbers and extrapolating further. The report's summary acknowledges this limitation, which was a serious design flaw (CBFEM Modeling Report 9).

Moreover, impingement and entrainment "impacts" were treated as continuous, with no consideration of seasonal effects. And if, as we suspect, EPA's impingement and entrainment loss estimates treated all organisms impinged or entrained as dead even though many survive and are returned to the waterbody, treating them as fishing bycatch and returning them to the ecosystem via the model's detrital loop was also inappropriate (*see* CBFEM Modeling Report 3).

On page 9, the authors of the CBFEM Modeling Report state that "[i]mportantly, varying I & E treatment within the model did not lead to substantial community-level shifts within Chesapeake Bay. This suggests that the structure of the marine ecosystem in the Bay is not significantly changed by I&E losses." As for the response of individual biomass pools to I&E regimes, the results were mixed; some species/taxa increased in biomass, while others decreased. But given the substantial problems with the impingement and entrainment loss estimates EPA's consultants used for this study, any projections of population impacts must be viewed as wholly unreliable.

4. EPA's Estimates of Changes in Ecosystem Condition Due to Impingement and Entrainment Are Fundamentally Flawed

On page 2 of a July 2, 2012 EPA memorandum entitled "316(b) Stated Preference (SP) Survey -- Overview of Preliminary Modeling Exercises for Attribute Values" (EPA Preliminary Modeling Overview), the Agency says that "it is unlikely that reducing impingement and entrainment mortality will alter overall ecosystem conditions scores by more than 3% to 4%. After taking these considerations and the preliminary results of the CBFEM into account, EPA estimated that changes in aquatic conditions as a result of the proposed regulations are unlikely to exceed 2%."

UWAG cannot find the source of support for EPA's statement that reducing impingement and entrainment mortality can alter ecosystem conditions scores by even as much as 3-4%. The

community index evaluation does not discuss this issue. (It is concerned only with defining the baseline condition.) The CBFEM Modeling Report at p. 6 states that the I & E regimes had no effect on simulated community diversity. There is no mention in EPA's discussion of percent changes in community condition as affected by impingement and entrainment regimes.

In fact, the only place in the modeling report that references a specific percentage change in a specific biomass pool even close to 3 to 4% is the predicted response of weakfish biomass to the total elimination of impingement and entrainment (CBFEM Modeling Report 6).

In short, we are unable to find in the record any basis for the variations of 50-54% in the "condition of aquatic ecosystem" that were presented in the survey as fact.

III. EPA Failed to Provide Accurate, Adequate Information on the Consequences of Regulatory Options

It is well known, and EPA recognizes, that "[s]tated preference surveys . . . require the provision of information to enable respondents to comprehend the potential implications of their hypothetical choices" (77 Fed. Reg. 34,930 col. 1-2). The preliminary results from the survey "are dependent on the background information that was presented to respondents" (77 Fed. Reg. 34,928 col. 3). The information EPA chose to provide had a significant effect on the answers people gave to the survey questions. Had EPA provided different information, the answers would have been different.

For example, the answers would likely have been markedly different if EPA had provided respondents with more information, such as the following points EPA itself has made in earlier documents:

- [T]here are dramatic natural changes in fish populations on an annual basis and in the long run due to natural phenomena . . . ." (69 Fed. Reg. 41,588 col. 1).
- "[E]xisting fishery resource baselines may be inaccurate" (69 Fed. Reg. 41,598 col. 3).

- "[B]ecause of the location of the intake, the characteristics of a particular waterbody, or the behavioral patterns of the fish or shellfish in that particular waterbody, there may be little or no impingement mortality or entrainment occurring at the site" (69 Fed. Reg. 41,604 col. 1).

- "EPA also now assumes that the Phase II rule will not create increases in commercial harvest large enough to impact prices" (69 Fed. Reg. 41,624 col. 1).

- "Although the number of age one equivalent fish killed by impingement and entrainment is very large, precise quantification of the nature and extent of impacts to populations and ecosystems is difficult" (69 Fed. Reg. 41,586 col. 3).

These points are amplified in the attached LWB Analysis, which notes:

- [T]here is no published, peer-reviewed evidence that I&E mortality has measurably reduced the abundance of any commercial fish stock (Barnthouse 2011), and therefore no evidence that reducing I&E mortality will increase the abundance of any commercial fish stock (LWB Analysis 6).

- There simply is no credible way to attribute historical changes in the abundance of freshwater fish populations to I&E mortality (*id.* 8-9).

- The contribution, if any, of I&E mortality to any of these indices [the ones EPA used to measure "condition of aquatic ecosystems"] is unknown . . . . (*id.* 11).

- If [as some of the literature suggests] the abundance of fish eggs and larvae is uncorrelated or negatively correlated with the abundance of older fish, then "saving" eggs and larvae by reducing entrainment will not produce more one-year-old fish (*id.* 6).

Based on the NODA, EPA's efforts to assess respondents' ability to understand the complex biological relationships underlying the survey focused on the *single issue* of whether respondents understood that "fish saved" include large numbers of eggs and larvae (77 Fed. Reg. 34,930 col. 2). EPA says that it pre-tested the information in focus groups and cognitive interviews (*id.*). Though respondents said they understood that fish include eggs and larvae, the survey offered complex alternatives based on selected and cursory information that effectively masked this distinction.

IV. Green Energy Programs Offer Some Experience to Illustrate "Hypothetical Bias"

The NERA-Desvousges report describes the "hypothetical bias" that can distort some opinion surveys. Faced with a choice they have never experienced between goods they do not understand well, survey respondents may give answers that differ markedly from their actual behavior, were they offered similar goods in the market.

As it happens, electric utility companies have some experience in this area, as a result of surveying their customers regarding their support for renewable energy ("green" energy) products. Some companies asked customers whether they would be willing to pay a premium to get some of their power from renewable energy (due to the higher costs of renewable energy), recorded the answers, and then actually offered programs to allow customers to purchase renewable energy at slightly increased rates.

UWAG asked its members to provide such information. The result is described in the attached paper titled "Green Energy: The Difference Between Stated Intentions and Actual Behavior." Although this information, which was compiled quickly in the 30 days allowed for comment in this Docket, would not pass muster as a scholarly study, it represents a collection of anecdotal evidence that is nevertheless very relevant. It illustrates what we already know from the economic literature, namely that the difference can be enormous between what survey respondents say they prefer and what they actually do if offered a choice in practice. Nationwide, approximately 55% of the public indicate that they would like companies to increase their use of renewable energy.[5] But in practice, only one percent or fewer actually choose to pay for it, even where the cost difference between conventional energy sources and

[5] According to a presentation at the Renewable Energy Markets Conference, September 14, 2008 (slide 12). http://www.renewableenergymarkets.com/docs/presentations/2009/Monday_Compliance%20and%20Voluntary_Andreas%20Karelas.pdf .

"green" energy sources is small. Though admittedly unscientific, this information is a clear example of hypothetical bias.

V. Data from the Survey Do Not Satisfy the Information Quality Act

The "Information Quality Act" requires EPA to issue guidelines for ensuring and maximizing the "quality, objectivity, utility, and integrity" of information (including statistical information) it disseminates. Pub. Law 106-554 § 1(a)(3) [515]. EPA's Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity for Information Disseminated[6] by the Environmental Protection Agency (EPA/260R-02-008 December 2002) are the Agency's attempt to meet this requirement. In these Guidelines, EPA cites its Agency-wide Quality System, its Peer Review Policy, and a variety of other policies to show its dedication to high-quality information. *Id.* 10-14. Also, the data should be subject to the EPA Quality Manual for Environmental Programs (5360 A1 (May 5, 2000)).

The goal of the Agency-wide Quality System is "to ensure that environmental programs and decisions are supported by data of the type and quality needed and expected for their intended use." EPA, *Overview of the EPA Quality System for Environmental Data and Technology* at 2 (EPA/240/R-02/003 November 2002), http://www.epa.gov/quality/qs-docs/overview-final.pdf. The point of the Information Quality Act and applicable guidance is to ensure that the agencies do not move forward in cases where the information on which they will rely is too inadequate or unreliable for the task at hand.

[6] Similarly the Science Policy Council has published assessment factors that EPA is supposed to use as information is generated. See Science Policy Council, *A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information*, EPA 100/B-03/001 June 2003), http://www.epa.gov/os a/spc/pdfs/assess2.pdf. These factors complement the EPA IQA Guidelines, which apply to information as it is *disseminated*. The factors are soundness, applicability and utility, clarity and completeness, uncertainty and variability, and evaluation and review.

Ensuring the quality of data is particularly important in this case. With its stated preference survey, EPA is attempting to measure people's attitudes with a survey instrument method that is – at best – controversial. As indicated above and in the attached analyses, UWAG and EEI believe that the data from the survey is contrary to the purpose of the Information Quality Act to ensure and maximize the "quality, objectivity, utility, and integrity" of information disseminated by federal agencies. See 44 U.S.C. § 3516.

In this instance, there is no statutory requirement to do any quantitative analysis of non-use benefits. Indeed, commenters suggested a variety of alternative paths EPA could have followed to evaluate non-use benefits and judge their potential significance. See Desvousges, Comments on the Benefit Estimates of EPA's Proposed Phase II 316(b) Rule: Final Report at 43 (August 6, 2002); Comments of American Chemistry Council et al., Docket ID No. OW-2004-0020 at 3 (January 24, 2005); Comments of American Chemistry Council et al., Docket ID No. EPA-HQ-OW-2010-0595 at E-4 (September 20, 2010). Given that EPA has the option of discarding the survey results while still proceeding forward with its rulemaking in a timely fashion, and given the serious flaws in the survey and the resulting data, it would be inexcusable for EPA to opt to rely on the survey.

VI. It Is Not Proper to Complete the Survey after the Comment Period and Use it in the Rulemaking

EPA stated that the results of the Stated Preference Survey "may" be relevant to the § 316(b) rule. But EPA has not finished analyzing the survey results. According to EPA, 77 Fed. Reg. 34,929 col. 1, additional information will be available on EPA's website some time after the comment period closes.

EPA, therefore, cannot use its stated preference survey results to inform the rule or to calculate the supposed "benefits" of the final rule. Using survey data to support the result of this

rulemaking, without opening the results to public comment, would violate the Administrative Procedure Act, 5 U.S.C. §§ 500 *et. seq.* and deny affected entities due process.[7] Analyzing and using the survey results after the comment period also would violate Executive Orders on "transparency," sound science, and considering costs and benefits when promulgating federal rules.[8]

VII. This Survey Should Never Be Used for Site-Specific Analyses

As a result of the inaccurate, misleading, and certainly incomplete information provided, EPA must re-emphasize the point that the preliminary survey results on a national and regional basis "are not directly transferable to site-specific assessments" (77 Fed. Reg. 34,928 col. 3). As EPA has said repeatedly, "EPA's use of these methods for national rulemaking does not imply that these methods are the best or most suitable for studies of single facilities. In many cases,

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[7] To assure that all interested persons have a meaningful and effective opportunity to participate in the rulemaking process, the Administrative Procedure Act (APA) § 553(b) requires an agency to give notice of rulemaking "'sufficiently descriptive' to provide interested parties with a fair opportunity to comment and to participate in the rulemaking," *Kennecott v. U.S. E.P.A.*, 780 F.2d 445, 452 (1985) (citing *Chocolate Mfrs. Ass'n v. Block*, 775 F.2d 1098, 1104 (4th Cir. 1985)); see Charles H. Koch, Jr., *Administrative Law and Practice* § 4:32 (3d ed. 2010); *Solite Corp v. U.S. E.P.A.*, 952 F.2d 473, 484 (C.A.D.C. 1991) (quoting *Connecticut Light & Power Co. v. NRC*, 673 F.2d 525, 530-31 (D.C. Cir. 1982), that it is an integral agency duty "to identify and make available technical studies and data that it has employed in reaching the decisions to propose particular rules."); *N.A. of Regulatory Utility Commissioners v. F.C.C.*, 737 F.2d 1095, 1121 (C.A.D.C. 1984) (explaining "[d]isclosure of staff reports allows the parties to focus on the information relied on by the agency and to point out where that information is erroneous or where the agency may be drawing improper conclusions from it."); *see also Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 392 (C.A.D.C. 1973) ("It is not consonant with the purpose of a rule-making proceeding to promulgate rules on the basis of inadequate data, or on data that, critical degree, is known only to the agency," *id.* at 393).

[8] See Memorandum, Transparency and Open Government (January 21, 2009), http://www.whitehouse.gov/the_press_offi_ce/TransparencyandOpenGovernment/_; Executive Order 13563, "Improving Regulation and Regulatory Review," 76 Fed. Reg. 3821 (January 21, 2011) ("each agency shall ensure the objectivity of any scientific and technological information and processes used to support the agency's regulatory actions"); Executive Order 13579, Regulation and Independent Regulatory Agencies (July 11, 2011) (costs and benefits to be considered).

site-specific details on local fish populations and waterbody conditions may make other assessment approaches, such as population or ecosystem modeling, possible." EPA, *Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule* (EPA 821-R-11-002, March 28, 2011) at 3-1. "EPA . . . is not advocating this [regional] approach for impact and/or benefits analyses that might be conducted for individual [NPDES] permits." 68 Fed. Reg. 13,543 col. 3 (March 19, 2003) (NODA for Phase II rule).

Clearly, the Stated Preference Survey cannot be used for site-specific assessments of benefits, and it would be best to state this principle clearly in any future discussions of the survey to avoid any confusion.

VIII. Conclusion

For the reasons stated above and developed more fully in the attached analyses, UWAG and EEI urge EPA to abandon the effort to estimate benefits of a § 316(b) rule by using a stated preference survey. EPA's previous estimate of commercial and recreational use values provides a far more accurate gauge of the potential benefits of the § 316(b) regulatory options under consideration. And there is no scientifically credible reason to believe that fish losses associated with cooling water intake structures have caused the type of significant and irreversible losses for which people are likely to hold non-use values. Thus, a qualitative assessment of potential non-use values will satisfy both EPA and OMB guidelines for economic analysis. Relying on survey results so fundamentally flawed would serve only to jeopardize the rule, rather than bolstering it.

Therefore, we strongly recommend that EPA set aside the survey results and complete the rulemaking promptly after refining the rule consistent with our earlier comments on EPA's proposed rule, 76 Fed. Reg. 22,173 (Apr. 20, 2011), and our more recent comments on EPA's NODA Related to Impingement Mortality Control, 77 Fed. Reg. 34,315 (Jun. 11, 2012). By

incorporating the improvements we have recommended in the rule, EPA will help to streamline the rule and to bring its benefits more in line with its costs.

We also encourage EPA to state that the partial survey results generated to date cannot be considered guidance by EPA and should not be used or relied on by state and federal permitting directors in the exercise of their best professional judgment to determine the best technology available under § 316(b) in the issuance of NPDES permits. Such use of the results would fail to recognize the problems underlying the survey methodology, design, and data in the context of this rulemaking.

July 2012

Green Energy: The Difference Between Stated Intentions and Actual Behavior

EPA should not make policy decisions based on responses to opinion surveys regarding how much respondents are willing to pay for environmental improvements. Unrelated to the § 316(b) rulemaking, the electric utility industry has collected data on the difference between statements about what environmental benefits are worth and what respondents are willing to pay in practice.

EPA's *Guidelines for Preparing Economics Analyses* (EPA 240-R-10-001) (December 2010), http://yosemite.epa.gov/ee/epa/ eed.nsf/webpages/guidelines.html , acknowledge the possibility of "hypothetical bias." Asked a hypothetical question, members of the public often say they would do something they would not do if faced with an actual choice. This "hypothetical bias" could be tested by asking respondents how much they would pay for saving fish and then asking them to contribute actual money to a fund to help save fish. EPA did not do this.

UWAG's members have information that allow them to compare consumers' survey answers to their actual behavior. For some time, electric power companies have been offering customers "green energy" products, which involve paying a slightly higher rate for electric power generated from renewable sources.

Utility customers are enthusiastic about renewable energy. A survey by the Natural Marketing Institute of over 4000 U.S. citizens found that 55 percent of consumers want companies to increase their use of renewable energy. Partly because of this (asserted) public demand, no doubt, the number of utilities with a green power pricing program grew from 45 in 2003 to 184 in 2009.

DTE Energy, for example, has a GreenCurrents program. Data from this program show that over 22,000 Detroit Edison residential customers are actually willing to pay $2.50 a month when offered slightly more expensive green energy. Of DTE Energy's 1,900,000 customers, this amounts to only 1.16 percent.

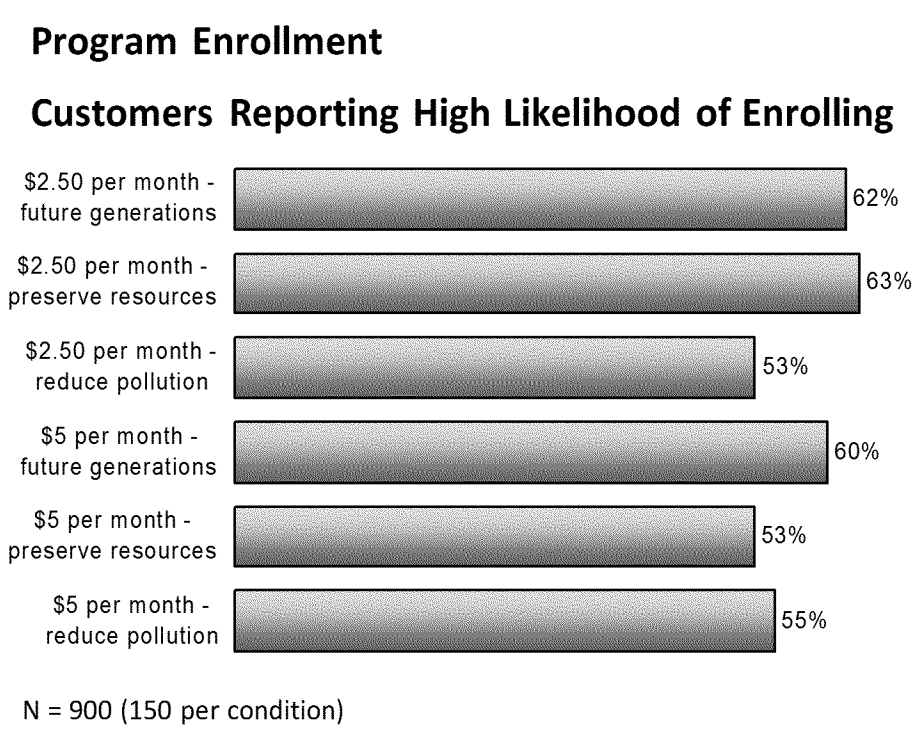
South Carolina Electric & Gas (SCE&G) participates in a green energy program known as PaCE (Palmetto Clean Energy). Surveys conducted before the program was offered showed that roughly 49% of the customers said they would be willing to pay more for renewable energy. The average subscriber in the PaCE program pays 4 percent more for electricity to get 12% of it from green power. Of 650,000 customers, only 250 have signed up (about 0.04 percent).

Another UWAG member (Company 1) offers its customers 150 kilowatt-hour "blocks" of renewable energy at $4.00 each. In a survey conducted in 1998, 84 percent of the company's customers said they wanted an option to support renewable energy. The program was launched in 2000, and customer participation peaked in 2008 with about 0.34 percent of its customers participating -- that is, about a third of one percent, as opposed to 84 percent who said they wanted the opportunity. In short:

Percent who say they want renewable energy	Percent who actually sign up to pay for renewable energy
84%	0.34%

Wisconsin Public Service (WPS), a division of Integrys Energy, reports that fewer than ½ of 1 percent of its nearly 500,000 residential, commercial, and industrial electric customers have opted into its NatureWise program, which provides local "green energy" at a cost of $2.40/month per block of 100 kWh. This is disappointing in light of the results of commercial customer focus groups in 2002 that indicated up to 50% would be willing to pay more for green energy. Moreover, as a result of a 2011 rate increase from $1.50/ block to $2.40/ block, approximately 40% of existing customers dropped their enrollment in the program.

Another company (Company 2) collected survey data in 2008. Then, 58 percent of the customers said they would be interested in buying green energy, because of the advantages of renewable energy listed in this chart:

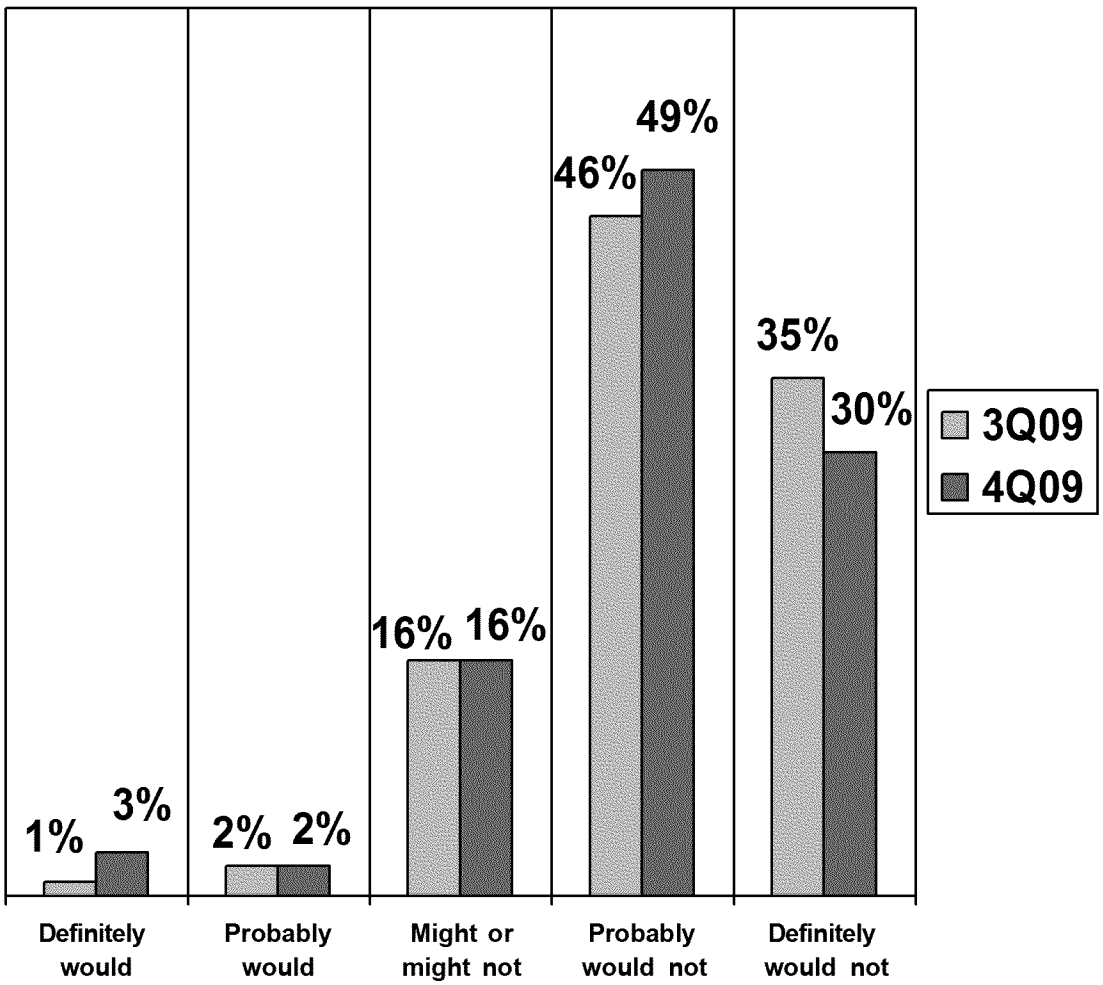


However, only 1 percent actually signed up.

Tampa Electric Company has a green energy program. Based on Customer Favorability reports and other research, Tampa Electric finds that the percentage of people who say they are willing to pay more is much greater than those who actually do.

In the third and fourth quarters of 2009, Tampa Electric asked its residential customers how likely they would be to buy renewable energy, with the following results:

10c. To encourage the development of electricity from renewable energy sources, how likely would you be to purchase a portion of your energy needs at a somewhat higher price than you normally pay?:



Those customers who said they *definitely would*, *probably would,* or *might or might not* were asked how much additional they would be willing to pay monthly to purchase a portion of their electricity needs from renewable energy sources.

	3rd Quarter 2009	4th Quarter 2009
Less than $5	39%	44%
Between $5 and $10	42%	33%
More than $10	19%	23%

The percentage of respondents who said they would pay an additional amount *less than $5* increased 5 percentage points from the third quarter. Twenty-three percent said they would pay *more than $10,* up 4 percentage points.

Despite the growing enthusiasm, only 2349 customers signed up for the program. As a percentage of the recent (May 2012) total of 610,000 customers, this is only 0.39%. The last time the company asked, in the fourth quarter 2009, 0.25% of residential customers said they participated in the program. The 2009 fourth quarter report was consistent with previous survey reports.

In 2001, Progress Energy did a study looking at various customer segments and their willingness to pay more for "green power." The following questions were asked:

Willingness to Pay/Interest in Green Power

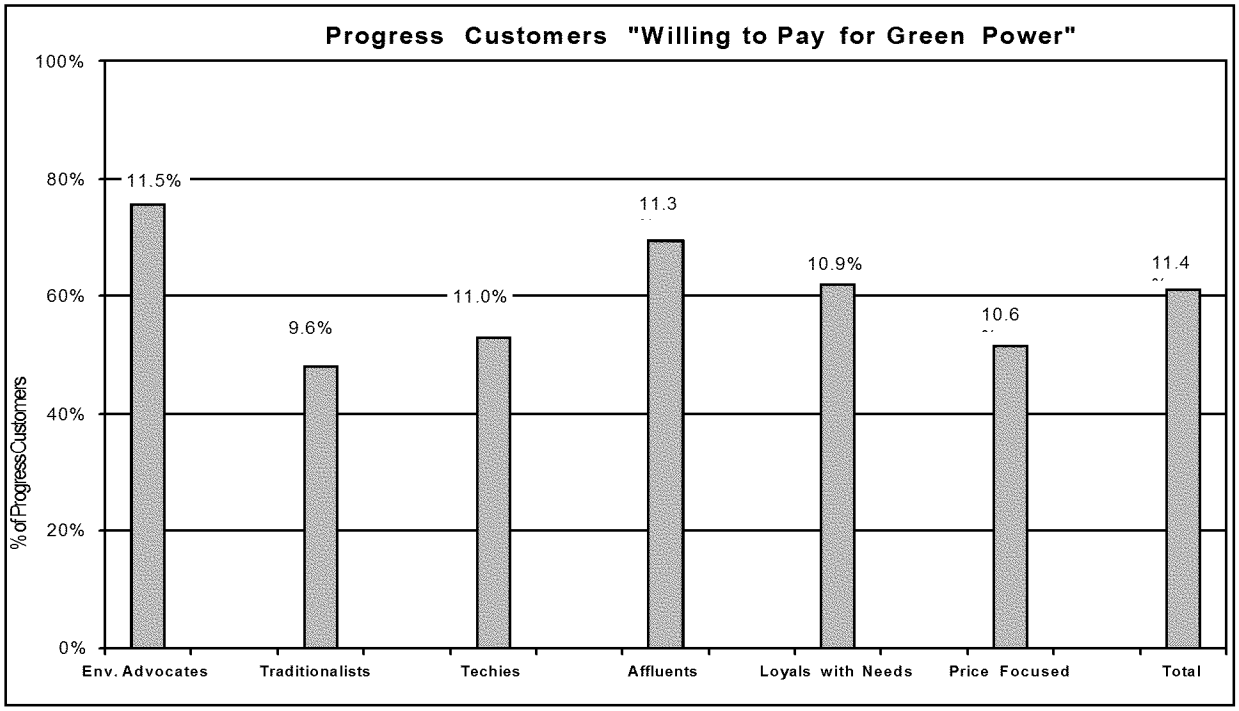
- I'd pay more to have some of my electricity made from environmentally friendly sources (water, wind, sun, etc.).
- [Q-55] If offered, please indicate the share of your electricity you would like from these sources

[None, 10%, 25%, 50%, 75%, 100%]

- [Q-56] If offered, please indicate how much extra you would pay each month to have the [above] share…

[None, $5, $10, $20, $30, $40, $50, $75]

This study showed that 75% of '"environmental advocates" said they would be willing to spend an average of 11.5% extra for renewable energy. No customer segment had less than 45% support for paying more for green power. In this chart, the percentage of people responding is shown by the bar heights, and the percentage extra they were willing to pay is the number at the top of the bar:



However, in the decade since this survey, Progress customers in North Carolina had the chance to actually sign up for "green power." Here are the results:

- NCGreenPower participants as of May 2012: 3,700 (Progress Energy customers). This is about 0.3% of North Carolina Progress Energy customers (1,200,000).

- Palmetto Clean Energy participants as of May 2012: 54. This is about 0.02% of South Carolina customers (250,000).

http://www.ncgreenpower.org/ .

Entergy, too, conducted a survey to determine the effectiveness of its marketing strategy and gain an understanding of opinions toward the Geaux Green program. Survey participants were broken out in to three categories – participating, interested, and random. "Participating" members were enrolled in the Geaux Green program. "Interested" members had requested information about the program but failed to enroll. "Random" had neither requested information, nor were they enrolled.

The survey indicated that 42.2% of Random and 76.4% of Interested members said they would be willing to pay $5 a month for green power. The Geaux Green Program actually required a commitment of only $2.25 a month, but the company

encountered significant resistance when it tried to sell this product. Most customers would ask how much money they would save each month. When told they must pay a premium, typically they did not sign up.

The program ran from April 2007 to July 2010 at Entergy Gulf States Louisiana (EGSL) and August 2008 to July 2010 at Entergy Louisiana (ELL), and the final enrolled customer count for July 2010 was small:

EGSL

Residential	393 of 325,601
Commercial	24 of 49,493
Industrial	6 of 3,443
Governmental	0 of 1,657
Total	423 of 380,195 (.11%)

ELL

Residential	106 of 578,152
Commercial	2 of 75,292
Industrial	0 of 7,177
Governmental	0 of 5,560
Total	423 of 666,180 (.06%)

In short, whereas nationwide about 55 percent of respondents say they would buy renewable energy, experience shows that anywhere from 0.02 to about 1.2 percent actually pay for it.

Company Name	Percent who say they want renewable energy	Percent who actually pay for renewable energy
Nationwide survey	55%	
DTE Energy		<1.2%
SCE&G	75%	0.04%
Company 1	84%	0.34%
Integrys Energy	50%	<0.5%
Company 2	58%	1%
Tampa Electric Co.	3-5% (definitely or probably would)	0.25-0.39%
Progress Energy	>45%	0.02-0.3%
Entergy		0.06-0.11%

NERA
ECONOMIC CONSULTING

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Comments on EPA's Notice of Data Availability for §316(b) Stated Preference Survey

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Executive Summary

The U.S. Environmental Protection Agency (EPA) on June 12, 2012 published a Notice of Data Availability (NODA) in the *Federal Register* providing preliminary data and econometric results based upon a stated preference (SP) survey (hereafter EPA survey) related to the potential benefits of regulatory alternatives for cooling water intake structures at power plants and other facilities under §316(b) of the Clean Water Act (EPA 2012a). EPA has solicited public comment–within a 30-day comment period–on all aspec ts of the stated preference study, including the methodology, the strengths and weaknesses of stated preference methods generally, and the appropriate role, if any, the study should play in the analysis of the final rule.

A. Objectives and Context of this Report

This report focuses on three questions related to the EPA survey:

1. Does the EPA survey provide the basis for respondents to provide meaningful responses?

2. Does EPA's empirical analysis indicate that the survey data and results yield valid willingness-to-pay estimates?

3. Do EPA's empirical results from the survey provide plausible national and regional willingness-to-pay estimates for §316(b) alternatives?

We assess the role the EPA survey should play in EPA's analysis of the final §316(b) rule in light of these evaluations.

1. Background on National Benefits and Costs in EPA April 2011 Regulatory Impact Analysis

Although EPA had earlier stated that the EPA survey would be used to supplement the benefits estimates it developed in the Regulatory Impact Analysis (RIA) for its April 2011 §316(b) Proposed Rule by providing potential additional estimates of "non-use" benefits (EPA 2010b), EPA states in the NODA that it would use the results of the survey to supplant rather than to supplement the RIA benefit estimates (EPA 2012a). Table E-1 shows the summary benefit-cost RIA results, which include detailed and comprehensive assessments of potential commercial and recreational fishing benefits.[1]

[1] Note that the EPA RIA benefit estimates include the value of additional forage fish based upon their contributions to additional commercial/recreational catch.

Table E-1. Summary of Annualized Social Benefits and Costs of Options in §316(b) Proposed Rule

	Option 1	Option 2	Option 3	Option 4
AnnualizedBenefits	$16.0	$92.2	$95.7	$15.8
AnnualizedCosts	$459	$4,699	$4,862	$383

Notes: Dollar values in millions of 2009 dollars.
Values are annualized using a 7 percent discount rate.
Benefits include estimates of both "use benefits" from commercial and recreational fishing and "non-use benefits" for the North Atlantic and Mid Atlantic regions only.
Source: EPA Section §316(b) Proposed Rule, pp. 22219 and 22247

Under EPA's preferred option (Option 1) using a 7 percent discount rate, national costs were estimated to be $459 million annually and national benefits were estimated to be $16 million annually, or about 3 percent of costs. EPA speculated that the benefits in Table E-1 may not fully account for potential non-use benefits and the Agency noted in the RIA that it was preparing a SP survey to estimate §316(b) benefits that would include potential non-use benefits (EPA 2011b, p. 8-6). Because EPA has prepared detailed estimates of use benefits, the usefulness of the EPA survey depends in large part on the extent to which it provides valid estimates of non-use benefits associated with the §316(b) regulatory alternatives.

2. Areas for Initial Comments on EPA Survey

These initial comments on the EPA survey are in three major areas corresponding to the three questions noted above:

EPA survey instrument;

Econometric analysis of EPA survey data; and

National benefit and benefit-cost comparisons based upon the EPA survey.

Note that within the limited 30-day comment period we do not address other aspects of the survey that also deserve evaluation, such as the nature of the survey procedures (e.g., the limitations of using a mail survey for data collection) and the specific sampling (e.g., the use of regions as the basis for stratifying the sample). These comments provide the basis for our conclusions regarding the role that the EPA survey should play in the evaluation of the final rule. The comments build upon our previous comments on EPA's analysis of §316(b) regulatory alternatives, including our comments on prior stages of the EPA survey.

B. Evaluation of the EPA Survey Instrument

Our review of EPA's survey instrument indicates that it suffers from fundamental flaws that make it an unreliable basis for estimating households' willingness-to-pay for regional and national §316(b) environmental benefits, including any non-use benefits.[2]

1. Overview of Major Flaws in EPA Survey Instrument

The major flaws include the following:

Inadequate and misleading biological information. Respondents are asked to evaluate policies predicated on four broad regional "scores:" (1) commercial fish populations based upon a score between 0 and 100 percent; (2) all fish populations, also based upon a score from 0 to 100 percent; (3) fish saved, based upon a percentage saved, with information provided on the numbers of fish saved; and (4) condition of aquatic ecosystems, based upon a score from 0 to 100 percent. Barnthouse (2012) provides an expert review of the survey instrument and the underlying biological information and concludes that "none of the four attributes used by EPA in the SP Survey provides scientifically valid information concerning the potential benefits to the public of reducing [impingement and entrainment] mortality" (p. 12). Dr. Barnthouse focuses his review on the "fish saved" attribute (because EPA may use this attribute alone to estimate willingness-to-pay values); he concludes that the metric is "questionable at best and highly misleading at worst" (p. 2) because EPA does not reveal its highly speculative nature or the correct context. The "fish saved" metric provides no information on the nature of the species that would be saved and how increases in their numbers might affect their viability in the various relevant water bodies. Barnthouse (2012) investigates the data used by EPA to develop its estimate of "fish saved" and finds that it involves highly uncertain extrapolations with enormous uncertainties. Moreover, the bulk of the gains are a single tiny forage species that would translate into a minuscule share of additional commercially harvested fish. In short, the EPA survey does not provide accurate scientific information to respondents that clarifies what is actually at stake to various fish species in various locations.

Complexity of accurate potential regional and national §316(b) biological benefits. Providing policy-relevant information for the rulemaking would mean that the EPA survey would need to present respondents with complex and detailed information on potential biological benefits for all species and facility locations, including an acknowledgement of the enormous uncertainties involved in developing this information. The vast majority of respondents would have no prior knowledge of these biological issues or no experience comprehending such information and the related uncertainties. Research on the cognitive processes that respondents use in

[2] The EPA survey results would not be appropriate to use (via "benefit transfer") for a site-specific benefits assessment given the survey's fundamental flaws. Since the focus of this report is on EPA's regional and national benefit-cost analysis of §316(b) options, we do not discuss the additional issues related to the inappropriateness of the EPA survey for use in site-specific benefit assessments.

these circumstances suggests that such a detailed survey instrument is not likely to provide valid estimates of households' willingness-to-pay.

Improper context for policy choice. The survey provides a misleading characterization of the likely full policy effects. For example, the survey materials state explicitly in the background section that "studies of industry suggest that effects on employment will be close to zero" even though elsewhere the survey materials indicate that electricity prices will rise (EPA 2011c). Various studies have shown that higher electricity prices lead to job losses (in part because they make U.S. companies less competitive internationally) and, indeed, that major environmental regulations are likely to lead to net negative effects on the national economy even when the positive effects of increased expenditures are taken into account. The fact that EPA provided this (erroneous) information suggests that the Agency recognizes that some survey participants would be influenced in their evaluation of fish and ecosystem improvements by concerns about policy impacts such as increased electricity prices (and, indeed, such effects might lead to negative non-use values, e.g., if some respondents were concerned about impacts on low income groups). The materials also fail to inform respondents of other potential negative environmental effects of the cooling tower retrofits that would be required under certain regulatory options, including aesthetic considerations and the potential for increased air emissions and greenhouse gas emissions.

Hypothetical bias. The EPA survey instrument has additional limitations that cause it to fall short of meeting the standards set by various government agencies and practitioners for an appropriately designed SP survey (see NERA Economic Consulting and W.H. Desvousges & Associates, 2010). Although the fundamental difficulties outlined above imply that the survey instrument is not usable for its intended purpose, it is important to be aware of these other limitations. In particular, even if respondents were provided with complete and accurate information, and appropriate context and the other fundamental difficulties were not present, the responses would be subject to the well-known difficulty of hypothetical bias. This bias refers to the difference between the value implied by SP responses–in this case, choices among policy alternatives, including the "no policy" alternative–and the values revealed by actual behavior. EPA contends that concerns of hypothetical bias in SP surveys have been overstated (EPA 2011d). However, the characteristics of this particular survey (e.g., unfamiliar commodities, non-use included, complex choices) more closely align with those that have exhibited considerable hypothetical bias. EPA fails to indicate to respondents the full potential consequences of their votes since, as emphasized above, the policy descriptions are inaccurate and misleading, and respondents do not have experience considering these types of choices. As we discuss below, the econometric results bear out this point that people's answers are not reflective of real economic tradeoffs.

2. Implications of the Major Flaws in EPA Survey Instrument

The net effect of these various flaws is that the current survey responses are not likely to reflect respondents' true willingness-to-pay for the detailed biological changes due to §316(b) policy alternatives. Academic literature on the cognitive processes involved in survey responses indicates that when the information provided to respondents is inadequate and/or the burden on respondents to determine a reasoned response is high, respondents tend to take shortcuts in answering the survey questions. These shortcuts–such as substituting an easier heuristic question or providing an apparently satisfactory answer ("satisficing") instead–do not reflect true willingness-to-pay for environmental gains.

The EPA survey is not likely to develop usable information for its intended purpose because it does not provide the detailed information and context that would be needed to provide the basis for valid willingness-to-pay responses for regional and national changes in EPA's selected attributes due to §316(b) policy alternatives. Minor changes to the survey instrument would not alter this conclusion. Indeed, the required complexity of the survey instrument indicates that the SP survey approach is not an appropriate means of estimating regional/national benefits for §316(b) alternatives.

C. Evaluation of EPA Survey Econometric Analysis

Our initial review of the EPA econometric analysis supports our concerns that the EPA survey instrument is not capable of yielding usable survey data on households' willingness-to-pay for §316(b) policy options.

1. Substantial Problems with the EPA Survey Econometric Analysis

Our review reveals the following substantial problems in EPA's econometric analysis of the data from the EPA survey.

Lack of replication. Our initial results indicate that there are fundamental flaws in the econometric exercise conducted by EPA. One prominent indication of these flaws is that the EPA estimation results could not be replicated. Although the data sample published by EPA is somewhat larger than the one on which EPA's results are based (because EPA continued to receive returned surveys after conducting its preliminary econometric analysis), the additional data should not lead to the substantial and consistent differences in results that we observe.

Model selection flawed. EPA's method to select the appropriate model based upon the survey data is flawed. We have serious concerns with the procedures used by EPA to select a model because they do not conform to statistical best practices. An equally troubling concern is that our analysis uncovered strong evidence that EPA's model for its chosen specification suffered from false convergence. The implication of this result is that any testing of alternative models that EPA did perform is unreliable. This completely invalidates the justification EPA uses to support its willingness-to-pay estimates derived from the fitted models.

"Irrational" respondent behavior. Our additional analyses of the EPA survey data display behavior on the part of respondents that is inconsistent with the underlying economic theory of a linear random utility model. These analyses indicate that–consistent with our expectations based upon the nature of the survey questions–respondents were confused or used heuristic methods to select a preferred alternative. Some of the indications of irrationality are quite striking. For example, our results showed that the EPA survey data imply that 35 percent of respondents had a negative value on the number of fish saved, which is the variable that underpins EPA's recommended use of the survey to generate benefit estimates. Our analysis further showed that 75 percent of respondents had a fundamental preference for more regulation, regardless of the tradeoff choices they were provided. Such a result is not consistent with the model underlying EPA's method, which requires people to make tradeoffs among attributes. Our results further showed that people were "adding up" the values of the fish attributes and not making the tradeoffs among them as required by the underlying model. Finally, respondents had much more difficulty making tradeoffs when presented with two choices having the same costs–rather than when costs differ–further suggesting that respondents did not differentiate among the various metrics and relied on short-cuts to try to answer the complex questions. The implication of respondents using these short-cut or heuristic approaches to make choices is that their choices are not consistent with uncovering valid assessments of willingness-to-pay for the changes in environmental indicators.

2. Implications of the Substantial Problems with the EPA Survey Econometric Analysis

These results all indicate that the EPA econometric results are not valid and do not provide an appropriate basis for developing valid regional or national estimates of households' willingness-to-pay for various §316(b) alternatives. Indeed, our findings of widespread irrational behavior by survey respondents means that the use of a larger sample or a different model specification would not "solve" the problems with the EPA econometric analysis. The flaws in the survey instrument make it incapable of developing data that can be used to produce meaningful estimates of willingness-to-pay for §316(b) policy options.

We emphasize that these conclusions do not relate to the general SP approach but rather to the specific application of the SP approach in the EPA survey.

D. Evaluation of National §316(b) Benefit-Cost Results Using the EPA Survey

The use of the EPA survey results would dramatically alter the benefit-cost calculations and conclusions regarding the proposed §316(b) regulatory alternatives.

1. National Benefit Calculations Based Upon the EPA Survey Using the Approach Outlined by EPA

In the NODA, EPA has provided its recommendations on how to use the EPA survey results to develop regional and national benefit estimates. EPA's approach would focus on the results for the "fish saved" variable. In particular, EPA propo ses calculating total regional willingness-to-pay by multiplying the dollar value of a 1 percent reduction in fish lost by the estimated regional percent improvement, and then multiplying by the number of households in the region; national totals would involve summing over the regions or using the results of the national survey. These national benefit estimates would substitute for the use value estimates from the RIA, since EPA argues that the survey values reflect both use and non-use values (although, as noted above, EPA's original motivation for the survey was to develop non-use values to supplement its RIA estimates).

Table E-2 shows the results of substituting the implied national[3] benefits from the EPA survey for the use and (partial) non-use benefits reported in EPA's RIA accompanying the §316(b) Proposed Rule. (Note that to facilitate comparisons, the benefit and cost estimates from the §316(b) Proposed Rule have been converted from 2009 dollars to 2011 dollars.) For the preferred Option 1, quantified benefits would change from about $16 million per year based upon the RIA estimates to about $2.3 *billion* per year using the results of the EPA survey. The annualized benefits calculated using the results of the EPA survey are therefore roughly 140 times (or 14,000 percent) larger than the quantified benefits reported in the RIA. The results are similarly dramatic for the other regulatory options EPA identified in its §316(b) Proposed Rule.

[3] We use the "national" version of the EPA survey to estimate national benefits; the results are very similar when results from the four regional surveys are used to produce a national benefit estimate.

Table E-2. Comparison of Quantified Benefits and Costs from §316(b) Proposed Rule and EPA Survey

	Option 1	Option 2	Option 3	Option 4
Benefits and Costs from the Proposed Rule:				
Commercial and Recreational "Use" Benefits (2011$ million)	$15.8	$36.8	$37.6	$15.4
Total Quantified "Non-use" Benefits	$0.5	$56.7	$59.4	$0.5
Total Quantified Benefits	$16.3	$93.6	$97.0	$15.9
Annualized Costs (2011$ million)	$466	$4,769	$4,934	$389
Benefits to Costs Ratio	0.03	0.02	0.02	0.04
Implied Benefits and Costs from the Survey:				
Implied Benefits from Survey (2011$ million)	$2,275	$7,330	$7,449	$2,228
Annualized Costs (2011$ million)	$466	$4,769	$4,934	$389
Benefits to Costs Ratio	4.9	1.5	1.5	5.7
Comparison of Non-use and Use Benefits:				
Implied "Non-use" to "Use" Benefits Ratio	143	198	197	143

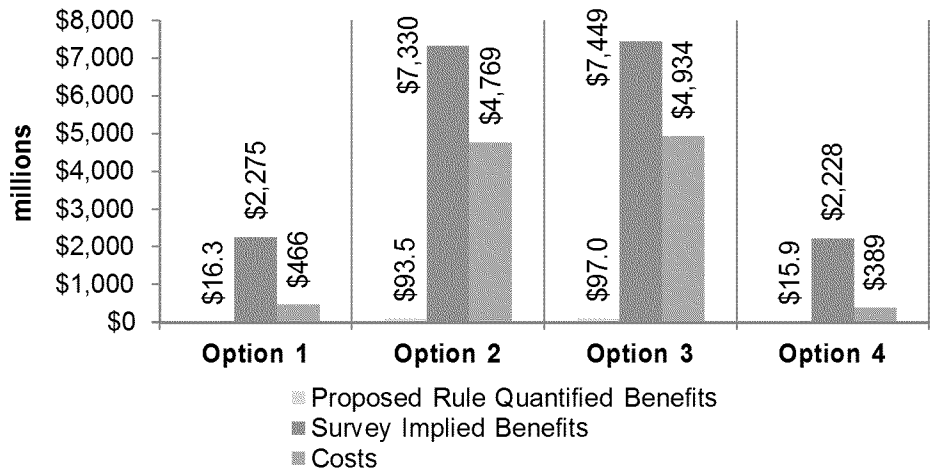
Note: Annualized benefits and costs calculated using a 7 percent discount rate
Source: EPA 2012b and NERA calculations

2. Implications of National Benefit Calculations Based Upon the EPA Survey Using the Approach Outlined by EPA

a. National Benefits

Figure E-1 illustrates the enormous increase in annualized (quantified) benefit estimates when the EPA survey results are substituted for the benefits calculated by EPA in the RIA for the §316(b) Proposed Rule. (Note that the RIA quantified benefit estimates are so much smaller than the values based upon the EPA survey that they are not visible in the bar graph.) Figure E-1 also includes the annualized cost estimates for comparison with the two benefits estimates (using a 7 percent discount rate to annualize benefits and costs).

Figure E-1. Comparison of Quantified Benefits and Costs from §316(b) Proposed Rule and EPA Survey

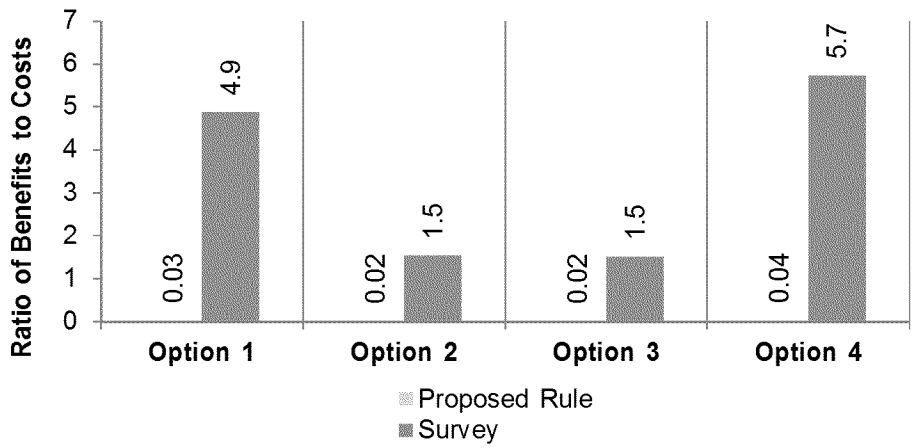


Note: Annualized benefits and costs are expressed in millions of 2011 dollars.
Benefits and costs are annualized using a 7 percent discount rate.
Source: EPA 2012b and NERA calculations

b. National Benefit-Cost Ratios

Figure E-2 illustrates the large increase in benefit/cost ratios between the Proposed Rule and the EPA survey. For Option 1, benefits would be about 3 percent of costs using the RIA benefit values and almost 500 percent of costs using the EPA survey.

Figure E-2. Benefit/Cost Ratios for Proposed Rule and Survey



Note: Benefits and costs are annualized using a 7 percent discount rate.
Source: EPA 2012b and NERA calculations

c. National Non-Use Benefits

One potential implication of the EPA survey results is that about 99.5 percent of all benefits from avoided fish losses would be "non-use" benefits as opposed to "use" benefits associated with commercial and recreational fishing, using the EPA RIA "use" benefit calculations from the

§316(b) Proposed Rule. We find this level of non-use benefits to be highly implausible, and, as discussed below, not supported by any systematic assessment of their likely significance. Of course, survey respondents in theory could have had "use" values in mind when they voted for a policy option. This raises the equally troubling issue that the estimates of use benefits from the EPA survey are too much larger than the use benefit estimates from the RIA to be taken seriously.

With regard to potential non-use values, it is instructive that EPA has not provided a systematic assessment of whether non-use benefits are likely to be significant due to §316(b) regulations, as EPA itself has previously recommended for site-specific benefit assessments (EPA 2004). In the RIA, EPA discusses the threatened and endangered species that might be affected (EPA 2011b), but the Agency does not rely upon threatened and endangered species as the justification for potentially substantial non-use benefits. Instead, EPA seems to believe that non-use benefits are likely to be significant–and worth spending substan tial resources to develop the EPA survey–because the majority of the biological gains represent un-harvested recreational and commercial catch and forage fish (the value of which are based upon the relatively minor use value of the additional catch they provide) (EPA 2011e, p. 22240). But the fact that the use values of additional forage fish are relatively small does not imply that they provide significant non-use values.

The economic literature and previous EPA guidance suggest non-use benefits are likely to be significant only if the resource (in this case the changes in fish populations) is "unique" (e.g., like the Grand Canyon) and if the potential gains are long-lasting; increases in the numbers of a widely dispersed wildlife species do not meet these criteria and thus would not be likely to generate significant non-use values (Freeman 2003). EPA has not provided any information to indicate that the changes due to §316(b) alternatives would meet these two requirements, and, as discussed above, Dr. Barnthouse's review of the biological information underlying EPA's survey information suggests that the gains would indeed consist of increases in the numbers of widely dispersed wildlife species.

EPA has provided no evidence that potential non-use benefits of the §316(b) alternatives are likely to be significant, let alone of the magnitude that is implied from the EPA survey. Although the money to undertake and analyze the EPA survey has already been spent, it seems important to acknowledge the principle that potential significance should be assessed in order to focus future efforts on situations in which the resources required to undertake such a survey are justified. Indeed, there is a further advantage of assessing likely significance–a comprehensive assessment of the likely significance of non-use benefits would provide guidance for the site-specific entrainment assessments called for in EPA's preferred option (Option 1).

d. Summary

In summary, we find the national benefit and implied non-use (or use) benefit estimates based upon the use of the EPA survey highly implausible, although it is of course not possible to "prove" that they are "wrong" just because of their magnitude. But in combination with our conclusions regarding the survey instrument and the EPA econometric analysis, these results are

additional confirmation that the EPA survey does not provide valid estimates of willingness-to-pay for §316(b) benefits.

E. Conclusions Regarding the Appropriate Role of the EPA Survey

We conclude that the EPA survey should not be used as the basis for calculating regional and national benefits in EPA's final assessment of various §316(b) regulatory alternatives. EPA has developed national commercial and recreational fishing benefit estimates using sound methodologies, and it would not make sense to supplant these estimates with the flawed EPA survey results. Consistent with prior EPA guidance, non-use benefits should be assessed in site-specific §316(b) determinations, where the assessments could be much more meaningful because they would focus on specific conditions and potential impacts (e.g., loss of unique resources such as threatened and endangered species).

Some at EPA–and some reviewers–might argue that "some non-use valuation is better than no non-use valuation." But the inherent problems with the EPA survey–as revealed by assessments of the survey instrument and statistical analyses–are too severe for the resulting estimates to serve as the justification for spending hundreds of millions or even billions of dollars each year, costs that ultimately would be paid for by society largely through higher electricity rates and price increases for many other goods and services. The results of the EPA survey are simply not reliable estimates of the benefits that households would receive if these §316(b) regulations were promulgated.

As noted above, we do not conclude that stated preference survey techniques in general are invalid or that in principle they should never be used for §316(b) assessments. Indeed, our conclusions also support a recommendation to focus benefit-cost evaluations of §316(b) alternatives at the site-specific level. In that context, there may be circumstances in which efforts to quantify non-use benefits are warranted. EPA regional and State officials can use site-specific information–potentially including the results of SP surveys for non-use valuation if the likelihood of significant non-use benefits justifies the expense of developing a sound methodology–to make sensible choices on individual §316(b) permits.

I. Introduction

The U.S. Environmental Protection Agency (EPA) has published preliminary results from a survey ("EPA survey") that it is considering using to develop revised estimates of the benefits of regulatory alternatives related to cooling water intake structures (CWIS) at power plants and other facilities under §316(b) of the Clean Water Act. This report evaluates key elements of the EPA survey and assesses whether the EPA survey should be used as the basis for EPA's final assessment of benefits for §316(b) regulatory alternatives.

A. Overview of the EPA Survey and Analyses

On June 12, the EPA published in the *Federal Register* a Notice of Data Availability ("NODA") related to a stated preference survey entitled "Fish and Aquatic Habitat" (EPA 2012a, p. 34,927). EPA is considering using the results of the EPA survey to provide the basis for estimates of the benefits U.S. households would receive from various §316(b) alternatives.

The EPA survey presented respondents with background information that included various assertions and illustrations concerning the importance of fish and the effects on fish populations of cooling water intake structures used by power plants and other industrial facilities. The survey then presented three choice questions, each of which asked respondents to choose one of three hypothetical policy options–the status quo, for which one would pay nothing, and two hypothetical policy options that would provide hypothetical regional or national improvements in various environmental attributes in exchange for paying some cost in the form of higher electricity and other prices.

The NODA also includes a description of the empirical model EPA developed using the data obtained from the EPA survey and technical support for its statistical analyses. The materials accompanying the NODA also describe a methodology on how to use the statistical results to generate regional and national estimates of the benefits of §316(b) regulatory options. These national estimates would supplant national benefit estimates developed by EPA when the proposed standards were issued by EPA in July 2011, with benefits generally calculated using well-established methods to value commercial and recreational fish catch.

B. Objectives of this Report

EPA has solicited public comment on all aspects of the EPA survey, including the methodology, the strengths and weaknesses of the survey method generally, and the appropriate role, if any, the study should play in the analysis of the final rule. The objective of our report is to evaluate the EPA survey and its potential usefulness in developing reliable benefit estimates for national §316(b) policy alternatives.

Our initial comments (provided within the 30-day comment period) on the EPA SP study are in three major areas:

1. Evaluation of the EPA survey instrument;

2. Assessment of the EPA econometric analysis; and

3. Assessment of the potential use of the EPA survey for national §316(b) benefit and benefit-cost comparisons.

This report provides the basis for our conclusions regarding the role that the EPA survey should play in EPA's evaluation of the final rule. These comments build upon our various previous comments on EPA's analysis of §316(b) regulatory alternatives, including our comments on prior versions of the survey (Harrison et al. 2010) and on the EPA proposed rulemaking (Harrison et al. 2011).

C. Organization of this Report

The remainder of this report is organized as follows. Section II describes the EPA benefit-cost assessment for the §316(b) proposed rulemaking and the potential role of the EPA survey to develop alternative benefit estimates for EPA's final evaluation. Section III provides an assessment of the EPA survey instrument. Section IV provides an empirical analysis using the survey response data that were provided by EPA, including an assessment of EPA's econometric estimates. Section V considers the implications of using the EPA survey results–rather than the information that was developed in the draft rulemaking–to estimate national §316(b) benefits. Finally, Section VI provides conclusions and recommendations.

II. EPA Benefit-Cost Assessment and Potential Role of EPA Survey

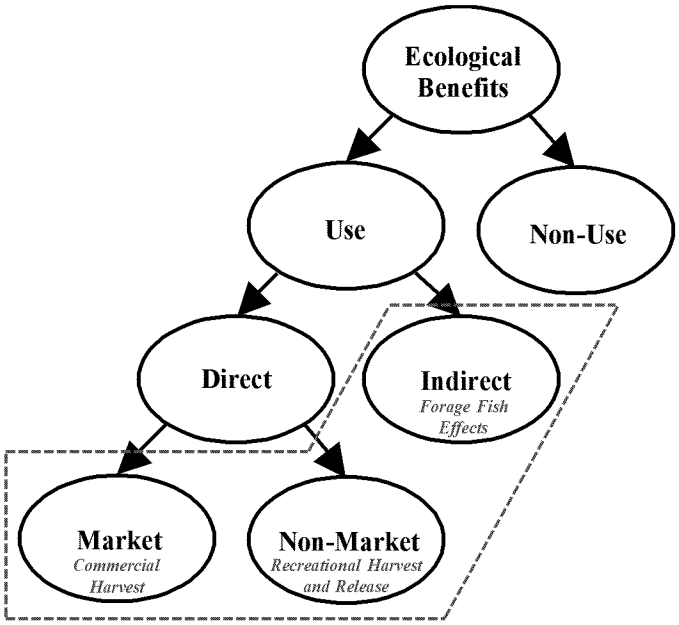
§316(b) of the Clean Water Act calls for the EPA to set regulations on the intake of cooling water by power plants and other facilities. These regulations provide the basis for individual §316(b) regulations imposed on power plants and other facilities in their National Pollution Discharge Elimination System (NPDES) permits, typically issued by states that have assumed regulatory responsibility for the NPDES program Clean Water Acts. The key regulatory requirement under §316(b) is that the location, design, construction, and capacity of a facility's cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impacts. In April 2009, the Supreme Court ruled that it is permissible under §316(b) for EPA and the states to consider costs and benefits in setting BTA regulations and in individual permit requirements.

In a Proposed Rule issued in July 2011, EPA developed estimates of the costs and benefits of four potential §316(b) regulatory options. In order to provide an appropriate context for the EPA survey–since EPA has now decided that the survey re sults would supplant the prior estimates if they were used in the final rule–this section provi des an overview of the July 2011 estimates. We begin with background on the various benefits categories, including both use and non-use benefits.

A. Categories of Potential §316(b) Benefits

The EPA *Guidelines for Preparing Economic Analyses* ("*Guidelines*") provide a summary of the benefit categories relevant to an assessment of ecological benefits, the general category of benefits relevant to §316(b) regulatory assessments (EPA 2010a). Figure 1, adapted from the *Guidelines*, provides a way of organizing the relevant categories based on how they are experienced. Figure 1 divides the ecological benefits into two major categories: use benefits and non-use benefits.

Figure 1. Summary of Benefit Classification Scheme from EPA *Guidelines*



Source: Adapted from EPA (2000, p. 7-9)

1. Use Benefits

Figure 1 shows a breakdown of use benefits into direct and indirect benefits, with direct benefits divided into market (commercial fishing) and non-market (recreational fishing) categories. Indirect use benefits are those that contribute through secondary effects on either marketed goods or non-market uses of a resource.

a. Market Commercial Fishing Benefits

Reducing fish losses at cooling water intakes may result in additional numbers of specific fish species that are caught or are available to be caught by commercial fishermen. This increased catch constitutes the market benefits, since commercial fish are bought and sold in fish markets. Market benefits are measured using market prices in the commercial fishing industry. *Ex vessel* prices reflect the values received by commercial fishermen (in contrast to wholesale and retail fish prices, which include mark-ups reflecting additional costs) and thus are the appropriate prices to value additional commercial catch. Data are available on *ex vessel* prices for the major commercial species that can be used to estimate the societal values of additional commercial catch. These values differ substantially among different fish species.

b. Non-Market Commercial Fishing Benefits

Non-market benefits reflect the value of opportunities for additional recreational catch for various fish species. Economists have developed well-established methods of evaluating the value that recreational fishermen place on additional catch of various types of fish. These values

can differ by species and by location of the fishery. The methods are referred to as "revealed preference" methods since they use observed behavio r to infer preferences.

Various researchers, including those supported by EPA grants, have used these methods to develop detailed estimates of the values that recreational fishermen place on additional catch. These values typically are greater than *ex vessel* commercial values for a given species and fishery.

c. Indirect Forage Fish Benefits

Forage fish are small prey or bait fish (e.g., bay anchovy and menhaden) that are generally near the base of the food chain. An increase in the number of forage fish may increase the population of commercially or recreationally valuable fish species and some of these increased numbers may be harvested. There are thus potential indirect benefits to commercial and recreational anglers of increasing the population of forage fish.

Biologists and economists have developed reliable methods of valuing forage fish populations by estimating the increase in harvested commercial and recreational game fish for a given increase in forage fish and then using the commercial and recreational values to calculate benefits. This value of forage fish is included in the use benefits calculated by EPA for the §316(b) Proposed Rule.

2. Non-Use Benefits

This section provides an overview of non-use benefits and the reasons given by EPA as to the need to develop surveys to determine their potential importance. We discuss the criteria that have been identified for determining when non-use values are likely to be important in light of the difficulties and expense of the survey approach.

a. Overview of Non-Use Benefits

Non-use benefits may arise if individuals value the change in an ecological resource without the prospect of using the resource or enjoying the option to use it in the future. That is, non-use value is separate from the potential specific gains to those who would gain through "use" of the resource, where use includes the variety of ways that specific gains may accrue to various households. The Grand Canyon provides the classic example of a resource for which there is likely to be significant non-use value if it were affected by a policy; households may value changes in the Grand Canyon (e.g., visibility) even if they do not intend to visit it. The EPA *Guidelines* (2010a) note various circumstances in which non-use benefits might arise:

knowledge that the resource exists in an improved state;

bequest values for future generations;

altruistic values for others' enjoyment of the resource; and

commitment to environmental stewardship.

Although this list provides some sense of the circumstances that might give rise to non-use values, it does not provide much guidance on when such values are likely to be significant. Non-use benefits are difficult (and expensive) to estimate or quantify because, as the EPA *Guidelines* indicate, estimating non-use benefits requires the use of surveys that are complicated and that can be expensive to conduct correctly (EPA 2010a). Thus, the leading stated preference practitioners emphasize that it is important first to determine whether non-use benefits are likely to be significant in order to avoid committing to an expensive analysis that may not provide useful information (Bateman *et al* 2002).

b. Prior EPA Criteria for Potential Significance of Non-use Benefits

EPA's §316(b) Phase II Rule (issued in 2005) provided guidance on the circumstances in which non-use benefits are likely to be significant. The Phase II Rule recommends considering the magnitude and character of ecological impacts implied by the results of biological assessments and other related information prior to determining whether to monetize potential non-use benefits (EPA 2004, p. 41648).

The Phase II Rule specifies that monetization of non-use benefits should be considered if an impingement mortality and entrainment characterization study determines that substantial harm is done to one or more of the following:

> A threatened or endangered species;
>
> The sustainability of populations of important species of fish, shellfish, or wildlife; or
>
> The maintenance of community structure and function in a facility's waterbody or watershed (EPA 2004, p. 41648).

These criteria imply that increases in the numbers of individuals within one or more fish species are unlikely to give rise to non-use benefits unless the species are threatened or endangered or the changes affect sustainability of the populations or are likely to result in other significant gains to the water body.

c. Economic Criteria for Potential Significance of Non-use Benefits

The economic literature on non-use valuation also provides useful guidance on situations in which non-use values are likely to be significant. In his well-regarded text on measuring environmental and resource values, Freeman (2003) reviews the literature on non-use values, considering the situations in which non-use values are likely to be significant. He concludes by noting that, while the literature is unresolved on this issue, non-use values are likely to be important when the resource in question is special or unique and the loss or injury is irreversible (or subject to a prolonged recovery):

> Another important question is, when are nonuse values likely to be important? The long literature on nonuse values emphasizes the *uniqueness or specialness of the resource in question* and the *irreversibility of loss or injury*. For example, economists have suggested that there are important nonuse values in preserving the Grand Canyon in its natural state and in preventing the global or local extinction of species and the destruction of unique ecological communities. In contrast, resources such as ordinary streams and lakes or a *subpopulation of a widely dispersed wildlife species are not likely to generate significant nonuse values because of the availability of close substitutes*. Moreover, the literature does not suggest that nonuse values are likely to be important where recovery from an injury is quick and complete, either through natural processes or restoration (Freeman 2003, pp. 156-157, emphases added).

Thus, Freeman's (2003) review of this literature suggests two operative criteria for evaluating whether non-use value for fish protection is likely to be significant:

the resource is unique; and

the loss would be irreversible or subject to a long recovery period.

If neither of these criteria applies, Freeman (2003) suggests that the non-use values are likely not to be important and thus would not justify an expensive survey. As Freeman notes in the above quotation, changes in the subpopulations of a widely dispersed species would not be likely to lead to significant non-use values (Freeman 2003, p. 156).

B. EPA Benefit-Cost Analyses of Proposed §316(b) Regulatory Options

This section describes the estimates of benefits and costs of the regulatory options evaluated in the RIA developed for the §316(b) Proposed Rule.

1. Overview of EPA Benefit-Cost Estimates

In its §316(b) Proposed Rule, EPA provides estimates of the benefits and costs of four regulatory options,[4] as displayed in Table 1. Note that benefits and costs are annualized using a 7 percent discount rate.[5]

[4] Option 1 = Impingement limitations based on modified traveling screens for all facilities with flow greater than 2 million gallons per day (MGD); Option 2 = Intake flow commensurate with closed-cycle cooling for facilities that have a design intake flow of greater than 125 MGD and impingement limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 3 = Intake flow commensurate with closed-cycle cooling for all facilities and impingement limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; and Option 4 = Impingement limitations based on modified traveling screens for all facilities with flow greater than 50 MGD.

Table 1. EPA's Annualized Benefit and Cost Estimates for §316(b) Proposed Rule

		Option 1	Option 2	Option 3	Option 4
Annualized Benefits	million 2009$	$16.0	$92.2	$95.7	$15.8
Annualized Costs	million 2009$	$459	$4,699	$4,862	$383

Note: Dollar values in millions of 2009 dollars.
Values are annualized using a 7 percent discount rate.
Source: EPA §316(b) Proposed Rule, pp. 22219 and 22247

EPA estimates that the total annualized costs of the preferred Option 1 are $459 million (using a seven percent discount rate). The annual costs of the other three regulatory options range from $383 million to almost $4.9 billion. These costs include those pertaining to technology installation, energy penalties including the effects of installation downtime, operation and maintenance of technologies, and a variety of administrative expenses. The installation downtime costs mainly measure the social costs incurred from lost electricity production when a generating facility takes additional downtime (beyond normal levels) to install control technologies.

EPA's evaluation shows that the quantified costs of each regulatory option exceed the quantified benefits by a very large margin (approximately 25 to 1 for Options 1 and 4 and approximately 50 to 1 for Options 2 and 3). EPA concluded that Option 1 was the preferred regulatory option despite its quantified costs exceeding its quantified benefits by hundreds of millions of dollars per year. EPA justifies this recommendation in part on speculation that non-use benefits for Option 1 may lead to benefits greater than costs.

2. EPA Determination of Use Benefits in the §316(b) Proposed Rule

In its §316(b) Proposed Rule, EPA provided preliminary estimates of the use and non-use benefits for the four regulatory options. The use benefit estimates were based on sound methodologies that used market values for commercial fishing benefits and non-market values for recreational fishing benefits. EPA noted that the totals included the effects of increased forage fish, which as noted above can provide for additional commercial and recreational benefits. Table 2 shows EPA's estimates of annualized use benefits (using a 7 percent discount rate) divided by major category. The methodologies used to estimate these values are summarized below.

[5] EPA also presents benefit and cost estimates using a 3 percent discount rate. The scale of benefits and costs using a 3 percent discount rate, and ratios between them, are qualitatively similar to the estimates using a 7 percent discount rate. We only include estimates using a 7 percent discount rate in our comments.

Table 2. EPA's Annualized Use Benefit Estimates for §316(b) Proposed Rule

	Option 1	Option 2	Option 3	Option 4
Commercial Use Benefits	$0.9	$3.3	$3.3	$0.9
Recreational Use Benefits	$14.2	$32.4	$33.3	$13.9
Quantified T&E Species Use Benefits	$0.5	$0.6	$0.6	$0.4
Total Use Benefits	$15.6	$36.3	$37.2	$15.3

Note: Dollar values in millions of 2009 dollars.
Values are annualized using a 7 percent discount rate.
Source: EPA §316(b) Proposed Rule, pp. 22242 and 22245

a. Market Commercial Fishing Benefits

EPA calculated commercial fishing benefits–including both direct and indirect (forage) biological gains–using commercial fish market prices between 2005 and 2009 obtained from National Oceanic and Atmospheric Administration's National Marine Fisheries Service. For the preferred Option 1, the annualized commercial fishing benefits (using a seven percent discount rate) were estimated at $900 thousand, as displayed in Table 2.

b. Non-Market Recreational Fishing Benefits

EPA calculated recreational fishing benefits–also including both direct and indirect (forage) biological gains–using detailed estimates of the estimated marginal value per fish for the affected species. These values are based upon a detailed meta analysis of the many studies that have evaluated how recreational fishermen value additional catch.

EPA estimated the "Low," "Mean" and "High" values of annualized recreational fishing benefits (using a seven percent discount rate) for the preferred Option 1 to be $7.2 million, $14.2 million, and $28.5 million, respectively. Table 2 shows the "Mean" value of annualized recreational fishing benefits for each regulatory option.

c. Use Benefits from Threatened and Endangered Species

Table 2 includes use values for recreational fishing of two threatened and endangered ("T&E") species: pallid sturgeon and American paddlefish. As EPA explains in the Proposed Rule (p. 22245), it estimated use benefits for these T&E species despite restrictions on their capture because it has information on baseline recreational fishing of these species and the potential impacts of the regulatory options. EPA notes (p. 22245) that the primary category of potential benefits for T&E species is non-use benefits, but as discussed below, EPA did not perform a full assessment of potential non-use benefits related to T&E species for the Proposed Rule.

3. EPA Assessment of Non-use Benefits in the §316(b) Proposed Rule

EPA does not provide an assessment of the likely significance of non-use benefits. Instead, EPA claims that non-use values need to be monetized "[b]ecause the majority of annual [impingement and entrainment] mortality losses include unharvested recreational and commercial fish and

forage fish" (EPA 2011e, p. 22240). The Agency presents two methods of estimating non-use benefits in the §316(b) Proposed Rule: (1) a "benefit-transfer" method using a stated preference study from Rhode Island on households' willingness to pay to remove impediments to fish migration, and; (2) a "habitat-based" method. Using the "benefit-transfer" method, EPA estimated annual benefits of about $500,000 for Option 1 in the North Atlantic and Mid-Atlantic regions only. Because non-use benefits were not monetized for five of the seven regions, EPA notes that "total estimated benefits are likely to be significantly understated" (EPA 2011b, p. 10-4). Using the habitat-based method, EPA estimated a national annual willingness-to-pay of about $500 million for Option 1.

Table 3 shows EPA's estimates of non-use benefits for each option using the "benefits transfer" method and the habitat-based method (and using a 7 percent discount rate). EPA used the "benefits transfer" non-use estimates for calculating the total quantified benefits of regulatory options in the Proposed Rule.

Table 3. EPA's Annualized Non-Use Benefit Estimates for §316(b) Proposed Rule

	Option 1	Option 2	Option 3	Option 4
Benefits Transfer (Johnston et al.)				
North Atlantic	$0.1	$11.5	$12.0	$0.1
Mid-Atlantic	$0.4	$44.5	$46.5	$0.4
Northeast + Mid-Atlantic	$0.5	$55.9	$58.5	$0.5
Habitat-Based Estimation				
California	-	-	-	-
North Atlantic	$0.4	$168.0	$176.2	$0.4
Mid-Atlantic	$195.5	$929.1	$940.7	$196.3
South Atlantic	$0.3	$0.4	$0.4	$0.3
Gulf of Mexico	$142.6	$305.9	$305.0	$142.0
Great Lakes	$9.7	$9.6	$9.6	$9.6
Inland	$128.7	$130.0	$131.6	$125.4
Total	$477.2	$1,542.8	$1,563.4	$474.0

Notes: All values are in millions of 2009 dollars.
Values are annualized using a 7 percent discount rate.
Source: EPA, *Environmental and Economic Benefits Analysis for Proposed* §316*(b) Existing Facilities Rule*, pp. 8-14, 9-16, 11-3, and 11-4

As we have discussed in prior comments and as EPA has acknowledged, neither the "benefits-transfer" nor the "habitat-based" method is sufficiently reliable to provide meaningful estimates of non-use benefits associated with the §316(b) regulatory options. EPA (2010) has developed a substantial list of characteristics that a good benefits transfer would contain. These characteristics are not met with the "benefit-transfer" approach used for the §316(b) Proposed Rule. The "habitat-based" method suffers various limitations, including the fact that the methodology includes values for many benefits–such as improved fish nurseries, habitat for

birds and other species, and enhanced nutrient cycling–that are beyond those that would be associated with the proposed regulations.

EPA has indicated that neither the "benefits-transfer" approach based on the Rhode Island study nor the "habitat-based" method will be used as a basis for a final §316(b) regulatory decision. Instead, as noted in the NODA, EPA has indicated the possibility that the EPA survey would be used to develop benefit estimates that are intended to include non-use benefits.

4. Summary of EPA's Quantified Benefits and Costs

Table 4 summarizes EPA's annualized benefit and cost estimates for the §316(b) Proposed Rule, using a 7 percent discount rate and expressed in millions of 2009 dollars. The quantified non-use benefits are based on the "benefits transfer" method for the North Atlantic and Mid-Atlantic regions, as discussed above.

Table 4. EPA's Annualized Benefit and Cost Estimates for §316(b) Proposed Rule (millions 2009$)

	Option 1	Option 2	Option 3	Option 4
Annualized Benefits				
Commercial Use	$0.9	$3.3	$3.3	$0.9
Recreational Use	$14.2	$32.4	$33.3	$13.9
Quantified T&E Species Use	$0.5	$0.6	$0.6	$0.4
Subtotal (Use Benefits)	$15.6	$36.3	$37.2	$15.3
Quantified Non-use	$0.5	$55.9	$58.5	$0.5
Total	$16.0	$92.2	$95.7	$15.8
Annualized Costs	$459	$4,699	$4,862	$383

Notes: All values are in millions of 2009 dollars.
Values are annualized using a 7 percent discount rate.
Totals may differ from the sum of rows because of independent rounding.

Source: EPA, *Environmental and Economic Benefits Analysis for Proposed §316(b) Existing Facilities Rule, pp.* 8-14, 9-16, 11-3, and 11-4, and Proposed Rule, p. 22219

Table 5 shows EPA's annualized benefit and cost estimates in millions of 2011 dollars. These benefits and costs will be compared later in this report with implied benefits from the EPA survey in 2011 dollars.

Table 5. EPA's Annualized Benefit and Cost Estimates for §316(b) Proposed Rule (millions 2011$)

	Option 1	Option 2	Option 3	Option 4
AnnualizedBenefits				
Use	$15.8	$36.8	$37.7	$15.5
QuantifiedNon-use	$0.5	$56.8	$59.4	$0.5
Total	$16.3	$93.6	$97.1	$16.0
AnnualizedCosts	$466	$4,769	$4,934	$389

Notes: All values are in millions of 2011 dollars.
Values are annualized using a 7 percent discount rate.
Source: EPA, *Environmental and Economic Benefits Analysis for Proposed* §316*(b) Existing Facilities Rule, pp.* 8-14, 9-16, 11-3, and 11-4, Proposed Rule, p. 22219, and NERA calculations as explained in text

C. Potential Use of EPA Survey

In the NODA, EPA has indicated that the EPA survey may be used to develop regional and national benefit estimates for §316(b) regulatory options that it presumes would include use and non-use benefits. In contrast to the detailed biological and economic assessments used to assess use values, for the §316(b) Proposed Rule, the EPA survey purports to assess the values that households place on the environmental benefits based upon a survey.

The estimates of use benefits for the §316(b) Proposed Rule are based on sound methodologies that use actual market and (in the case of recreational fishing) revealed preference behavior to assess the values of fishing gains. Although EPA had earlier stated that the EPA survey would be used to supplement the benefits estimates it developed in the Regulatory Impact Analysis (RIA) for its April 2011 §316(b) Proposed Rule by providing potential additional estimates of "non-use" benefits (EPA 2010b), EPA has stated that the benefits estimated using the EPA survey would supplant these estimates on the theory that the EPA survey would provide estimates of total benefits, including use and non-use benefits.

As noted in the economic literature and as suggested by EPA's prior guidance on determining the significance of non-use benefits, non-use benefits are highly contingent upon site specific factors such as the particular affected species or the ecological conditions of the relevant water body. As a threshold issue, it seems clear that non-use benefits should be assessed at local levels so that the implications of alternative regulations for particular fish specifies and/or ecological conditions could be evaluated. Any survey conducted at the regional or national level will necessary omit these important site-specific considerations and thus not provide survey participants with enough information to provide meaningful responses. As EPA states in its *Guidelines*, "it is better to acknowledge gaps in information by discussing them qualitatively or by reporting physical measures … than to employ conceptually flawed methods of monetization" (EPA 2010a, p. 7-36)

EPA would have been confronted with the importance of species-specific and site-specific information if it had preceded the development of the survey by an assessment of the likely

significance of non-use benefits in this rulemaking. EPA has responded to a prior recommendation to assess the likely significance of non-use benefits in our prior comments by quoting Bateman et al. (Bateman 2002, p. 75) that there are "no easy rules for determining at the outset" whether non-use values are likely to be significant. However, Bateman et al. (2002) also notes that "[o]ne of the issues to be determined before commissioning a study is the extent to which non-use values are likely to be important" (p. 74). In addition, Bateman et al. (2002) does not imply that non-use values should be monetized regardless of the cost of doing so or the likely importance of the results. Sensible regulatory policy requires that the EPA consider the potential nature of non-use benefits and how they might be estimated before committing to a costly and time-consuming study.

The following section describes the EPA survey instrument, including its reliance on broad regional measures of what are purported to be environmental impacts of §316(b) alternatives. As will be discussed, the failure to clarify the potential nature of potential non-use (and use) benefits as well as the failure to provide important context means that the survey instrument does not provide an acceptable means of obtaining information on potential of §316(b) benefits.

III. Evaluation of the EPA Survey Instrument

This section provides an overview of the EPA survey instrument. We then assess its usefulness, first with regard to some general considerations in the survey literature and then with regard to specific features of the EPA survey.

A. Overview of the EPA Survey Instrument

This section provides a brief overview of the EPA survey, including the survey process and the survey itself as well as background on focus groups and other pre-survey activities. As noted above, given the limited comment period, we focus our comments on the survey instrument and do not comment on the survey process or the pre-survey activities.

1. Survey Process

EPA conducted its stated preference survey in mail format, sending a questionnaire to the population samples in each of its five target regions: the Northeast, Southeast, Inland, and Pacific areas of the country, as well as a 'National' sample drawn from the nationwide population. The address sample for the mail survey was drawn from a database that covers 97 percent of residences in the United States.

EPA sent out a total of 6,800 of the regional surveys and 960 of the national surveys, with a target sample size of 2,000 and 288 for the regional and national surveys, respectively. The number of surveys sent to each region differed based on household populations. For example, 1,440 households were surveyed in the Northeast region for target sample size of 417, whereas 2,480 households were surveyed in the Inland region for a target sample size of 732.

At the time of EPA's statistical analyses (as reported in the NODA), EPA had received 2,313 completed and returned surveys across all regions. The average response rate was 33 percent.

2. Survey Questionnaire

Twenty-four versions of the eighteen page questionnaire were used, each containing the same background information on the subject of fish losses and cooling water intake structures. The versions differ in the specific policy alternatives that are presented to the various respondents, both in terms of the various changes in regional environmental measures and in the potential cost of the policy. The questionnaires also ask respondents to rate their personal investment in the issues considered in the survey (e.g., how important they consider prevention of fish losses, whether or not they fish or consume fish, etc.) and their understanding of the survey materials. Respondents also are asked to provide demographic information.

Each survey contains three valuation questions that ask respondents to choose among three options, two policy options and one "No Policy" option that would maintain the status quo. The policy options are characterized by changes in four regional environmental benefit metrics that purport to reflect the effects of different §316(b) policy alternatives and by an assumed annual

cost (which respondents are told would be paid for in the form of higher electricity rates and other prices). Among all surveys sent, there are 72 distinct pairs of policy options that are provided. The surveys also include the baseline levels of each environmental attribute for the given region.

3. Environmental Benefit Measures

The survey summarizes the potential benefits of policy options in terms of four broad environmental benefit measures. The validity of these measures is key to the potential use of the survey, since the empirical analysis involves using the choices that respondents make to "pay" for these benefit measures to estimate the dollar value that households are presumed willing to pay for changes in these measures, and ultimately in §316(b) policy options if the survey results are used. Thus, it is important that these measures are both understandable and accurately reflect potential impacts of alternative §316(b) policy options. As discussed below and in the remainder of this section, the measures used in the EPA survey do not pass these two important tests. Barnthouse (2012) provides further details on the biological problems with these four measures, concluding that "[n]one of the four attributes used by EPA in the Stated Preference Survey provides scientifically valid information concerning the potential benefits to the public of reducing [entrainment and impingement] mortality."

The EPA survey instrument lists four measures of the potential environmental benefits of the alternative policies:

1. Commercial fish populations;
2. Fish populations (all fish);
3. Fish Saved (per year); and
4. Condition of aquatic ecosystems.

a. Commercial Fish Populations

The following figure shows the summary that is presented to respondents regarding a score to measure the effect of policies on commercial fish populations. The score is said to range between zero for no harvest to 100 for maximum long-term harvest.

Figure 2. Description of Commercial Fish Populations from EPA Survey Instrument for the Northeast

Effect of Policy	What It Means
Commercial Fish Populations (Fish Used by People)	A score between 0 and 100 percent showing **the overall health of commercial and recreational fish populations**. Higher scores mean more fish and greater fishing potential. A score of 100 means that these fish populations are at a size that maximizes long-term harvest; 0 means no harvest. **The current score in Northeast waters is 42.**

Source: EPA survey instrument

There are several features of this measure that raise serious questions on its usefulness as a means of estimating the dollar value of commercial and recreational benefits, relative to the detailed information that EPA has developed in its RIA.

> *No indication of how scale calculated.* The measure is a score between 0 and 100 percent that purports to show "the overall health of commercial and recreational fish populations." There is no indication of how this score is calculated or the significance of differences in the values.
>
> *Broad regional measure with no information on species and location.* In contrast to the detailed assessments of use benefits in EPA's RIA, this measure does not provide any indication of the species that are potentially affected or the fishery locations that are affected.
>
> *No non-use rationale.* There seems no reason to expect households to have non-use benefits from greater commercial and recreational catch *per se* and thus no reason to substitute a survey approach for well-tested approaches to measure market and non-market fisheries benefits.

These characteristics indicate that the EPA survey is an inferior means of assessing the value that households place on increased commercial and recreational catch, compared to the detailed assessments in the EPA RIA. As discussed below, the EPA survey simply gives respondents too little information to develop a sensible evaluation of the proper value of increased commercial and recreational catch using this unspecified regional score and, if such detailed information were provided, it is difficult to see how survey respondents could develop sensible assessments.

b. Fish Populations (All Fish)

The following figure shows the summary that is presented to respondents regarding a score to measure the effect of policies on total fish populations. The score is said to range between zero for no fish to 100 for the largest natural size possible.

Figure 3. Description of Fish Populations (All Fish) from EPA Survey Instrument for the Northeast

Effect of Policy	What It Means
Fish Populations (All Fish)	A score between 0 and 100 percent showing **the estimated size of all fish populations** compared to natural levels without human influence. A score of 100 means that populations are the largest natural size possible; 0 means no fish. **The current score in Northeast waters is 26.**

Source: EPA survey instrument

This measure also has features that raise questions on its usefulness as a means of estimating the dollar value of benefits, relative to the detailed information that EPA has developed in its RIA.

> *No indication of how scale calculated.* The measure is a score between 0 and 100 percent that is claimed to show "the estimated size of all fish populations." There is no indication of how this score is calculated or the significance of differences in the values.
>
> *Unclear relationship to commercial/recreational fish population measure.* The materials indicate that about one-sixth of fish lost are species caught by commercial and recreational fishermen, with the other five-sixths being forage fish that "serve as food for larger fish, birds, and animals." This characterization suggests that forage fish are valued for their contributions to commercial/recreational fish, but there is no indication of the nature and empirical significance of this indirect benefit.
>
> *Potential non-use rationale not provided.* The survey provides no link between this measure and potential non-use benefits. The description of forage fish implies that they are valued for their contributions to commercial and recreational catch. There is no indication that changes in this measure indicate effects on the viability of specific species in specific locations, or the type of detailed information that would be necessary to provide a sound basis for potential non-use benefits.

These characteristics suggest that surveying households on the value they place on total fish population is an inferior means of assessing the value that households place on use benefits–including the indirect benefits of increased commercial and recreational catch due to additional forage fish–compared to the detailed assessments in the EPA RIA. As discussed below, the EPA survey simply gives respondents too little information to develop sensible benefit estimates using this unspecified regional score and, indeed, if such detailed information were provided, it is difficult to see how survey respondents could develop sensible assessments. Moreover, the difficulties are particularly great for using the results for this measure to infer non-use benefits, which the literature (and common sense) indicate would be based upon unique and long-lasting gains rather than changes in the numbers of fish.

c. Fish Saved (Per Year)

The following figure shows the summary that is presented to respondents regarding a score to measure the effect of policies on fish saved per year. The score ranges between zero percent for no reduction in fish losses to 100 percent for all fish saved due to the policy. In the actual questions, respondents are provided with specific numbers of fish saved. In the case of the Northeast survey, the materials state that 1.1 billion fish are lost in water intakes. Thus, a 50 percent reduction is noted to save 0.6 billion fish.

Figure 4. Description of Fish Saved (Per Year) from EPA Survey Instrument for the Northeast

Effect of Policy	What It Means
Fish Saved (per Year)	A score between 0 and 100 percent showing the **reduction in young fish lost** compared to current levels. A score of 100 would mean that no fish are lost in cooling water intakes (all fish would be saved because of the new policy). **The current score in Northeast waters is 0.** This represents the status quo (no policy) with about 12% of plants already using advanced cooling systems.

Source: EPA survey instrument

Dr. Barnthouse (2012) focuses his comments on the EPA survey on the "fish saved" attribute (since it is one recommended for use by EPA); he concludes that the metric is "questionable at best and highly misleading at worst" (p. 2) because EPA does not reveal its highly speculative nature or the correct context. Barnthouse (2012) investigates the data used by EPA to develop its estimate of "fish saved" and finds that it involves highly uncertain extrapolations with enormous uncertainties. Moreover, the bulk of the gains are a single tiny forage species (bay anchovies, each weighing 0.00381 pounds) that would translate into a minuscule share of additional commercially harvested fish (0.025 percent). In short, the EPA survey does not provide accurate scientific information to respondents that clarifies what is actually at stake to various fish species in various locations.

This measure also has limitations similar to the "total fish" measure that raise questions on its usefulness as a means of estimating the dollar value of benefits, relative to the detailed information that EPA has developed in its RIA.

No indication of the nature of the fish saved. The background materials imply that the bulk of these are forage species, but this is not clear in the characterization of the policy choice. Nonetheless, the EPA survey materials still create the underlying impression that the fish that are being affected by the regulation are ones that matter to humans, especially the recreational and commercial species.

No indication of relative significance of the gains. It is not possible for respondents to understand the significance of the gains in fish population–either as a number or a percentage improvement–without context on how these numbers relate to individual

species or bodies of water. Moreover, without any indication of the size of the relevant population, the respondent has little basis to consider the significance of either the number of fish gained or the percentage reduction in fish losses. Indeed, the background materials appear to appreciate the importance of this context for determining the significance of the number of fish saved when they note that "[a]lthough scientists can predict the number of fish saved each year, the effect on fish population is uncertain. This is because scientists do not know the total number of fish in Northeast waters and because many factors–such as cooling water use, fishing, pollution and water temperature–affect fish."

No indication of current fish protection controls in place. Respondents have no way of knowing the extent to which facilities already have controls in place that reduce fish losses due to cooling water intake. The baseline score of zero erroneously may imply to many respondents there are no controls in place.

No non-use rationale. Without a context for the fish gains–notably their effect on the viability of particular species in particular fisheries as well as their relationship to other factors affecting fish populations–there seems no rationale for interpreting values as reflecting non-use values.

These characteristics suggest that surveying households on the value they place on the numbers of fish saved is both an inferior means of assessing the value that households place on the gains from commercial and recreational catch and an invalid means of assessing any non-use value. As discussed below, the EPA survey simply gives respondents too little information to develop a sensible evaluation of the likely gains using this regional total fish saved as a metric. Moreover, as with the other measures, if such information were provided, it is difficult to see how survey respondents could develop sensible assessments. The difficulties are particularly great for using the results to infer non-use benefits, which the literature indicates (as emphasized above) would be based upon unique and long-lasting gains rather than changes in the numbers of individual fish.

d. Condition of Aquatic Ecosystem

The following figure shows the summary that is presented to respondents regarding a score to measure the effect of policies on the "condition of the aquatic ecosystem." The score is said to "show the ecological condition of affected areas," with the score "determined by many factors including water quality and temperature, the health of aquatic species, and habitat conditions."

Figure 5. Description of Condition of Aquatic Ecosystem from EPA Survey Instrument for the Northeast

Effect of Policy	What It Means
Condition of Aquatic Ecosystems	A score between 0 to 100 percent showing **the ecological condition of affected areas**, compared to the most natural waters in the Northeast. The score is determined by many factors including water quality and temperature, the health of aquatic species, and habitat conditions. Higher scores mean the area is more natural. **The current score in Northeast waters is 50.**

Source: EPA survey instrument

This measure has features that raise questions on its usefulness as a means of estimating the dollar value of benefits, relative to the detailed information that EPA has developed in its RIA.

> *No indication of how scale calculated.* The measure is a score between 0 and 100 percent that is described as reflecting many factors. But there is no indication whatsoever of how this score is calculated or the significance of differences in the values. Indeed, as discussed below, we have not been able to obtain information on how EPA determined the current scores (e.g., Northeast score is 50) or the potential effects of §316(b) policy alternatives.
>
> *Non-use rationale unclear.* The description implies that this effect might reflect the potential non-use value that households might place on changes. But without more information on the nature of the measure –and the significance of changes–it would be virtually impossible for respondents to provide meaningful valuations. As with the other measures, if sufficiently detailed information were provided–based upon specific ecosystem effects–it seems unlikely that respondents would be able to process the information and develop appropriate valuations. Moreover, as Dr. Barnthouse (2012) demonstrates, the scientific literature does not support any increase in such an index as a result of the policy. The index is based on habitat and pollution variables that would not be affected by the votes on the policy.

These characteristics suggest that surveying households on the value they place on the "condition of the aquatic ecosystem" is not likely to provide useful information. As discussed below, the EPA survey simply gives respondents too little information to develop a sensible evaluation using this undefined regional score and, indeed, if such information were provided, it is difficult to see how survey respondents could develop sensible assessments. The difficulties are particularly great for using the results to infer non-use benefits, which the literature indicate would be based upon unique and long-lasting gains.

4. Other Survey Activities

Before the final survey was determined, the EPA organized six focus groups and eight cognitive interviews as methods for pre-testing the design of the survey instrument. The EPA has made the results of these sessions available. The EPA survey instrument also included validity testing after the survey results were compiled; a split-sample external validity test for scope was conducted on the Northeast region survey data. In addition, a non-response study was completed for the Northeast region. EPA states that the corresponding studies for other regions have not yet been finalized. Given the constraints imposed by EPA's 30-day comment period, we do not comment on these other activities.

B. General Concerns about the EPA Survey Respondents' Task

When properly constructed, surveys can be useful tools for measuring public opinion. However, as survey researchers have long recognized, the answers that respondents give to a survey may be influenced by the design of the questionnaire itself. Decisions such as how to phrase the questions, which alternatives to offer, and the order in which to present the questions can have an effect on the survey results (Schuman and Presser 1981; Converse and Presser 1986; Groves et al. 2004). In addition to demonstrating that such questionnaire effects may occur, the survey research literature also investigates the cognitive processes that respondents use when answering complex survey questions. (Sudman et al. 1996; Tourangeau et al. 2000). In evaluating the EPA survey, the implications of these cognitive processes are important to consider since, as discussed below, the EPA survey poses major difficulties to respondents.

1. Survey Respondents May Replace Complex Survey Questions with "Heuristic Questions"

a. Overview of Concern

Often survey questionnaires simply assume that respondents will do whatever it takes to provide the types of answers that are needed. Questionnaires are frequently too long, too difficult and not sufficiently interesting to the respondents. The drafters of the questions can work in blissful ignorance, though, because most respondents will answer all the questions that they are asked. The problem is that their answers may not be meaningful.

The psychologist Daniel Kahnemann (who won the Nobel-Prize in economics) has proposed a simple explanation of how survey respondents deal with questions that are too numerous and difficult. Instead of answering the target question actually given in the questionnaire, the respondent substitutes an easier, heuristic question (Kahnemann 2011).

Kahnemann illustrates the nature of this response based upon the target question, "How much would you contribute to save an endangered species?" To answer this question, a respondent would have to decide which species should be thought about, figure out how much money (s)he has available for contributions, take into account other obligations and come up with an answer. In most cases, the respondent would not do all this work, and would substitute a heuristic alternative such as "How much emotion do I feel when I think of dying dolphins?" The amount

of money stated in the answer would depend on the intensity of feeling that the respondent experiences when thinking about the dolphins.

b. Relevance to EPA Survey

There are clear similarities between the EPA survey and Kahnemann's example of dying dolphins noted above. However, the EPA survey deals with biological issues that are even more complex and nuanced. Unlike dolphins or certain endangered species, most people do not have pre-formed opinions about the forage fish that comprise the majority of the species affected by cooling water regulations. People may substitute "heuristic questions" for the complex scenarios provided in the EPA survey, and, in this case, it is not even clear that people have sufficient information to answer these substitute questions.

2. Survey Respondents May Avoid Substantial Cognitive Effort and "Satisfice"

a. Overview of Concern

Stanford professor Jon Krosnick has introduced the concept of "satisficing," which he defines as when a survey respondent avoids the substantial cognitive effort required for a difficult question and simply provides an apparently satisfactory answer instead (Krosnick 1991). To give the answer that is actually required to produce meaningful survey results, Krosnick describes a four-step procedure:

> [Producing high-quality data] requires that respondents proceed through four stages of cognitive processing. They must carefully interpret the meaning of each question, search their memories extensively for all relevant information, integrate that information carefully into summary judgments and report those summary judgments in ways that convey their meaning as clearly and precisely as possible. Performing those four steps carefully and comprehensively constitutes what might be called *optimizing* (Krosnick 1991, p. 214) [internal citations omitted].

When survey questions are too difficult, most respondents do not expend the necessary energy to provide the required answer, and simply decide to compromise and expend less energy instead. As a more recent text puts it, respondents "truncate the search process as soon as enough information has come to mind to form a representation that is sufficient for the judgment at hand" (Sudman et al. 1996). Such a search would not be extensive unless the respondent was highly motivated because the topic had important personal consequences, a rare circumstance not typically found in surveys. Accordingly, the respondents' judgments are based on information which most easily comes to mind.

Krosnick et al. (1996) suggest three factors that may contribute to satisficing:

- the difficulty of the task;
- the respondent's ability to perform the task; and

the respondent's motivation to perform the task.

According to Krosnick et al. (1996, p. 32), "[t]he greater the task difficulty and the lower the respondent's ability and motivation to optimize, the more likely satisficing is to occur."

b. Relevance to EPA Survey

The EPA survey would appear to meet all three of the conditions for "satisficing" outlined by Krosnick et al.

First, the task was difficult in that the referendum questions require substantial effort from the respondents. To begin, there is a great deal of information that the respondent must process before completing the voting task. Once they have reviewed the background information, they must then read and attempt to understand the instructions for completing the referendum.[6] They must first consider their opinions on each of five criteria, some of which they may not have previously thought about. Respondents then must figure out how to combine the criteria. For example, a respondent may have preferred to maximize the commercial fish populations but been indifferent to the total fish populations. Such a respondent would then have to decide which of these two criteria was most important and then extend the ranking to all five criteria. Given the complexity of this task it would not be surprising that many respondents would simplify their task in some way, perhaps voting on the basis of costs and the numbers of fish saved per year. Applying the principles described by Kahneman and Krosnick, a likely way that respondents might satisfice is to base their answers on these two criteria and not seriously consider the different options for the three other criteria.

In addition to requiring a difficult task, most respondents' ability to develop these detailed assessments is likely to be low. It is likely that respondents had not given much thought to the effect of cooling water intake structures on fish populations prior to taking the survey. Finally, respondents' motivation to develop these detailed assessments is likely to be low, particularly for respondents who know nothing about fishery biology or who do not live near areas potentially influenced by cooling water intake structures.

3. Responses May Depend on the Degree of Balance in the Information Provided

a. Overview of Concern

Various studies have shown that responses of potential WTP are affected by the background information given to survey respondents (Fischhoff and Furby 1988; Lazo et al. 1992). In describing the Exxon Valdez CV questionnaire, Carson et al. (1998) explain how that study took care to ensure that the information presented to respondents was balanced:

[6] With an in-person interview, the interviewer can ensure the respondent understands the referendum task before (s)he votes for a particular option. Since the EPA SP survey was self-administered, there is no certainty that the respondent understood the directions (s)he was given.

> "Unlike ordinary attitude questionnaires, the Exxon Valdez CV instrument included several design features to discourage cursory responses in favor of the program. The respondents were given 20 minutes of carefully pretested information, both verbal and pictorial, about what the program would and would not accomplish. Equally important immediately before they were asked to vote, the questionnaire provides several reasons why they might want to vote *against* the program. With this context, those voting 'for' the program are likely to be sufficiently sure of their responses so that they are not attracted to the [would not vote] option" (337). [emphasis in original]

The implication is that it is important to provide balanced descriptions of the policy alternatives that are provided in the questionnaire.

b. Relevance to EPA Survey

The EPA survey does not provide respondents with any information about why someone might prefer the "current situation" (i.e., no policy) to one of the offered policy alternatives. It provides extensive information on the impacts to environmental attributes (even those such as the "Condition of Aquatic Ecosystem," for which there is no clear scientific link to the regulations), but limited information on the costs to society such as how higher electricity prices are expected to impact jobs and gross domestic product.

Indeed, as discussed below, our review of the EPA questionnaire, and the comments by respondents in the survey responses and EPA's own focus groups, indicates that respondents did not have sufficient information to provide meaningful responses.[7]

Respondents also do not or could not understand the significance of the fish losses relative to fish populations and the impact that individual fish loss has on commercial and recreational fisheries and ecosystem health. For example, of particular concern is the relative importance of cooling water intake structures on coastal fish populations. According to Barnthouse (2012), fish populations are affected by many stressors and there is no credible way to attribute historical changes in these populations to impingement and entrainment mortality (p. 7). Such information is crucial for people to understand that none of the other major factors that limit fish populations will be affected by the proposed regulation.

Respondents were instead provided with this information in the survey: "Cooling water use is not the largest cause of fish loss in most areas (fishing causes greater losses), but has affected some fish populations" (p. 3). Without relevant context, people are asked to evaluate changes in the number of fish saved with little knowledge as to the potential effects of those savings.

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[7] For example, a 2010 focus group participant said: "We're not informed voters, here. This is one piece of paper and it's telling you, 'that's perspective', and it doesn't even say where the statistics come from, so until we become informed voters, I-how do I know whether I would vote this way or not until I hear the pros and cons?" (Waltham, MA, 7/29/10, pp.12). Similarly, a survey respondent stated: "I have a B.S. in biology & the wording of the survey/layout were still incredibly opaque!"

4. Summary of General Concerns

In sum, when the respondent burden is high, survey respondents may be more likely to take shortcuts in answering the survey questions. Compared to other types of surveys, stated preference surveys that are used to value environmental policies place a larger burden on respondents. The typical public opinion survey measures respondents' attitudes about an issue with which they likely possess some familiarity. In contrast, respondents to SP surveys on environmental policies are unlikely to have ever considered the specific topic prior to taking the survey. As a result, the SP survey instrument must educate respondents on the issue at hand and provide all of the information that would be relevant for a respondent to make an informed choice. At 18 pages in length, the EPA survey is burdensome even though, as emphasized above and discussed more below, it does not provide sufficient information on the nature of the biological benefits (Bradburn 1979). Once fatigued, respondents are more likely to provide incomplete answers, seek ways to speed up the interview (Herzog and Bachman 1981; Sudman and Bradburn 1982), or satisfice.

C. Specific Concerns with the EPA Survey Instrument

This section provides specific concerns with the EPA survey instrument, building upon the general considerations outlined above. As discussed above, surveys should provide complete and accurate information about both the positive and negative impacts of alternative policies and should minimize hypothetical biases in order for the survey responses to provide useable information. When surveys do not provide complete and accurate information about the trade-offs between positive and negative impacts, respondents are likely to use heuristics, or short cuts, to make decisions. These results do not provide the basis for valid estimates of the willingness to pay for improvements.

We have concluded that the EPA survey instrument suffers from the following fundamental flaws:

1. Respondents were not given sufficient information and context to determine the significance of the fish gains;

2. Environmental attributes were included without scientific justification;

3. The survey instrument provides insufficient and misleading information on economic impacts; and

4. The survey instrument is likely subject to hypothetical bias.

The remainder of this section provides details and discussion on these flaws in the survey instrument.

1. Respondents Were Not Given Sufficient Information and Context to Determine the Significance of the Fish Gains

Figure 4 (above) from the EPA survey instrument for one version of the Northeast region survey describes the measure for "Fish Saved (per year)" to survey respondents. In several ways, the design of this variable makes it likely that respondents will over-react and consequently over-value the effect the policy has on this attribute. On page 4 of the survey, respondents are first presented with a number for fish loss, 0.1 to 1.1 billion fish each year. Without an estimate of the total fish population, these numbers lack the necessary context to make appropriate utility-cost tradeoffs. When you talk about billions of something out of context, it will produce a strong reaction, as shown in the following example comments from EPA's focus groups:

> *"[C]learly it's trying to make us think it's big 'cause it's using numbers like one billion, you know, this billion. But yet at the same time leaving out what the actual total number of fish are."* (Philadelphia, PA, 9/23/10, pp.11)

> *"Yeah. Like you say one billion you automatically are like, oh, wow."* (Philadelphia, PA, 9/23/10, pp.11)

> *"It seemed to be larger than it really was to me"* . (St. Louis, MO, 8/4/10, pp.21)

> *"I assume we'd eat more salmon in America in a year, so it's just, you know, it's hard to see"* (St. Louis, MO, 8/4/10, pp.21)

> *"[T]here was a statement somewhere early on 1.1 billion fish are lost. Well when you read that, like, wow. That's a ton of fish just a big problem. Well, if the population of fish is 100 billion, then it's not."* (Philadelphia, PA, 9/23/10, pp.11)

> *"Like that part of it did tell you how much, you know how much we could lose, but it never told you how much that we have. It said that there's no way that they could tell or especially when the species that we didn't fish for ourselves that were used for other fish to eat or things like that could lead to a little problem trying to understand"* (Philadelphia, PA, 9/23/10, pp.2).

Another problem with the "Fish Saved" attribute is the way that it is presented in the choice set, particularly when compared to the other attributes. A range of zero percent to 100 percent fish saved is used for attribute levels between the choice sets for Fish Saved. The other three attributes show a very small range of change in attribute levels between the choices.

This caused a noticeable effect on survey respondents, who did not separately consider each environmental attribute, but instead tended to focus most of their attention on the Fish Saved attribute because the others didn't really change.

We confirm this behavior of respondents using empirical tests that are described in the following section. Quotes from EPA focus groups also provide evidence that respondents focused on the "Fish Saved" attribute because that was the only one that really changed. For example:

> *"[F]or me it seemed relatively inconsequential when I compared A and B, they're virtually the same statistics except on the fish saved per year, where there were a lot more fish saved. It's like, hey, for twelve more dollars a year saves 0.3 billion more fish? So, I selected Option B."* (Bethesda, MD, 8/18/10, pp. 6)
>
> *"That's how I felt."* (Bethesda, MD, 8/18/10, pp. 6)
>
> *"Exactly the same."* (Bethesda, MD, 8/18/10, pp. 6)

Only one participant disagreed, saying that the condition of the aquatic ecosystem was primary.

In another focus group, participants responded in much the same way:

> *"I think the most striking thing on the page, or op tion, was -or statistic, was the 50% and the 1.4 billion fish saved. So, that alone helped with my decision. Then looking down, some of them are not as much of a difference."* (East Providence, RI, 8/12/10, Interview #6, pp. 2)
>
> In reference to the attributes that matter to the participant, one participant responded, *"It was more the ones that were - had a larger difference. But, I mean I read all of them and all of it was taken into consideration; but the closer ones, not as much."* (East Providence, RI, 8/12/10, Interview #6, pp. 2).

If the other three environmental attributes had varied over similarly wide ranges (for example, if the "total fish population" was provided as an esti mate of the change in total fish as opposed to as an index between 0 and 100), it is reasonable to expect that survey respondents would have focused less on the "Fish Saved" attribute, and thu s EPA would have found lower implicit prices for this attribute.

2. Environmental Attributes were Included Without any Scientific Justification

Figure 5 (in the previous section) from the EPA survey instrument for the Northeast describes the measure for the condition of aquatic ecosystems. This again is a rating based on the "ecological condition of affected areas". The respo ndents are provided with virtually no information about the relationship between the condition of aquatic ecosystems and the policy in question. The respondents are asked if maintaining ecological health of aquatic ecosystems is important to them on page 3 and again on page 6 of the survey, yet they are never given any information about how cooling water intake structures affect the ecological health of aquatic ecosystems.

As Barnthouse (2012) shows in his comments, EPA's derivation of the aquatic ecosystem index suffers from a variety of flaws, including that it is based largely on pollution measures which would not be affected by the proposed regulations. Nonetheless, the EPA questionnaire allows respondents to infer that forage fish loss may affect ecosystem health from the food web diagram on page 1 of the survey. However, it fails to explain the specific effects and the degree of the effect because it is not possible develop a scientifically sound explanation.

Focus groups' responses showed that ecological health was important to certain respondents, but they (understandably) did not see the connection with the cooling water regulation. For example:

> *"It would have been nice to know how the condition of the aquatic ecosystem would have been improved besides just a numerical value."* (Bethesda, MD, 8/18/10, pp. 8)

> *"[A]dd a qualification to that in what ways it will be improved, and the first two pages it doesn't address the ecosystem really at all. Besides fish, does it mean any other, you know, environmental effects or is it simply just fish?"* (Bethesda, MD, 8/18/10, pp. 8)

When the focus group moderator asked the group, "what were you imagining when you saw that 'condition of aquatic ecosystems'? What did you think was happening when that changed (the rating)?" The responses were:

> *"I personally thought everything from pollution to the fish to just everything. It's an ecosystem. Literally comprises everything as a whole."* (Bethesda, MD, 8/18/10, pp. 8)

> *"Right down to dissolved oxygen content. Perhaps the dead zone in the Chesapeake Bay."* (Bethesda, MD, 8/18/10, pp. 8)

3. The Survey Instrument Provides Insufficient and Misleading Information on Economic Impacts

The EPA survey instrument provides insufficient and misleading information on the economic impacts of the cooling water intake regulations. The questionnaire states that "studies of industry suggest that effects on employment will be close to zero" even though elsewhere in the materials survey respondents are informed that the regulatory policies would increase the costs of goods and services, including electricity and common household products. Various economic studies have pointed out that higher electricity prices lead to job losses and other economic hardships even after accounting for the positive effects of expenditures on controls (see Schmalensee 1993). EPA has itself noted that under some regulatory scenarios, certain power plants would close, but this information is not included in the EPA survey materials.

The EPA survey instrument is unclear on the costs of the alternative policies, including requirements for regulated facilities and impacts on households. The focus groups wanted to know how the policies would affect jobs and costs:

> "*I wanted to know if there were job losses related to this.*" (Bethesda, MD, 8/18/10, pp. 3)

> "*I didn't know what goods and services that would increase.*" (East Providence, RI, 8/12/10, Interview #1, pp. 15)

> "*What would the job effect be? That would be similar to having manufacturers (say)... 'hey, if you're going to regulate me too much, I'm closing up my door'*. (Bethesda, MD, 8/18/10, pp. 9)

"*I was just wondering about the ultimate effect. It wasn't so much just jobs, but this is just looking at the going government policy and it always has a multiple effect just like the ecocycle or ecosystems.*" (Bethesda, MD, 8/18/10, pp. 9)

"*I just want to know cost, whether more jobs would be created by...equipment, manufacturing equipment, monitoring equipment-take care of the equipment, you know, would there be some job creation in this cost?*" (St. Louis, MO, 8/4/10, pp. 3)

"*I'd like to have seen more information. Like, who is going to build it? Who is going to maintain?...And what are the costs to those companies? Is it really going to affect my business? Is it going to be to the point where we're forcing these companies in New England to put these filter systems or enclosed systems in, and it's going to drive these businesses out of this area and go to different areas?*" (East Providence, RI, 8/12/10, Interview #1, pp. 14)

Unfortunately, accurate answers to these reasonable questions of the focus group participants were not provided to the survey respondents.

The lack of scientific information linking impingement and entrainment losses for cooling water intake structures to environmental attributes included in the survey (such as "Condition of Aquatic Ecosystems") makes the omission of important information on economic impacts all the more glaring. It is not surprising that a willingness-to-pay survey that provides respondents with misleading evidence in support of regulation and insufficient evidence against regulation produces implausibly large benefits, which is what we show in Section V.

The fact that EPA provided any information on jobs and economic impacts suggests that the Agency recognizes that some survey participants would be influenced in their evaluation of fish and ecosystem improvements by concerns about policy impacts other than the dollar costs to their own households. However, the materials fail to inform respondents of other potential negative effects of the cooling tower retrofits that would be required under certain regulatory options, including aesthetic considerations and the potential for increased air emissions and greenhouse gas emissions.

4. The EPA Survey Likely Suffers from Hypothetical Bias

The EPA survey instrument has additional limitations that cause it to fall short of meeting the standards set by various government agencies and practitioners for an appropriately designed SP survey (see NERA Economic Consulting and W.H. Desvousges & Associates, 2010). Although the fundamental difficulties outlined above mean that the survey instrument is not usable for its intended purpose, it is useful to be aware of these other limitations. In particular, even if respondents were provided with complete and accurate information and appropriate context, and the other fundamental difficulties could be overcome, the responses would be subject to the well-known difficulty of hypothetical bias.

EPA contends that the concerns over hypothetical bias are greatly exaggerated. EPA relies primarily on a study by Johnston (2006) and a meta-analysis by Murphy et al (2005) to support its position that hypothetical bias is not likely to be a major problem in the EPA survey. We

disagree with EPA's conclusion and maintain that even if many stated preference studies have found little hypothetical bias, the characteristics of this particularly survey more closely align with those that have found considerable hypothetical bias. We reached this position after a thorough review of the literature on hypothetical bias, including those studies cited by the Agency.

To evaluate how the hypothetical nature of the questions affects SP results, researchers have performed several experiments to test for hypothetical bias. Generally, these studies find hypothetical bias. Vossler et al. (2003) reveal that a majority of the studies find significant response differences in hypothetical and real situations. Murphy and Stevens (2004) note that the literature shows hypothetical bias across a wide variety of CV approaches.[8] Johnston (2006) concurs: "Most research finds significant divergence between stated and actual behaviors" (p. 469). Following Vossler and Kerkvliet (2003), these studies fall into four groups.

The first group of studies tested the difference between actual payments for private goods and stated CV payments for the same private goods (Bishop and Heberlein 1979; Dickie, Fisher, and Gerking 1987; List and Shogren 1998; Cummings, Harrison, and Rutström 1995; Berrens and Adams 1998). The second group of studies evaluated the difference in stated CV payment and revealed actual WTP for public goods for which observed behaviors are available (Knetsch and Davis 1966; Brookshire, et al. 1982; Loomis, Creel and Park 1991; Shabman and Stephenson 1996). These two groups of studies reflect "use" values for natural resource services and generally demonstrate hypothetical bias.

The third group of studies developed simulated market experiments to test whether CV values are comparable to the amount respondents would really pay if an actual market existed. This synthetic form of external validation involves comparing CV values to actual cash payments from a simulated market for the same commodity (Kealy, Montgomery, Dovidio 1990; Seip and Strand 1992; Bohm 1992; Duffield and Patterson 1992; Brown et al. 1996; Champ et al. 1997). For example, Duffield and Patterson (1992) compare stated and actual WTP for maintenance of instream water flows in Montana and find that CV values exceed actual payments by a factor of 4 for residents and a factor of 3 for nonresidents. Brown et al. (1996) elicited WTP for a road-removal program on the North Rim of the Grand Canyon. The results show that mean stated WTP was four to six times the mean actual WTP, with the means being statistically different.

The last group of studies contains studies that use the referendum format to elicit WTP values for various types of goods, both private and public. In a number of these studies, the CV referenda did not reflect an actual referenda, much like the CV study that Stratus has conducted for this litigation (Cummings et al 1997; Bjornstad et al. 1997; Taylor 1998; Cummings and Taylor 1999; Taylor et al. 2001; Brown et al. 2003; Landry and List 2007; Burton et al. 2007; Carson, Groves, and List 2008). However, an actual group payment was part of the study design. Overall, these studies reveal that hypothetical bias persists, even when the referendum format is used.

[8] Most of the literature has focused on the use of CV questions, especially the referendum format, but the conclusions of the literature apply to the SP survey EPA conducted.

A subset of the referenda studies has compared CV results from a simulated referendum for a public good to voting results from an actual referendum for the identical public good (Carson, Hannemann, and Mitchell 1986; Shabman and Stephenson 1996; Champ and Brown 1997; Vossler and Kerkvliet 2003; Vossler et al. 2003; Schläpfer Roschwitz, and Hanley 2004; Johnston 2006). Table 6 summarizes this set of studies. To evaluate EPA's contention about the lack of hypothetical bias, it is useful to compare the features of the EPA survey to these studies. First, the EPA survey does not reflect an actual referendum. Respondents choose between hypothetical policy choices. Second, the nature of the public good, shown in the second column of Table 6, differs substantially between the EPA studies and the actual referenda. The studies that do not exhibit hypothetical bias involve well-understood public services actually used by the voters. These referenda asked voters to approve bonds or other funding for the construction of sewage treatment plants, public road maintenance and improvements, public water supply provision, and river front park improvements. The one exception to this conclusion is the Shabman and Stephenson (1996) study of flood protection projects. Clearly, though, all of these studies are remarkably different from the policy choices involving increases the number of forage fish saved.

The commodities depicted in the two studies that clearly demonstrate hypothetical bias are open space preservation and rural landscape protection. While some voters may use open spaces and directly benefit from some rural landscape protection, other voters will not use these types of natural resource services. When the commodities of the hypothetical referenda studies are examined, the majority (but admittedly not all) of them are also largely non-use commodities. Thus, the use/nonuse distinction likely explains at least part of the findings on hypothetical bias in referenda studies. Cameron and Englin (1997), Blamey, et al. (2001), Johnston, et al. (1995), and Johnston (2006) all demonstrate that first-hand experience or familiarity with the good leads to a closer correspondence between stated intentions and actual behaviors.

Table 6. Empirical Studies on Actual Referenda

Study	Referendum	Familiarity and Salience of Proposed Project	Evidence of Hypothetical Bias?
Carson, Hanneman and Mitchell (1987)	Construction of sewage treatment plants in California in 1984	High familiarity and salience. No additional information provided in the survey.	No, only if undecided responses are recoded as no
Johnston 2006	Provision of public water supply to Village of North Scituate, RI in 2001	High familiarity and salience. No additional information provided in the survey.	No
Vossler and Kervliet 2003	Riverfront park improvements in downtown Corvallis, OR in 1998	High familiarity and salience. Community had studied the issue for 6 years. No additional information provided in the survey.	No*
Vossler, et al. (2003)	Purchase of open space near Corvallis, OR in 1995	High familiarity and salience. Most discussed item on the ballot that year. No additional information provided in the survey.	No, only if undecided responses are recoded as no
Schläpfer, Roschwitz, and Hanley (2004)	Improved protection of rural landscape near Zurich, Switzerland in 1996	Some familiarity and salience. The CV survey provided substantial information.	Yes
Shabman and Stephenson (1996)	Flood protection project in Roanoke, VA in 1989	High familiarity and salience. Flooding two years earlier caused $200 million in property damage. The CV survey provided substantial information.	Yes
Champ and Brown (1997)	Use of budget surplus for road maintenance in Fort Collins, CO in 1996	High familiarity and salience. No additional information provided in the survey.	No

* However, the study was also designed to test the treatment of undecided votes. If undecided votes are re-coded as votes against, then there is a statistical difference between the actual vote and the survey results.

The second feature of the actual referenda studies that merits discussion is the salience and familiarity of the good to survey respondents. Certainly, this feature is related to the use values aspects identified above. However, what is an important extension of that concept is the amount of information provided to the CV survey respondents in advance of their votes in the survey. For the majority of these studies, the survey designers did not have to provide information about the issues to the respondents. In fact, Johnston (2006) believes that this lack of additional information is one of the reasons that his study does not exhibit hypothetical bias. For most of these studies, the survey respondents had access to information about the ballot issue from a variety of sources and viewpoints. The two studies that did provide substantial information to the respondents exhibit hypothetical bias. This feature is relevant to the evaluation of hypothetical bias for the EPA survey. EPA's survey responses as well as its focus groups and cognitive interviews all show that people have limited awareness of the potential effects of cooling water intake systems on forage fish populations. Thus, the EPA survey included information in order to "educate" the respondents prior to their hypothetical votes. Providing so much information to respondents is a symptom of the lack of salience and a corresponding likelihood of hypothetical bias in the EPA study.

The last feature of the actual referendum studies that is relevant to a discussion of hypothetical bias is the treatment of the undecided voters in the CV survey. Two of the studies that do not find hypothetical bias do so only because they treat the undecided votes as votes against. In addition, Vossler and Kerkvliet's (2003) study design includes a separate element to test for the treatment of undecided votes. They find that there is no clear evidence that undecided votes should be treated as votes against and that doing so results in statistical differences. Vossler et al. (2003) conclude that it is an open question whether undecided votes should be recoded as votes against. Wang (1997) reasons that "common sense suggests that if a respondents is answering truthfully, a DK [don't know/not sure/would not vote] response is not the same as no" (p. 220).

In an actual referendum, the undecided votes would not be counted, either because the voters did not go to the polls or because they did not make an explicit choice on their ballot. Treating the undecided votes as votes against is particularly important when predicting the WTP for the commodity. Specifically, without such an adjustment of the undecided votes, the survey results over-predict both the percentage of votes for the proposition and the WTP for the commodity at issue.

EPA contends that it has taken all necessary steps to minimize hypothetical bias in this survey. In fact, here's what the EPA survey tells respondents:

"Your votes are important. Answer all questions as if it were a real, binding vote." There are many reasons why this survey fails to mimic a real referendum. First, the extensive use of the EPA logo and overall imprimatur makes it clear that this is an EPA sponsored study rather than an independent referendum. Second, EPA provides people with little information about how their votes will influence the provision of a good. Carson and Groves (2007) specifically point out that the survey respondent must perceive that they survey responses will influence the outcome of the policy and that there is a positive probability that they would have to pay the amount in

question.[9] Without such consequential circumstances being established, even stated preference proponents, such as Dr. Carson are dubious about the ability of the survey to yield responses that would mimic a real referendum. Finally, the EPA survey differs from a real referendum in that people have to make up their minds on the spot as to how they would vote and only have the information given to them in their survey (Schlapfer 2008, Desvousges Hudson and Ruby 1996 and Horowitz 2000).

Thus, hypothetical bias is prevalent in empirical studies. Most studies that claim to find no hypothetical bias depend on a manipulation of the undecided responses. The three studies that do not find hypothetical bias, without manipulation of the undecided responses, reflect use value goods without significant information dosing in the survey questionnaire. EPA's efforts to minimize hypothetical bias are totally inadequate. Clearly, the weight of the evidence suggests that hypothetical bias is likely present in the EPA survey results.

D. Conclusions Regarding the EPA Survey Instrument

For the reasons outlined above, we conclude that EPA's stated preference survey questionnaire is not capable of providing the basis for reliable estimates of benefits related to cooling water regulations. The "commodity" is poorly defined, respondents are not well informed, and the information provided biases the respondent. Therefore, the value estimates produced by the survey would not reflect the public's true value for reducing fish loss from cooling water system.

In light of these fundamental flaws, we conclude that the EPA survey instrument cannot provide meaningful results of household willingness-to-pay to reduce fish losses resulting from cooling water intake structures. Given the characteristics of the survey, it seems likely that respondents used heuristics to make their decisions. The next section on the EPA econometric analysis provides empirical assessments of the proposition that respondents used heuristics rather than rationally weighing the effects of environmental improvements against the assumed cost.

[9] Carson and Groves further argue that the survey question has to be framed as a single take it or leave it question about a single good. Clearly, this is not the case for the SP format used in the EPA survey. Finally, they argue that the good has to be something that people care about. This latter condition begs the question of whether respondents even knew what a forage fish was prior to taking this survey.

IV. Evaluation of the EPA Survey Econometric Analysis

This section begins with a brief overview of the econometric analysis used by EPA to convert survey responses into estimates of willingness-to-pay for environmental attributes. We then describe our attempts to replicate the EPA results, including validation of EPA's selected specification and its parameter estimates for all survey regions. We conclude from these replication attempts and additional statistical analyses that EPA's econometric analysis suffers from several critical flaws that stem in large part from the inadequacies of the survey instrument. These econometric difficulties thus would not be "solved" through additional analysis or estimation since they reflect the fundamental limitations of the survey data that were developed.

A. Overview of the EPA Survey Econometric Analysis

The EPA econometric analysis is based on a random utility model, in which the utility of a survey respondent is assumed to be "the sum of systematic [or observed] and random [or unobserved] components" (Holmes and Adamowicz 2003, p. 189). It is common in the stated preference literature to use a random utility model to convert survey responses into welfare measures. These models allow for coefficients on attributes to be distributed across sampled individuals according to a set of estimated coefficients and researcher-imposed restrictions (EPA 2012b). The researcher estimates the parameters of the probability distribution that characterizes how utility is distributed in the population.

EPA assumes the policy preferences of survey respondents are a function of the level of each of the environmental attributes included in the survey and the cost to the respondent of the policy options. In particular, EPA uses a mixed logit model to model policy choice given policy costs and environmental attributes. The mixed logit model is a generalization of the multinomial logit model which "obviates the three limitations of standard logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time" (Train 2003). The model is estimated using simulated maximum likelihood. Willingness-to-pay for the environmental attributes in all four survey regions (as well as for the national survey) is estimated from the fitted mixed logit models for each region using simulation. Appendix B provides a more complete description of the mixed logit methodology.

EPA chose a model specification based on the estimation of various mixed logit models for the Northeast region. The preferred specification includes a fixed cost coefficient and random coefficients on the environmental attributes (with free correlation across these coefficients). EPA then used its preferred specification to estimate mixed logit models on data from the other four surveys. The fitted models were used to calculate willingness-to pay (or "implicit prices") for the environmental attributes in each region. As noted, EPA is considering the use of these willingness-to-pay values to calculate the benefits of various §316(b) regulatory options.

Figure 6, reproduced from EPA (2012b), shows EPA's estimation results for the Northeast region.

Figure 6. EPA Northeast Estimation Results

Variable	Coefficient [c]	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	-0.08269	0.36139	-0.229	0.8190
COM_FISH	0.20338	0.05351	3.801	0.0001
FISH_POP	0.07493	0.08347	0.898	0.3693
FISH_SAV	0.03044	0.00519	5.868	0.0000
AQUATIC	0.20973	0.08991	2.333	0.0197
Nonrandom parameters in utility functions				
COST	-0.02792	0.00447	-6.239	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT-	0.03823	1.05647	0.036	0.9711
sdCOM_FISH-	0.17539	0.28451	0.616	0.5376
sdFISH_POP-	0.17880	0.31559	0.567	0.5710
sdFISH_SAV-	0.05615	0.01159	4.845	0.0000
sdAQUATIC-	0.26680	0.33937	0.786	0.4318

[a] The mixed logit results have a χ^2 of 518.40 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.22.

[b] EPA received a total of 421 completed surveys for the Northeast region. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary Northeast model was estimated based on 394 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

Source: EPA (2012b), p. 21

B. Overview of Evaluation of EPA Survey Econometric Analysis

We find serious deficiencies in EPA's econometric analysis presented in the NODA. EPA's model selection process is flawed and the estimation results are not replicable. In addition, we find that parameter estimates for models estimated on the Northeast survey data differ substantially depending on the software package used to estimate the model. We provide evidence that EPA's Northeast region model suffered from false convergence, and thus the parameter estimates presented by EPA were not the true maximum likelihood estimates. This invalidates EPA's testing of alternative specifications, all of which was performed for the northeast region only (EPA 2012a, p. 19).

We have also conducted numerous additional analyses in order to determine the extent of the problems and whether an appropriate specification could be found. This includes conducting analyses on all of the survey data pooled to minimize problems due to small sample sizes. The results of these analyses on the pooled data imply behavior on the part of survey respondents that is inconsistent with the underlying economic theory of a linear random utility model. Likely causes of these results include the following:

1. Respondents were inherently irrational. Specific categories of irrational behavior (e.g. anchoring, the willingness-to-pay/willingness-to-accept gap, et cetera) are well-documented

in the behavioral economics literature. The econometric analysis may be uncovering the aggregate effects of such individual behavior.

2. Respondents were confused by the survey and thus answers were irrational because they were based on incorrect understanding of the information presented or insufficient context to provide a proper understanding of the resources they were being asked to value.

3. Respondents allowed external information, political bias, bias toward the survey administrator or popular misconceptions to influence a decision that should have been based solely on the information presented in the survey.

4. Respondents used heuristic approaches to select the preferred alternative or are "satificing" to avoid significant cognitive effort (see Section IV). Although they attempted to find the best alternative in a rational way, their decision-making sometimes led them to choose a set of alternatives across the three choice experiments that are not consistent with any rational set of preferences.

Some or all of these mechanisms may be occurring to some degree; we cannot provide a quantitative indication of whether one is more important than another. Regardless, these data cannot possibly produce sensible estimates of willingness-to-pay because respondents are clearly not behaving in a manner consistent with the underlying economic theory.[10] We conclude that EPA's econometric analysis is not a sufficient basis for §316(b) (or any other) benefits estimation.

C. Fundamental Deficiencies of EPA Survey Econometric Analysis

We attempted to reproduce the econometric analysis EPA released in the NODA. We used the survey response data published by EPA. (As noted below, these data include a slightly larger number of observations than those used by EPA to conduct its analysis.) To eliminate any possibility for differences in results owing to differences between software packages, we purchased a license for the NLOGIT software, the package used by EPA for estimation. We used the LIMDEP code published by EPA to attempt to replicate EPA results.

We were therefore able to follow the EPA methodology step by step, from statistical testing to model selection to the fitted model output. In doing so, we came to the following two conclusions.

1. EPA's chosen specification as presented in the NODA most likely suffered from false convergence for the Northeast region, invalidating any testing of alternatives that EPA carried out; and

[10] This should not be construed to mean that SP surveys can never be used to calculate willingness-to-pay for a resource, particularly when no other means are available. Rather, this conclusion applies to these data collected by this specific survey instrument.

2. EPA's econometric results are consistently not replicable, suggesting some fundamental problems with estimation. EPA appears to have made errors in setting up the data or using the software.

The following sections discuss both of these issues in detail.

1. EPA's Process for Choosing a Specification Is Invalidated by False Convergence of Its Selected Model

In the materials accompanying the NODA, EPA discusses how it chose a specification. We review EPA's discussion in detail because it contains conceptual errors that may have resulted in the selection of an inappropriate model.

EPA notes that a "comparison of model outputs for the Northeast survey" was used to assess "various statistical models." EPA determined that the "best overall model fit and greatest robustness of results" were achieved with a model in which cost had a fixed, rather than random, coefficient. EPA notes that it estimated a model in which cost had a coefficient with a lognormal distribution, but that model converged with a lower log likelihood than the model with cost fixed.

EPA explains this result as follows:

> Given that mixed logit models such as these are nonlinear and estimated using simulated likelihood methods, it is possible for a seemingly less constrained model (e.g., with a lognormal cost distribution) to converge with a lower log likelihood than an otherwise parallel model with a fixed cost coefficient.

This explanation is both incorrect and incomplete. It is incorrect because the test results imply a negative value of an asymptotically chi-squared-distributed test statistic for comparing the model with cost lognormal to the model with cost fixed. The chi-squared distribution has support only on positive numbers, so this result is theoretically impossible and cannot be explained by the nonlinearity of the model.

EPA's statement is incomplete because it omits an explanation of how these test results could arise using the simulated maximum likelihood method. There are two possible explanations:

1. The simulation draws are not comparable across the two models (i.e., the difference is due to simulation error); or

2. The optimizer is not finding "true" global maxima (i.e., it is finding local maxima).

The results described later in this section suggest that the second explanation is more plausible than the first. If the optimization algorithm is indeed having difficulty finding global maxima, estimates of willingness-to-pay (WTP) derived from the different specifications tested by EPA may be inaccurate and unreliable. Regardless, if either of the two issues is occurring, it would call into question the validity of EPA's estimates using its chosen specification.

Using EPA's estimation results for the northeast region displayed above in Figure 6, we note three additional concerns with the model specification choice. First, the constant and the fish population variables are included in the final model despite neither being statistically significant. EPA presents no testing of a model with these predictors omitted, and indeed, such tests would probably be invalid as a result of the convergence problems discussed above. Second, the parameter estimates for the standard deviations of the random coefficients are, with the exception of that for fish saved, not statistically significant, implying that these coefficients should be treated as fixed, not random. EPA's selection of a model with correlated random effects when the random effect standard deviations are not statistically significant is not consistent with good statistical practice. Again, no formal testing of alternative models is presented.

Finally, the estimated standard deviations of the normal distributions for the random coefficients imply that a substantial portion of the population of respondents has negative value for some or all of the environmental benefits of the regulation. Such irrational preferences are evident across all of the surveys. For example, in the Southeast model, the mean of the normal distribution for the fish saved coefficient is 0.026 and the standard deviation is 0.068. This implies that about 35 percent of the population places a negative value on fish saved. Irrational survey responses and their implications are discussed in more detail in section C.

EPA's failure to even acknowledge these issues is inconsistent with standard practice for performing econometric analyses, particularly mixed logit estimation. Thus, EPA's statement that "similar results and WTP estimates are generated with all preliminary model specifications" is not meaningful because of serious flaws in the statistical procedure. These problems cast doubts on the validity of all of the EPA modeling results that use this specification.

2. EPA's Model Results are Not Replicable

We repeated EPA's analysis for each survey using both LIMDEP (the package used by EPA) and STATA (using the mixlogit package developed by Arne Risa Hole at the University of Sheffield).[11] All of the models discussed in this report were estimated using the same number of Halton draws (300) and the same random number seed used by EPA.

Our results are shown in the following tables. For comparison, we also provide the results EPA reported in tables 8 – 12 of the "316(b) Memo" (EPA 2012b).

[11] Appendix C provides details on these software packages and tests that have been conducted to compare the results from each package.

Table 7. Estimation Results for the Northeast Region Survey

	EPA, LIMDEP		NERA, LIMDEP		NERA, STATA	
Log likelihood	(different scale)		-899.57		-889.07	
Parameter	**estimate**	**std error**	**estimate**	**std error**	**estimate**	**std error**
means						
Constant	-0.083	0.361	-0.049	0.013	-0.052	0.011
Com Fish	0.203	0.054	0.060	0.043	0.097	0.047
Fish Pop	0.075	0.083	-0.014	0.074	-0.025	0.082
Fish Saved	0.030	0.005	0.021	0.003	0.025	0.004
Aquatic Cond	0.210	0.090	0.095	0.081	0.145	0.083
nonrandom						
Cost	-0.028	0.004	-0.021	0.003	-0.028	0.004
Standard deviations						
sd Constant	0.038	1.056	0.087	0.018	0.080	0.016
sd Com Fish	0.175	0.285	0.006	0.138	0.224	0.078
sd Fish Pop	0.179	0.316	0.003	1.125	0.413	0.157
sd Fish Saved	0.056	0.012	0.051	0.020	0.031	0.006
sd Aquatic Cond	0.267	0.339	0.009	0.715	0.472	0.140

Source: EPA (2012b) and NERA calculations

Table 8. Estimation Results for the Southeast Region Survey

	EPA, LIMDEP		NERA, LIMDEP		NERA, STATA	
Log likelihood			-1100.541		-1098.39	
Parameter	**estimate**	**std error**	**estimate**	**std error**	**estimate**	**std error**
means						
Constant	0.080	0.342	-0.029	0.007	-0.035	0.007
Com Fish	0.121	0.046	0.136	0.051	0.153	0.047
Fish Pop	0.125	0.071	0.042	0.065	0.007	0.066
Fish Saved	0.026	0.005	0.019	0.005	0.020	0.004
Aquatic Cond	0.232	0.079	0.161	0.087	0.178	0.074
nonrandom						
Cost	-0.035	0.004	-0.040	0.004	-0.042	0.005
Standard deviations						
sd Constant	0.025	1.168	0.074	0.013	0.075	0.013
sd Com Fish	0.095	0.164	0.263	0.106	0.268	0.087
sd Fish Pop	0.093	0.139	0.065	0.198	0.295	0.140
sd Fish Saved	0.068	0.010	0.044	0.032	0.042	0.007
sd Aquatic Cond	0.122	0.129	0.375	0.384	0.535	0.123

Source: EPA (2012b) and NERA calculations

Table 9. Estimation Results for the Pacific Region Survey

	EPA, LIMDEP		NERA, LIMDEP		NERA, STATA	
Log likelihood			-557.3831		-555.89	
Parameter	**estimate**	**std error**	**estimate**	**std error**	**estimate**	**std error**
means						
Constant	0.246	0.541	-0.025	0.015	0.000	0.011
Com Fish	0.103	0.104	0.078	0.063	0.101	0.071
Fish Pop	0.142	0.151	0.091	0.094	0.119	0.103
Fish Saved	0.053	0.011	0.091	0.013	0.110	0.020
Aquatic Cond	0.209	0.166	0.174	0.099	0.231	0.123
nonrandom						
Cost	-0.022	0.005	-0.039	0.006	-0.048	0.008
Standard deviations						
sd Constant	0.026	1.927	0.095	0.021	0.075	0.018
sd Com Fish	0.204	0.159	0.105	0.151	0.281	0.130
sd Fish Pop	0.140	0.365	0.197	0.149	0.455	0.210
sd Fish Saved	0.139	0.053	0.086	0.025	0.135	0.026
sd Aquatic Cond	0.187	0.508	0.654	0.235	0.946	0.238

Source: EPA (2012b) and NERA calculations

Table 10. Estimation Results for the Inland Region Survey

	EPA, LIMDEP		NERA, LIMDEP		NERA, STATA	
Log likelihood			-1797.797		-1797.14	
Parameter	**estimate**	**std error**	**estimate**	**std error**	**estimate**	**std error**
means						
Constant	-0.250	0.353	-0.045	0.006	-0.044	0.005
Com Fish	0.099	0.032	0.065	0.029	0.064	0.030
Fish Pop	0.112	0.054	0.020	0.044	0.020	0.045
Fish Saved	0.025	0.004	0.006	0.002	0.007	0.002
Aquatic Cond	0.087	0.066	0.053	0.050	0.048	0.051
nonrandom						
Cost	-0.032	0.003	-0.034	0.003	-0.034	0.003
Standard deviations						
sd Constant	0.027	2.016	0.068	0.008	0.068	0.009
sd Com Fish	0.073	0.169	0.134	0.057	0.144	0.057
sd Fish Pop	0.069	0.208	0.063	0.079	0.067	0.082
sd Fish Saved	0.052	0.008	0.022	0.003	0.021	0.003
sd Aquatic Cond	0.527	0.403	0.437	0.113	0.449	0.089

Source: EPA (2012b) and NERA calculations

Table 11. Estimation Results for the National Survey

	EPA, LIMDEP		NERA, LIMDEP		NERA, STATA	
Log likelihood			-630.73		-630.98	
Parameter	**estimate**	**std error**	**estimate**	**std error**	**estimate**	**std error**
means						
Constant	-0.061	0.604	-0.040	0.012	-0.043	0.012
Com Fish	0.174	0.066	0.083	0.062	0.082	0.056
Fish Pop	0.251	0.124	-0.026	0.100	-0.009	0.096
Fish Saved	0.039	0.011	0.025	0.006	0.024	0.005
Aquatic Cond	0.140	0.136	0.064	0.108	0.125	0.100
nonrandom						
Cost	-0.035	0.005	-0.029	0.005	-0.030	0.005
Standard deviations						
sd Constant	0.023	1.828	0.088	0.020	0.091	0.020
sd Com Fish	0.137	0.521	0.058	0.298	0.027	0.104
sd Fish Pop	0.117	0.564	0.423	0.215	0.407	0.186
sd Fish Saved	0.108	0.056	0.032	0.010	0.033	0.008
sd Aquatic Cond	0.161	1.218	0.527	0.178	0.490	0.157

Source: EPA (2012b) and NERA calculations

As shown in the preceding tables, we were unable to replicate EPA's results with either the LIMDEP or STATA software. In part, this is because our results are based on a slightly different number of observations than used by EPA because the analysis reported in the materials accompanying the NODA does not use all of the observations published in the dataset.[12] However, the extent of disagreement between our results and EPA's cannot be explained by relatively small differences in sample size.

We note the following key discrepancies from the NERA results compared to the EPA results:

1. The "status quo" constant (which EPA calls the "alt ernative-specific constant" or ASC) is negative and statistically significant in all of the NERA models except the Pacific region, but is not statistically significant in EPA's models. This result indicates a fundamental preference for more regulation (on average), regardless of the characteristics of the regulation (even if it does not affect any of the attributes in the model). This is not consistent with rational choice theory. EPA notes that the insignificance of the ASC "should be viewed as a desirable result" because "respondents are not willing to pay a posit ive or negative amount for a regulation that has no effects on ecological attributes" (EPA 2012, p. 25). We find the opposite result, indicating that respondents generally have a pre-existing bias. Note that because the constant has a random coefficient in this specification, and the estimated standard deviation is larger than the mean in most cases, the result implies that some subset of respondents have a bias against more regulation and some have a bias toward more regulation. This echoes many of the transcribed respondent comments displayed in Appendix A.

[12] For example, EPA's preliminary results for the northeast region are based on responses from 367 individuals, whereas our results are based on 391 observations. (Note that EPA erroneously claims that their results are based on responses from 394 decision-makers; however it is clear from the EPA model output that only 367 were included).

2. Various parameter estimates that NERA obtained for the Northeast model differ markedly from those reported by EPA. As discussed in more detail below, our hypothesis is that the optimization algorithm in LIMDEP is having difficulty finding the global maximum of the likelihood function when estimating a model with an unrestricted random coefficients covariance matrix on this particular dataset.

3. The standard deviations for the random parameters are not statistically significant for any of the variables in EPA's models with the exception of fish saved, whereas our results indicate that the standard deviations are statistically significant for all of the random coefficients with the exception of fish population.

4. With the exception of results for the northeast region, NERA's results are very consistent between LIMDEP and STATA. The largest differences in parameter estimates for other regions occur for the "fish pop" variable, which is never statistically significant in any of the models. Because the predictor is not significant, it is not surprising that a range of parameter estimates is obtained across the different software packages.

It is very disconcerting that the EPA results are not replicable using the same software, code, and dataset. The differences are not trivial, and in certain cases mask key problems with the analysis. In the next section we investigate and discuss these problems in more detail.

3. Significant Estimation Problems for the Northeast Model Invalidate EPA's Specification Selection Process

Our analysis uncovered strong evidence that EPA's model for the Northeast likely suffered from false convergence. For the Southeast, Pacific, Inland, and National surveys, our results were quite similar between STATA and LIMDEP. For the northeast region, however, the results are not consistent between the two packages. The maximized value of the likelihood is higher by about 10 when estimation is done in STATA compared to LIMDEP. These values should be directly comparable for identical models estimated on identical data using the same random number seed and same number of Halton draws. The maximized likelihood at convergence using LIMDEP was -899.57, as compared to -889.07 using STATA, suggesting that LIMDEP is trapped at a local maximum and is unable to find the global maximum. This is a relatively large difference, indicating a likelihood ratio of about $e^{10} \approx 22{,}000$. The likelihood ratio is, colloquially, a measure of the relative plausibility of the two sets of parameter estimates. Thus the parameter estimates provided by STATA are about 22,000 times more plausible than those provided by LIMDEP in this case.

As noted above, EPA admits to obtaining smaller values of the maximized log-likelihood for models in which cost was treated as random rather than fixed. This is a theoretically impossible result. When we tested models with cost given a lognormal distribution in LIMDEP, we obtained larger, not smaller, values of the log-likelihood (-865.01 compared to -899.57). However, when we estimated a model with random coefficients independent in LIMDEP, a less complex model than the specification used by EPA, we also obtained a larger value of the maximized log likelihood than when free correlation was allowed (-895.75 compared to -899.57). This is precisely the sort of problem that EPA encountered when estimating a model with cost

lognormal. Notably, when we estimated both models in STATA, we obtained a larger value of the maximized likelihood for the model with free correlation (-889.07 compared to -897.30), the only sensible result for comparisons of this type. These comparisons provide strong evidence that the nonsensical results obtained by both NERA and EPA for less constrained models estimated on the Northeast data using LIMDEP were the result of false convergence of this particular model in LIMDEP. Such false convergence is fairly common in models estimated on small sample sizes, as is the case here. EPA should have carried out testing of alternative models using one of the other region's survey dataset. In that case it likely would have caught this serious problem. Unfortunately, EPA notes that alternative models were tested only using the Northeast region data (EPA 2012, p. 19).

We conclude that the regression results displayed by EPA in the NODA are not reliable and thus cannot produce meaningful estimates of willingness- to-pay. They differ markedly from our estimates, which we obtained using two industry-standard software packages. EPA's specification choice was based entirely on testing alternative models for the Northeast region, which very likely exhibited false convergence. EPA also appears to have overlooked obvious problems such as the nonsensical values of the chi-square tests. A more careful examination likely would have led to very different results. However, these results are quite contrary to those reported by EPA and indicate that survey respondents followed various heuristics rather than making tradeoffs among attributes as required by utility theory. As such, it is not possible to develop valid benefit estimates with these data.

D. Evidence of "Irrational" Behavior in EPA Survey Responses

We initially set out to test alternative model specifications with the objective of providing guidance to EPA in selecting an appropriate specification. Our research led us to a more fundamental concern with these data: survey respondents clearly did not behave in a manner consistent with the underlying economic theory of a linear random utility model. In this section we provide results of several alternative specifications that show evidence of "irrational" behavior on the part of survey respondents. We provide econometric evidence of three distinct types of such behavior.[13]

1. Respondents did not differentiate among environmental attributes.

2. Respondents were more concerned about cost when the costs of the policy options were equal.

3. The distribution of random coefficients in a model with cost also having a random coefficient implies that substantial portions of the population (half or more) have the "wrong sign" on one or more policy attributes (i.e. a positive sign on cost or a negative sign on one or more environmental benefits).

[13] This is by no means a complete list. Given the limited timeframe we had to conduct these analyses, we note these three items because they are sufficient to make the point that individuals were clearly not behaving rationally. A more exhaustive analysis could undoubtedly allow for additional and more complete results.

These results show that a large portion of respondents are not answering the choice experiments rationally. They are described in more detail in what follows.

1. Respondents Did Not Differentiate Among Environmental Attributes

We tested two separate classes of models where some or all of the environmental attributes were aggregated. The first class replaces all four of the environmental attribute variables ("fish pop," "fish saved," "commercial fish," and "aquatic condition") with their sum (which is given a random coefficient). The second class replaces the separate "fish pop," "fish saved," and "commercial fish" variables with the sum of these three variables, leaves the aquatic condition variable in the model as a separate predictor, and models coefficients on both predictors as random.

All classes model cost as fixed, include a "status quo" constant modeled as random, and allow an unrestricted covariance matrix for random coefficients. The models are compared with EPA's preferred specification and formal nested model tests are performed. The test used is a likelihood ratio test, in which the deviance (twice the difference in the log likelihoods between the two models) is compared with the critical value of a chi squared distribution with degrees of freedom equal to the difference in the number of parameters between the two models. If the deviance is less than the critical value, we accept the less complex model (the one with fewer parameters). This is the standard test for comparing the fit of mixed logit models.

The results are summarized in Table 12. In four of the five regions, the statistical testing indicates that the second class of model is preferable to EPA's chosen specification (and in the fifth region, the Northeast, the test statistic is close to the critical value).

This result suggests that rather than considering all of the categories of benefits independently, respondents are simply adding the values of the different fish benefits and deciding on the basis of that total value. Thus, despite EPA's efforts to "break the correlation" between the different benefit categories through the survey design, respondents are not consistently distinguishing between the different categories of fish benefits and instead only distinguishing between the (aggregate) fish benefits and overall aquatic condition. This behavior of survey respondents is not consistent with the underlying economic theory, which requires that respondents consider each attribute separately.

Table 12. Likelihood Ratio Tests on the Differentia tion between Environmental Attributes

			Log Likelihood					
Region	Model Class	Software	EPA Spec	Alternative	Deviance	Δp	Critical Value (0.05 level)	Test Outcome
Northeast	Class 1	LIMDEP	-899.57	-903.84	8.54	15	25.00	Accept Alternative
		STATA	-889.07	-904.14	30.14	15	25.00	Reject Alternative
	Class 2	LIMDEP	-899.57	-898.75	-1.64	11	19.68	N/A
		STATA	-889.07	-899.12	20.10	11	19.68	Reject Alternative
Southeast	Class 1	LIMDEP	-1100.54	-1114.41	27.74	15	25.00	Reject Alternative
		STATA	-1098.39	-1112.94	29.10	15	25.00	Reject Alternative
	Class 2	LIMDEP	-1100.54	-1107.74	14.40	11	19.68	Accept Alternative
		STATA	-1098.39	-1106.63	16.48	11	19.68	Accept Alternative
Pacific	Class 1	LIMDEP	-557.38	-573.22	31.67	15	25.00	Reject Alternative
		STATA	-555.89	-571.93	32.08	15	25.00	Reject Alternative
	Class 2	LIMDEP	-557.38	-560.47	6.17	11	19.68	Accept Alternative
		STATA	-555.89	-564.73	17.68	11	19.68	Accept Alternative
Inland	Class 1	LIMDEP	-1797.80	-1822.53	49.47	15	25.00	Reject Alternative
		STATA	-1797.14	-1824.96	55.65	15	25.00	Reject Alternative
	Class 2	LIMDEP	-1797.80	-1803.54	11.49	11	19.68	Accept Alternative
		STATA	-1797.14	-1805.16	16.05	11	19.68	Accept Alternative
National	Class 1	LIMDEP	-630.73	-638.09	14.72	15	25.00	Accept Alternative
		STATA	-630.98	-638.91	15.85	15	25.00	Accept Alternative
	Class 2	LIMDEP	-630.73	-635.42	9.38	11	19.68	Accept Alternative
		STATA	-630.98	-635.47	8.97	11	19.68	Accept Alternative

Source: NERA calculations as described in text.

2. Respondents were Twice as Concerned about Cost when the Costs of the Policy Options were Equal than when the Costs Differed

Through our testing of alternative specifications, we discovered that respondents appeared to have reacted differently when the costs of the two policy alternatives were the same relative to when the costs of the policy options differed.

To test whether this effect was statistically significant, we investigated models with two separate cost coefficients – one for choice experiments in which the presented costs were the same and one for which the presented costs differed. We compared this "two cost" specification to the "class 2" model from the previous section because in all but one case the "class 2" model was preferred.

The results are presented in Table 13. In all but one region, the "two cost" model is preferred to the model with a single cost coefficient. This cannot be explained by nonlinearity of utility in cost, since the mean of cost does not differ across the two types of choice experiments (ones in which the presented costs were the same versus those in which they differed). As shown in the table, the means of the distributions for the cost coefficients are different by a factor of two, indicating that respondents were, on average, twice as concerned about cost when the costs of the two policy options were the same.

A possible explanation for this result is that respondents had more trouble deciding on a policy option when the presented costs were the same. This suggests that respondents are using a "process" or "heuristic" to select an option (as suggested in Section IV), rather than rationally trading off costs and benefits. For example, some people may be committed to choosing additional regulation regardless of the cost and then choosing whichever alternative "looks better." This is a more difficult task when one or more of the policy characteristics are identical. This type of behavior is not consistent with rational choice theory.

Table 13. Tests of the "Two Costs" Model

Region	Software	Log Likelihood: Two Price Model	Log Likelihood: Base Model	Deviance	Δp	Critical Value (0.05 level)	Test Outcome
Northeast	STATA	-895.56	-899.12	7.12	1	3.84	Accept Two-price
Southeast	STATA	-1100.45	-1106.63	12.36	1	3.84	Accept Two-price
Pacific	STATA	-558.62	-564.73	12.22	1	3.84	Accept Two-price
Inland	STATA	-1801.75	-1805.16	6.82	1	3.84	Accept Two-price
National	STATA	-634.38	-635.47	2.18	1	3.84	Reject Two-price

Region	Mean of Cost Coefficient: Costs equal	Mean of Cost Coefficient: Costs not equal
Northeast	0.065	0.022
Southeast	0.071	0.035
Pacific	0.068	0.038
Inland	0.052	0.031
National	0.046	0.025

Source: NERA calculations as described in text.

3. Distributions for Random Coefficients Imply that the Majority of the Surveyed Population was Irrational

As discussed previously, the parameter estimates for EPA's selected specification imply that substantial portions of the population have a negative value for one or more of the benefits of the regulation. EPA does not explore alternative distributions for these parameters that have mass only on one side of zero, which is the usual solution to this problem when one believes that decisions are being made in a rational way.

However, in light of the evidence of irrational decision-making on the part of respondents that we discuss above, it may be reasonable to assume that some individuals are actually less likely to choose a policy option with higher environmental benefits; these individuals may be "anti-regulation," perhaps due to perceived "over-reach" of the regulation (or regulations in general).

We therefore test a model with cost given as a normally distributed random coefficient. The only reason not to do so is because the results may imply that some individuals have a positive value for cost; however, this is no more illogical than some individuals having a negative value for environmental benefits.

Allowing for heterogeneity in sensitivity to cost is probably as important, if not more important, than allowing heterogeneity in the value of benefits. In light of the evidence of irrationality of decision-makers in this sample, it is plausible that some individuals with a strong pro-regulatory position would be more likely to choose a more expensive regulatory option even if it did not make sense on a benefit-cost basis. Moreover, one of the original reasons for developing random utility models was to allow for heterogeneity in the marginal utility of income. EPA's chosen specification does not allow for this type of heterogeneity.

We estimated a model identical to EPA's chosen specification with the exception that cost is given a random coefficient and the fish pop variable, which is not statistically significant, is omitted. We omit fish pop mainly because its coefficient distribution, which is centered near zero

with a large variance, artificially inflates measures of irrationality that we explore in this model. Thus, respondent behavior would actually appear more irrational had we left this variable in the model. Unrestricted covariance is allowed.

The model was estimated both for the Northeast survey and for all five surveys pooled. The latter model leads to similar conclusions and the much larger sample size alleviates concerns about inflated estimates of variance parameters due to small sample sizes. In both cases, the model with cost random provides a much better fit to the data than the model with cost fixed ($p < 0.01$).

Table 14 shows the probability of coefficients having the "wrong sign" in each of these models. Note that the probability of a respondent being fully "rational" is only about 50 percent, indicating that nearly half of the population has the incorrect sign for at least one of the policy attributes. Also note that the distribution of the "status quo" coefficient implies that about three quarters of the population has a built-in bias toward more regulation, regardless of the characteristics of the regulation.

Table 14. Probability of Irrational Behavior Using the Model with Normally Distributed Cost

	Probability	
Characteristic	**Northeast**	**All data pooled**
Full rationality (correct sign on all coefficients)	51.0%	52.0%
Wrong sign on commercial fish	11.9%	23.4%
Wrong sign on fish saved	20.2%	26.9%
Wrong sign on aquatic condition	5.5%	7.1%
Wrong sign on cost	23.4%	19.8%
Bias toward more regulation	78.2%	75.9%

Source: NERA calculations as described in text.

E. Conclusions on the EPA Survey Econometric Analysis

EPA used the random utility model and mixed logit estimation to convert the survey responses into estimates of willingness-to-pay for various environmental attributes. We followed the EPA methodology step-by-step, from its model selection decision to estimates of each survey region.

We found that the model selection decision was flawed and the estimation was not replicable. These findings alone should be sufficient to show that far more analysis is needed before any decision could be made about the proposal of using EPA's survey results to estimate benefits in any regulatory proceeding.

We conducted some of these additional analyses in an attempt to determine the underlying problems with the EPA estimates. We concluded that EPA's model choice was based on false convergence of the selected model in LIMDEP.

We also found strong evidence of irrational behavior on behalf of survey respondents. The survey respondents did not differentiate between the environmental attributes, likely because they did not have sufficient context and information to form preferences for these attributes.

They also did not properly trade off costs and benefits, indicating that they were using heuristics or "short-cuts" to make their decisions.

These results imply that a revised analysis would be needed for model selection and estimation as a pre-condition for producing meaningful willingness-to-pay estimates. However, our alternative model tests strongly suggest that the problems with the survey instrument are sufficiently severe that the current dataset cannot be used to produce meaningful willingness-to-pay estimates for §316(b) policy options.

V. Use of EPA Survey Results to Estimate Benefits

EPA has specifically requested comment on whether the stated preference survey should be used to estimate the benefits of the regulatory options for the §316(b) final rule. EPA has noted that if these benefits are used, they would supplant the estimated benefits of the §316(b) Proposed Rule.

In this section we describe EPA's proposed method for using the survey to estimate §316(b) benefits. We then calculate these benefits for each regulatory option, and evaluate the implications of these benefit estimates.

A. EPA Proposed Method for Estimating §316(b) Benefits

The econometric results discussed in the previous section are used by EPA to estimate the marginal annual willingness-to-pay ("WTP") for a one percentage point change in a given environmental attribute (the four attributes are Commercial Fish Populations, Fish Populations, Fish Saved per Year, and Condition of Aquatic Ecosystems). This WTP value is referred to as the "implicit price" of the environmental attribute.

According to the supporting documents to the NODA, the implicit price can be calculated as the coefficient on the environmental attribute divided by the coefficient on the program cost. But because the mixed logit model includes random coefficients, implicit prices are actually estimated by EPA using a bootstrap simulation approach, in which each of the environmental attribute coefficients is assumed to be normally distributed.

EPA notes that annual WTP per household can be calculated for a given regulatory option by multiplying actual estimated changes in environmental attributes due to regulation (e.g., 50 percent increase in fish saved per year) by their respective implicit prices and then summing across the environmental attributes.

EPA indicated in the supporting documents to the NODA that annual WTP per household may be estimated using solely the "Fish Saved per Year" attribute, by multiplying its implicit price by the percentage change in fish saved. EPA asserts that using only this one attribute will result in a conservative estimate of benefits in that it assumes zero impacts on the other three environmental attributes.

Finally, total annual WTP within each survey region under each regulatory option would be calculated by multiplying the annual household WTP by the number of households in the survey region. Annual WTP for each survey region would then be discounted using the region-specific regulatory compliance schedule, which is based on biological considerations and the anticipated timeline of rule implementation.

EPA does not provide WTP or total §316(b) benefit estimates in the supporting documents to the NODA. However, it provides the inputs for these calculations, which include the implicit prices of the "Fish Saved" attribute and the estimated number of fish saved per year for each region and regulatory option. In the following subsections, we calculate the §316(b) benefits implied by the

EPA survey and the method that EPA has outlined in the NODA and we comment on our serious concerns related to the plausibility and precision of these estimates.

B. §316(b) Benefits Implied by the EPA Survey

As noted above, EPA does not calculate WTP for changes in environmental attributes and does not estimate total regional or national benefits in the NODA. In what follows we therefore estimate the implied benefits for each §316(b) regulatory option using the national survey results[14] and the methodology described above. While we do not endorse the validity of the inputs to these calculations (and have shown in the previous section that the econometric results are neither replicable nor robust to alternative modeling choices), without these calculations it is not possible to fully assess the plausibility of the survey results.

Table 15 displays the estimated benefits for each regulatory option implied by the survey results. Annual benefits are calculated as the product of the implicit price (per percentage point) of fish saved, the change in fish saved, and the number of households. The discounted present value and annualized value of benefits are then estimated using the national "time profile of benefits" from the Proposed Rule and a seven percent discount rate. Table 15 shows that the annualized benefits (using a seven percent discount rate) implied by the survey results range from $2.2 billion to $7.4 billion.

[14] We use the "national" version of the EPA survey to estimate implied benefits, but it should be noted that the results are similar when the implied benefits from the regional surveys are estimated and summed together.

Table 15. Implied Benefits from the EPA Survey

	Option 1	Option 2	Option 3	Option 4
ImplicitPrice of Fish Saved	$1.13	$1.13	$1.13	$1.13
Change in Fish Saved (%)	24.25	78.13	79.39	23.75
Number of Households (million)	111.67	111.67	111.67	111.67
Annual Benefits (2011$ million[1]	$3,060	$9,859	$10,018	$2,997
Discount Rate	7.0%	7.0%	7.0%	7.0%
Discounted Present Value of Benefits (2011$ million)[2]	$31,400	$101,165	$102,796	$30,752
Annualized Benefits (2011$ million[3]	$2,275	$7,330	$7,449	$2,228

Notes: [1]Annual Benefits are calculated as the product of the implicit price of fish saved, the change in fish saved and the number of households.
[2]The discounted present value of benefits is calculated over 50 years using the regulatory compliance schedule in the §316(b) Proposed Rule, which is based on the anticipated timeline of rule implementation and biological considerations (EPA 2011, Appendix D).
[3]Annualized benefits are calculated using the formula in EPA 2011b, Appendix D.
Source: EPA 2011b, EPA2012b and NERA calculations

C. Comparison to §316(b) Proposed Rule Benefits and Implied Non-Use Benefits

In the §316(b) Proposed Rule, EPA calculates the commercial and recreational "use" benefits of each regulatory option. Well-established and sound methods are available to perform these calculations, which include not only the estimated values of commercial and recreational fish but also the benefits of potential additional forage fish and non-harvested recreational and commercial fish. These benefits estimates were described in Chapter II.

Table 16 displays EPA's estimates of commercial and recreational "use" benefits for each regulatory option, which range from $15 million for Option 4 to $38 million for Option 3. (The results are displayed for a seven percent discount rate and have been adjusted to 2011 dollars to enable a direct comparison with the implied benefits from the survey.)

As explained in Chapter II, EPA only partially quantified non-use benefits in the §316(b) Proposed Rule. The vast majority of quantified benefits were comprised of "use" benefits, as displayed in Table 16. This aligns well with intuition. Non-use values are the benefits related only to the existence of the fish that would be lost due to cooling water intake. EPA notes in the survey questionnaire that over 80 percent of the fish lost are forage species that do not interact with humans (except indirectly as food for larger fish, which is already incorporated into the "use" value calculations). The vast majority of the fish and aquatic ecosystems affected by the

§316(b) Proposed Rule would not meet the criteria that economists have developed for assessing whether non-use benefits are likely to be significant: (1) the resource is unique; and (2) the loss is irreversible (see Chapter II for details). Thus, based on information provided by EPA, there is no reason to expect the potential non-use benefits of the §316(b) Proposed Rule to be significant relative to use benefits.

As EPA notes in the NODA, if the benefits from the survey are used in the final §316(b) rule, they will supplant the commercial and recreational use benefits calculated by EPA for the Proposed Rule (EPA 2012a). From a theoretical perspective, this is the correct approach. The results of the survey will capture both use and non-use benefits, so it would be double counting to add these benefits to the use benefits calculated for the §316(b) Proposed Rule.

It is instructive to note how drastically benefits would change if the benefits estimates from the §316(b) Proposed Rule are replaced by the benefits calculated using the EPA survey. As displayed in Table 16, the ratios of quantified benefits to costs from the §316(b) Proposed Rule are between 0.01 and 0.04, indicating that none of the four options are justifiable from a benefit-cost perspective. Table 16 also displays the benefit-cost ratios using the benefits implied by the results of the EPA survey (and the same cost estimates). These ratios range from 1.5 to 5.7, indicating that all four options could be justified from a benefit-cost perspective using the benefits implied by the survey.

Table 16. Comparison of Benefits and Costs from Proposed Rule and EPA Survey

	Option 1	Option 2	Option 3	Option 4
Benefits and Costs from the Proposed Rule:				
Commercial and Recreational "Use" Benefits (2011$ million)	$15.8	$36.8	$37.6	$15.4
Total Quantified "Non-use" Benefits	$0.5	$56.7	$59.4	$0.5
Total Quantified Benefits	$16.3	$93.6	$97.0	$15.9
Annualized Costs (2011$ million)	$466	$4,769	$4,934	$389
Benefits to Costs Ratio	0.03	0.02	0.02	0.04
Implied Benefits and Costs from the Survey:				
Implied Benefits from Survey (2011$ million)	$2,275	$7,330	$7,449	$2,228
Annualized Costs (2011$ million)	$466	$4,769	$4,934	$389
Benefits to Costs Ratio	4.9	1.5	1.5	5.7
Comparison of Non-use and Use Benefits:				
Implied "Non-use" to "Use" Benefits Ratio	143	198	197	143

Note: Annualized benefits and costs calculated using a seven percent discount rate
Source: EPA 2012b and NERA calculations

These comparisons also provide a check on the intuition noted above that "use" benefits should comprise a substantial portion of total benefits. The implied non-use benefits of the survey can be calculated by subtracting the §316(b) Proposed Rule's "use" benefits from the total implied benefits from the EPA survey.

As shown in the bottom row of Table 16, the implied "non-use" benefits are between 144 and 199 times larger than the "use" benefits. In other words, the "non-use" benefits account for over 99 percent of total benefits, whereas the commercial and recreational use benefits account for less than one percent of total benefits.

As noted above, for the vast majority of resources affected by cooling water intake structures, the resources are not unique and the potential damages are reversible. This suggests that non-use benefits are unlikely to account for a significant portion of total benefits in this case, let alone 99 percent.

Of course, the actual magnitude of non-use benefits is an empirical question. However, it is also well known that stated preference surveys are highly imprecise in practice. If the implications of the results of such a study defy common sense, then it is the researcher's duty to determine whether the intuition is wrong or whether the underlying study is flawed. In this case, the most likely causes of the unintuitive results are the serious problems with the survey instrument and econometric results described in the previous chapters.

D. Comparison of Implied Use Benefits from EPA Survey to Use Benefits using Market Valuation

Stated preference surveys such as the EPA Survey measure total willingness-to-pay, which includes both use and non-use values. Because the survey results do not provide separate estimates for use and non-use values, the preceding analysis assumed that use benefits were equal to those calculated by EPA for the §316(b) Proposed Rule.

Of course, in reality, survey respondents may have had "use" values in mind when they voted for a policy option. This would imply that "nonuse" benefits do not comprise over 99 percent of the total implied benefits of the EPA Survey. However, it raises an equally troubling issue regarding the reliability of the implied benefits estimates. If use values were indeed a significant component of respondents' willingness-to-pay, then the estimates of "use" benefits from the EPA survey are too much larger than the "use" benefit estimates from the §316(b) Proposed Rule to be taken seriously.

1. Comparison assuming Use Benefits are 50 percent of Total Implied EPA Survey Benefits

For example, assume that "use" benefits comprise 50 percent of total implied survey benefits. In that case, implied "use" benefits are between $1.1 and $3.7 billion for the four regulatory options, as displayed in Table 17. This is compared to the "use" benefits from the §316(b) Proposed Rule of between $16 and $38 million. The implied "use" benefits from the EPA survey are 70 to 100

times larger than those calculated using well-established and relatively uncontroversial market-based methods.

Table 17. Comparison of Annualized Use Benefits

	Option 1	Option 2	Option 3	Option 4
Implied Benefits from Survey (2011$ million)	$2,275	$7,330	$7,449	$2,228
50% of Implied Benefits from Survey (2011$ million)	$1,138	$3,665	$3,724	$1,114
"Use" Benefits from 316(b) Proposed Rule	$16	$37	$38	$15
Ratio of NODA to 316(b) Proposed Rule "Use" Benefits	71.9	99.5	98.9	72.2

Note: Seven percent discount rate used to calculate the discounted present values of benefits.
Source: EPA 2012b and NERA calculations

2. Comparison using "Commercial Fish Population" Attribute to Estimate EPA Survey Use Benefits

Another estimate of implied "use" benefits from the EPA survey can be attained using the "Commercial Fish Populations" environmental attribute, which is described to survey participants as "fish *used* by people" (emphasis added) and "the overall health of commercial and recreational fish populations."

Given these descriptions, the preferences measured by the Commercial Fish Population attribute can reasonably assumed to estimate "use" benefits. While it is theoretically possible that certain people have non-use values associated with the health of the commercial fish population in particular, it is more plausible that any "existence" values would be captured by other more general environmental attributes such as "Total Fish Populations," "Fish Saved," or "Condition of Aquatic Ecosystems."

EPA estimates the implicit prices in each region for the Commercial Fish Populations attribute, but does not estimate the total benefits implied by these implicit prices. Compared to the "Fish Saved" attribute, it is more difficult to estimate the implied benefits of the Commercial Fish Populations attribute. To our knowledge, explicit estimates of the changes in commercial and recreational fish populations due to the change in the number of fish saved by the §316(b) regulatory options do not exist.

Nevertheless, the EPA survey implicitly provides information on the magnitude of the changes in Commercial Fish Populations due to the policy options. EPA uses biological data to select a range of potential increases in each environmental attribute due to the §316(b) regulations. Survey respondents were presented with changes in each attribute between zero and the "max change assigned" for each attribute. For the "Fish Saved" attribute, this maximum change was 95 percent in the national survey. For the "Commercial Fish Populations" attribute, the corresponding maximum change was 6 percent (EPA 2012b). For the purpose of this analysis,

we assume that the percentage change in "Fish Saved" is propo rtional to the percentage change in "Commercial Fish Populations."

This assumption enables the calculation of an alternative estimate of the "use" benefits implied by the EPA survey results by multiplying the implicit prices by the expected changes in Commercial Fish Population due to the §316(b) regulatory options.

Table 18 displays these implied "use" benefits. Estimated ch anges in "Commercial Fish Populations" of 1.5 to 5.0 percent lead to annualized "use" ben efits of $614 million to over $2 billion. The annualized benefits are calculated in the same manner as described above, using a seven percent discount rate.

Table 18. Implied Commercial and Recreational Use Benefits of the EPA Survey

	Option 1	Option 2	Option 3	Option 4
ImplicitPrice of Commercial Fish Populuations	4.93	4.93	4.93	4.93
Maximum Change in Environmental Attribute:				
Fish Saved	95%	95%	95%	95%
Commercial Fish Populations	6%	6%	6%	6%
Change in Environmental Attribute due to Regulation s:				
Fish Saved	24.3%	78.1%	79.4%	23.8%
Commercial Fish Populations (estimated)	1.53%	4.93%	5.01%	1.50%
ImpliedAnnualized"Use" Benefits (2011$ million)	$627	$2,020	$2,052	$614

Note: Change in Commercial Fish Population calculated as the change in Fish Saved multiplied by the ratio of maximum changes in Commercial Fish Population to Fish Saved.

Source:

Table 19 compares the implied "use" benefits from the EPA sur vey to the "use" benefits calculated in the §316(b) Proposed Rule using well-establ ished market valuation methods. The implied "use" benefits of the EPA survey are 40 to 56 times lar ger than the benefit calculations for the same regulatory options from the §316(b) Proposed Rule. Estimates of "use" benefits have changed by over 4000 percent relative to the benefits calculated in the §316(b) Proposed Rule. The results for Options 2 and 3 are particularly dramatic, with the difference in estimates being roughly $2 billion.

Table 19. Comparison of Commercial and Recreational Use Benefits

	Option 1	Option 2	Option 3	Option 4
Estimated "Use" Benefits Calculated in:				
NODA using EPA Stated Preference Survey	$627	$2,020	$2,052	$614
Proposed Rule using Well Established Methods	$15	$36	$37	$15
Ratio of NODA to Proposed Rule "Use" Benefits	40.9	55.8	55.3	40.9

Source: NERA Calculations and EPA materials

These implied "use" benefit estimates show that the survey results are overwhelmingly imprecise. Consider an analogous scenario in which a business changes a reliable methodology of calculating future earnings and finds that profits calculated with a new method were 40 times larger than the calculation with the old method. There is, of course, no doubt that this business would react by either seriously re-examining its new methodology or by simply throwing these new results in the wastebasket and starting over, knowing that errors have clearly been made. There is no justification for EPA to be any less cautious spending the money of electricity ratepayers.

E. Conclusions on the Use of the EPA Survey to Estimate §316(b) Benefits

The use of the EPA survey in the final §316(b) rule would drastically change the benefits estimates of the §316(b) regulatory options. This section estimated the implied benefits of the EPA survey for these four options. These implied benefit estimates showed that the EPA survey results are either too implausible, too imprecise, or both.

The estimates in the §316(b) Proposed Rule provide what seem to be reliable measures of "use" benefits. The implied "non-use" benefits from the EPA survey are between 150 and 200 times larger than these "use" benefits. Particularly given that characteristics of the resources in question, we find these estimates to be highly implausible. It would unexpected if non-use benefits accounted for a significant portion of total benefits in this case, let alone 99 percent.

If, instead, survey respondents had "use" benefits in mind when selecting the policy options, an equally concerning issue arises. If "use" benefits comprise a significant portion of the total survey benefits, then these results are too imprecise (when compared to the reliable estimates from the §316(b) Proposed Rule) to be taken seriously.

VI. Conclusions on the Potential Use of the EPA Survey

This chapter summarizes our conclusions and recommendations regarding the potential use of the EPA survey in the final §316(b) rule. We also comment on the implications of our assessment for site-specific benefit-cost assessments.

A. The EPA Survey Should Not be Used in the Final §316(b) Rule

Our analysis of the EPA survey indicates that it does not provide the necessary information and context to respondents in order to provide the basis for meaningful assessments of the national §316(b) alternatives. The results of our empirical analysis and our estimation of implied benefits confirm that the EPA survey data are not usable. It would therefore be inappropriate to use the results of the EPA survey in the Final §316(b) Rule.

We emphasize we do not conclude that SP surveys should not be used in general or that SP surveys should never be used to assess potential non-use benefits of environmental regulations. However, we question whether any national or regional survey attempting to elicit WTP for measures of this type could provide reliable national benefit estimates. The detailed information and context that would be needed to provide the basis for valid willingness-to-pay responses would be too difficult for respondents to evaluate, resulting in choices based upon heuristic and "satisficing" choices that cannot be interpreted as valid estimates of willingness-to-pay.

Non-use benefits should instead be evaluated in site-specific assessments, which could be much more meaningful since they could focus on specific potential conditions (e.g., loss of unique resources such as threatened and endangered species).

B. EPA Should Encourage the Use of Sound Site-Specific Benefit-Cost Methodologies

EPA notes that the EPA survey results are not directly transferable to site-specific situations because they are predicated on the background information provided to respondents on the regional and national impacts of the regulatory alternatives (EPA 2012b, p. 30). As noted above, we do not develop comments on issues related to "benefit transfer," although given the flaws we have identified, this particular survey would not be appropriate for benefit transfer.

EPA should encourage use of sound site-specific benefit-cost methods, both in its comments and in the example it sets with its own analyses. Use benefits should be estimated using the well-established and sound methodologies that EPA seems to have used to estimate the use benefits of the §316(b) Proposed Rule. To assess non-use benefits for individual facilities, analysts should first assess whether non-use benefits are likely to be significant, as EPA concluded was important in its prior rulemaking (EPA 2004). If non-use benefits are found likely to be significant, analysts can consider the gains of this additional information–in terms of greater understanding of the benefits and costs of site-specific alternatives–against the costs of developing a sound survey.

References

Arrow, K., R. Solow, P.R. Portnoy, E.E. Leamer, R. Radner, and H. Schuman. 1993. "Report of the NOAA Panel on Contingent Valuation." 58 *Fed. Reg.* 4601 *et seq*. January 15.

Banzhaf, H. Spencer, Dallas Burtraw, David Evans, and Alan Krupnick. 2004. *Valuation of Natural Resource Improvements in the Adirondacks*. Washington, DC: Resources for the Future.

Barnthouse, Larry. 2012. "Review of attribute calculations within the 316(b) Stated Preference Survey." Hamilton, OH: LWB Environmental Services, Inc.: July.

Barnthouse, Larry. 2010. Review of proposed EPA willingness to pay survey. Hamilton, OH: LWB Environmental Services, Inc.: September.

Bateman, Ian J., et al. 2002. *Economic Valuation with Stated Preference Techniques: A Manual*. Northampton, MA: Edward Elger.

Berrens, Robert P. and Richard M. Adams. 1998. "Applying contingent valuation in the design of fee hunting programs: Pheasant hunting in Oregon revisited." *Human Dimensions of Wildlife* 3(3): 11-25.

Bettman, J.R., M.F. Luce, and J.W. Payne. 1998. "Constructive Consumer Processes." *Journal of Consumer Research* 25: 187-217.

Bhatia, M.R. 2005. "From Evidence to Calibration for Starting Point Bias: Willingness to pay for treated mosquito nets in Gujarat, India." *Applied Economics* 37: 1-7.

Bishop, Richard C. and Thomas A. Heberlein. 1979. "Measuring Values of Extramarket Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics* 61(5): 926-930.

Bjornstad, David, Ronald Cummings, and Laura Osborne. 1997. "A Learning Design for Reducing Hypothetical Bias in the Contingent Valuation Method." *Environmental and Resource Economics* 10: 207-221.

Blamey, R. K. et al. 1995. "Respondents to Contingent Valuation Surveys: Consumers or Citizens?" *Australian Journal of Agricultural Economics* 39: 263-288.

Bohm, P. 1992. "CVM Spells Responses to Hypothetical Questions." Working paper. Stockholm: University of Stockholm, Department of Economics.

Bradburn N. 1979 "Respondent Burden." In L. Reeder (ed.) Health Survey Research Methods: Second Biennial Conference, Williamsburg, VA Washington D.C. : US Government Printing Office.

Brookshire, D.S., M. Thayer, W.D. Schulze, and R. d'Arge. 1982. "Valuing public goods: a comparison of the survey and hedonic approaches." *American Economic Review* 72(1):165-177.

Brown, T.C., P.A. Champ, R.C. Bishop, and D.W. McCollum. 1996. "Which Response Format Reveals the Truth About Donations to a Public Good?" *Land Economics* 72(2):152-66.

Brown, Thomas C., Icek Ajzen, and Daniel Hrubes. 2003. "Further tests of entreaties to avoid hypothetical bias in referendum contingent valuation." *Journal of Environmental Economics and Management* 46:353-361.

Burton, Anthony C., Katherine S. Carson, Susan M. Chilton, and W. George Hutchinson. 2007. "Resolving Questions About Bias in Real and Hypothetical Referenda." *Environmental Resource Economics* 38: 513-525.

Cameron, Trudy Ann and Jeffrey Englin. 1997. "Welfare Effects of Changes in Environmental Quality under Individual Uncertainty about Use." *RAND Journal of Economics* 28(0): S45-S70.

Carson, R.T., W.M. Hanemann, R.C. Mitchell. 1986. *The Use of Simulated Political Markets to Value Public Goods.* Working Paper. Economics Department, University of California, San Diego.

Carson, Richard T., W. Michael Hanemann, Raymond J. Kopp et al. 1998. "Referendum Design and Contingent Valuation: The NOAA Panel's No-Vote Recommendation." *The Review of Economics and Statistics* 80(2): 335-338.

Carson, Richard T., Nicholas E. Flores, and Norman F. Meade. 2001. "Contingent Valuation: Controversies and Evidence." *Environmental and Resource Economics* 19(2): 173-210.

Carson, R.T. and T. Groves. 2007. "Incentive and informational properties of preference questions." *Environmental Resource Economics.* 37: 181-210.

Carson, Richard, Theodore Groves, and John List. 2008. *Probabilistic Influence and Supplemental Benefits A Field Test of the Two Key Assumptions Behind Using Stated Preferences*. Draft: February.

Champ, Patricia A. and Thomas C. Brown. 1997. "A Comparison of Contingent and Actual Voting Behavior." Unpublished paper, Rocky Mountain Research Station, USDA Forest Service, Fort Collins, CO.

Champ, Patricia A., Richard C. Bishop, Thomas C. Brown, and Daniel W. McCollum. 1997. "Using Donation Mechanisms to Value Nonuse Benefits from Public Goods." *Journal of Environmental Economics and Management* 33:151-162.

Cummings, Ronald G. and Laura O. Taylor. 1999. "Unbiased Value Estimates for Environmental Goods: A Cheap Talk Design for the Contingent Valuation Method." *The American Economic Review.* 89(3): 649-665.

Cummings, Ronald G., Glenn W. Harrison and E. Elisabet Rutström. 1995. "Homegrown Values and Hypothetical Surveys: Is the Dichotomous Choice Approach Incentive-Compatible?" *American Economic Review* 85(1): 260-266.

Cummings, Ronald G., Steven Elliott, Glenn W. Harrison, and James Murphy. 1997. "Are Hypothetical Referenda Incentive Compatible?" *Journal of Political Economy* 105(3):609-621.

Czaja, Ronald and Johnny Blair. 1996. *Designing Surveys: A Guide to Decisions and Procedures*. Thousand Oaks, CA: Pine Forge Press.

Desvousges, W.H., S.P. Hudson, and M.C. Ruby. 1996. "Evaluating CV Performance: Separating the Light From the Heat." In The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs. D.J. Bjornstad and J.R. Kahn, eds. Brookfield, VT: Edward Elgar Publishing Limited.

Diamond, Peter and Jerry Hausman. 1994. "Contingent Valuation: Is Some Number Better Than No Number?" *Journal of Economic Perspectives* 8: 45-64.

Diamond, Peter et al. 1993. "Does Contingent Valuation Measure Preferences? Experimental Evidence" in *Contingent Valuation: A Critical Assessment*, ed. by Jerry Hausman. New York: Holland.

Diamond, Peter. 1996. "Testing the Internal Consistency of Contingent Valuation Surveys." *Journal of Environmental Economics and Management* 30: 337-347.

Dickie, M., A. Fisher, and S. Gerking. 1987. "Market transactions and hypothetical demand data: a comparative study." *Journal of the American Statistical Association* 82(1): 69-75.

DiFilippo, Michael N. and John S. Maulbetsch. 2003. *Use of Degraded Water Sources as Cooling Water in Power Plants*. Report prepared for the California Energy Commission (CEC) Public Interest Energy Research (PIER) Program. Sacramento: CEC.

Duffield, J.W. and D.A. Patterson. 1992. "Field Testing Existence Values: An Instream Flow Trust Fund for Montana Rivers." Paper presented at the Allied Social Science Associations annual meeting. New Orleans, LA, January 4.

Frederick, Shane and Baruch Fischhoff. 1998. "Scope (in)sensitivity in elicited valuations." *Risk Decision and Policy.* 3(2): 109-123.

Fischhoff, Baruch and Lita Furby. 1988. "Measuring Values: A Conceptual Framework for Interpreting Transactions with Special Reference to Contingent Valuation of Visibility." *Journal of Risk and Uncertainty* 1: 147-184.

Freeman, A. Myrick III. 2003. *The Measurement of Environmental and Resource Values: Theory and Methods*. 2nd ed. Washington, DC: Resources for the Future.

Green, Donald. 1998. "Referendum Contingent Valuation, Anchoring, and Willingness to Pay for Public Goods." *Resource and Energy Economics* 20: 85-116.

Hackl, Franz and Gerald J. Pruckner. 2005. "Warm Glow, Free-Riding and Vehicle Neutrality in a Health-Related Contingent Valuation Study." *Heealth Economics* 14: 293-306.

Hanemann, W. Michael. 1994. "Valuing the Environment Through Contingent Valuation." *Journal of Economic Perspectives* 8: 19-43.

Harrison, David, Albert L. Nichols, and Meghan McGuinness. 2009a. *A Victory for Economic and Environmental Rationality: Supreme Court Allows Cost-Benefit Analysis in Setting Important Clean Water Act Standards*. Boston, MA: NERA Economic Consulting, April. www.nera.com/extImage/PUB_Clean_Water_Act_0809.pdf .

Harrison, David, Andrew Foss, Albert L. Nichols, Samuel Grausz, and David Nagler. 2009b. *Preliminary Costs and Benefits of California Draft Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling.* Report prepared for the California Council for Environmental and Economic Balance. Boston, MA: NERA Economic Consulting, September. www.swrcb.ca.gov/water_issues/programs/npdes/docs/cw_a316_2009sept/comments/hertel_attachments/neracceeb_costsbenefits.pdf

Harrison, David, Gregory K. Leonard, Andrew Foss, William H. Desvousges, and Holly Michael. 2010. *Comments on EPA's Proposed Survey to Estimate the Potential Benefits of Alternative Cooling Water Intake Policies*. Report prepared for the American Chemistry Council, American Forest & Paper Association, American Petroleum Institute, and Utility Water Act Group. Boston, MA: NERA Economic Consulting and WH Desvousges & Associates, September.

Harrison, David, Gregory Leonard, Albert Nichols, Noah Kaufman, and Andrew Foss. 2011. *Comments on Economic Issues Related to EPA's Proposed Regulations for Cooling Water Intake Structures at Existing Facilities*. Report prepared for the Utility Water Act Group. Boston, MA: NERA Economic Consulting, August.

Herzog, A. Regula and Jerald G. Bachman. 1981. "Effects of Questionnaire Length on Response Quality." *Public Opinion Quarterly*. 45(4): 549-559

Holmes, Thomas P. and Adamowicz, Wiktor L. 2003. "Attribute-Based Methods." In *A Primer on Nonmarket Valuation*. Kluwer Academic Publishers: Dordrecht.

Horowitz, John. 2000. "Discussion of Theory and Design of Stated Preference Methods." Stated Preference: What Do We Know? Where Do We Go? A Workshop Sponsored by the USEPA's National Center for Environmental Economics and National Center for Environmental Research. Washington, DC: October 12.

Johnston, R.J., T.F. Weaver, L.A. Smith and S.K. Swallow. 1995. Contingent Valuation Focus Groups: Insights From Ethnographic Interview Techniques. *Agricultural and Resource Economics Review* 24(1): 56-69.

Johnston, Robert J. 2006. "Is Hypothetical Bias Universal? Validating Contingent Valuation Responses Using a Binding Public Referendum." *Journal of Environmental Economics and Management* 52:469-481.

Kahnemann, Daniel. 2011. *Thinking, Fast and Slow*. New York, NY: Penguin Group.

Kealy, M.J., M. Montgomery, and J.F. Dovidio. 1990. "Reliability and Predictive Validity of Contingent Values: Does the Nature of the Good Matter?" *Journal of Environmental Economics and Management* 19(3):244-263.

Knetsch, J.L. and R.K. Davis. 1966. "Comparisons of methods for recreation evaluation." In: A.V. Kneese, S.C. Smith (Eds.), *Water Research*, Resources for the Future Inc. Baltimore: John Hopkins Press. 125-142.

Krosnick, Jon A. 1991. "Response Strategies for Coping with the Cognitive Demands of Attitude measures in surveys." *Applied Cognitive Psychology* 5: 213-236.

Krosnick, Jon A., Sowmya Narayan, and Wendy R. Smith. 1996. "Satisficing in Surveys: Initial Evidence." *New Directions for Evaluation* 70: 29-44, p.32.

Landry, Craig E., and John A. List. 2007. "Using Ex Ante Approaches to Obtain Credible Signals for Value in Contingent Markets: Evidence from the Field." *American Journal of Agricultural Economics* 89(2):420-429.

Lazo, Jeffrey K., William D. Schulze, Gary H. McClelland, and James K. Doyle. 1992. "Can Contingent Valuation Measure Nonuse Values?" *American Journal of Agricultural Economics* 74(5): 1126-1132.

List, J.A and J.F. Shogren. 1998. "Calibration of the difference between actual and hypothetical valuations in a field experiment." *Journal of Economic Behavior and Organization* 37(2):193-206.

Loomis, J., M. Creel, and T. Park. 1991. "Comparing benefit estimates from travel cost and contingent valuation using confidence intervals for Hicksian welfare measures." *Applied Economics* 23(11): 1725-1731.

Loureiro, Maria L. and Justus Lotade. 2005. "Interviewer Effects on the Valuation of Goods with Ethical and Environmental Attributes." *Environmental and Resource Economics* 30: 49-72.

Maulbetsch, John S. and Michael N. DiFilippo. 2007. *Issues Analysis of Retrofitting Once-Through Cooling Plants with Closed-Cycle Cooling*. Report prepared for the Electric Power Research Institute (EPRI). EPRI Product No. TR-052907. Palo Alto ,CA: EPRI.

Maulbetsch, John S. and Michael N. DiFilippo. 2010. *Performance, Cost, and Environmental Effects of Saltwater Cooling Towers*. Report prepared for the California Energy Commission (CEC) Public Interest Energy Research (PIER) Program. Sacramento: CEC.

McClelland, G.H., W.D. Schulze, J.K. Lazo, D.M. Waldman, J.K. Doyle, S.R. Elliot, and J.R. Irwin. 1992. *Methods for Measuring Non-Use Values: A Contingent Valuation Study of Groundwater Cleanup*. Boulder: University of Colorado.

Murphy, J.J. and T.H. Stevens. 2004. "Contingent valuation, hypothetical bias, and experimental economics." *Agricultural and Resource Economics Review* 33(2): 182-192.

National Oceanic and Atmospheric Administration (NOAA). 1994. "Natural Resource Damage Assessments; Proposed Rules." 59 *Fed. Reg.* 1062 *et seq*. January 7.

National Oceanic and Atmospheric Association (NOAA). 1996. "Natural Resource Damage Assessments; Final Rule." 61 *Fed. Reg.* 440 *et seq*. January 5.

National Research Council. 2004. *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*. Washington, DC: NRC.

NERA Economic Consulting and W.H. Desvousges & Associates. 2010. "Comments on EPA's Proposed Survey to Estimate the Potential Benefits of Alternative Cooling Water Intake Policies." September.

Norwood, F. Bailey. 2005. "Can Calibration Reconcile Stated and Observed Preferences?" *Journal of Agricultural and Applied Economics*, April.

Payne, J.W., J.R. Bettman, and D.A. Schkade. 1999. "Measuring Constructed Preferences: Towards a Building Code." *Journal of Risk and Uncertainty* 19: 243-270.

Portney, Paul. 1994. "The Contingent Valuation Debate: Why Economists Should Care." *Journal of Economic Perspectives* 8(4): 3-17.

Schläpfer, Felix, Anna Roschewitz, and Nick Hanley. 2004. "Validation of Stated Preferences for Public Goods: A Comparison." *Ecological Economics* 51:1-16.

Schläpfer, F. 2008. "Contingent valuation: A new perspective." *Ecological Economics* 64(4): 729-740.

Schuman, Howard and Stanley Presser. 1981. *Questions and Answers in Attitude Surveys: Experiments on Question Form, Wording, and Context*. Thousand Oaks, CA: Sage Publications.

Seip, K. and J. Strand. 1992. "Willingness to Pay for Environmental Goods in Norway: A Contingent Valuation Study with Real Payment." *Environmental and Resource Economics* 2(1):91-106.

Shabman, L. and K. Stephenson. 1996. "Searching for the correct benefit estimate: empirical evidence for an alternative perspective." *Land Economics* 72(4): 433-449.

Sudman, Seymour and Norman M. Bradburn. 1982. *Asking Questions: A Practical Guide to Questionnaire Design.* San Francisco, CA: Jossey-Bass Publishers.

Sudman, Seymour, Norman M. Bradburn, and Norbert Schwarz. 1996. *Thinking About Answers: The Application of Cognitive Processes to Survey Methodology.* San Francisco, CA: Jossey-Bass Publishers.

Taylor, Laura 0. 1998. "Incentive Compatible Referenda and the Valuation of Environmental Goods." *Agricultural and Resource Economics Review* 27(2):132-39.

Taylor, Laura O., Michael McKee, Susan K. Laury, and Ronald G. Cummings. 2001. "Induced-Value Tests of the Referendum Voting Mechanism." *Economics Letters* 71:61-65

Thompson, Dale B. 2002. "Valuing the environment: Courts' struggles with natural resource damages." *Environmental Law*, January.

Train, Kenneth E. 2009. *Discrete Choice Methods with Simulation: Second Edition*. New York, NY: Cambridge University Press.

U.S. Department of Energy (DOE). 2008. *Electricity Reliability Impacts of a Mandatory Cooling Tower Rule for Existing Steam Generation Units*. Washington, DC: DOE.

U.S. Environmental Protection Agency (EPA) Science Advisory Board (SAB). 2009. *Valuing the Protection of Ecological Systems and Services*. Report Number EPA-SAB-09-012. May.

U.S. Environmental Protection Agency (EPA). 2000. *Guidelines for Preparing Economic Analyses*. Washington, DC: EPA, September.

U.S. Environmental Protection Agency (EPA). 2001. *Technical Development Document for Section 316(b) Rule for New Facilities*. Chapter 3: Energy Penalties, Air Emissions, and Cooling Tower Side-Effects. Washington, DC: EPA.

U.S. Environmental Protection Agency (EPA). 2004. National Pollution Discharge Elimination System-Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities. 69 *Fed. Reg.* 41576 *et seq*. July 9.

U.S. Environmental Protection Agency (EPA). 2010a. *Guidelines for Preparing Economic Analyses*. Office of the Administrator. EPA 240-R-10-001. Washington, DC: EPA, December 17.

U.S. Environmental Protection Agency (EPA). 2010b. *Supporting Statement for Information Collection Request for Willingness to Pay Survey For §316(b) Existing Facilities Cooling Water Intake Structures: Instrument, Pre-Test, and Implementation*. Washington, DC: EPA, July 21.

U.S. Environmental Protection Agency (EPA). 2011a. "Findings from 2010 Focus Groups Conducted Under EPA ICR #2402.01." Washington, DC: EPA, January 19.

U.S. Environmental Protection Agency. 2011b. *Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule*. Washington, DC: EPA, March 28.

U.S. Environmental Protection Agency (EPA). 2011c. "Fish and Aquatic Habitat: A Survey of Northeast Residents." Washington, DC: EPA, August 1.

U.S. Environmental Protection Agency (EPA). 2011d. *Response to "Comments of American Chemistry Council, American Forest & Paper Association, American Petroleum Institute, and Utility Water Act Group on ICR for Willingness to Pay Survey for Section 316(b) Existing Facilities Cooling Water Intake Structures (Federal Register Vol. 75, No. 139: 42438-42440; July 21, 2010) and EPA Supporting Documents"*. Docket ID No, EPA-HQ-OW-2010-0595. January.

U.S. Environmental Protection Agency. 2011e. *Proposed Rule: National Pollution Discharge Elimination System-Cooling Water Intake Structures at Existing Facilities and Phase I Facilities. 76 Fed. Reg. 22174.* April 20.

U.S. Environmental Protection Agency (EPA). 2012a. *National Pollutant Discharge Elimination System–Proposed Regulations To Establish Requirements for Cooling Water Intake Structures at Existing Facilities; Notice of Data Availability Related to EPA's Stated Preference Survey.* Federal Register Vol. 77, No. 113. Washington, DC: EPA, June 12.

U.S. Environmental Protection Agency (EPA). 2012b. *316(b) Stated Preference (SP) Survey – Survey Methods and Model Results.* Washington, DC: EPA, June 5.

U.S. Government Accountability Office (GAO). 2010. *Energy-Water Nexus: Improvements to Federal Water Use Data Would Increase Understanding of Trends in Power Plant Water Use*. Washington, DC: GAO.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report*. Washington, DC: NRC.

U.S. Office of Management and Budget (OMB). 1996. *Economic Analysis of Federal Regulations Under Executive Order 12866*. January 11.

U.S. Office of Management and Budget (OMB). 2003. *Circular A-4 to the Heads of Executive Agencies and Establishments Regarding Regulatory Analysis*. Washington, DC: OMB, September 17.

Vossler, Christian A. and Joe Kerkvliet. 2003. "A Criterion Validity Test of the Contingent Valuation Method: Comparing Hypothetical and Actual Voting Behavior for a Public Referendum." *Journal of Environmental Economics and Management* 45:631-649.

Vossler, Christian A., Joe Kerkvliet, Stephen Polasky, and Olesya Gainutdinova. 2003. Externally Validating Contingent Valuation: An Open-Space Survey and Referendum in Corvallis, Oregon. *Journal of Economic Behavior & Organization* 51:261-277.

Wang, Hua. 1997. "Treatment of 'Don't Know' Responses in Contingent Valuation Surveys: A Random Valuation Model." *Journal of Environmental Economics and Management* 32(2): 219-232.

Appendix A: Detailed Open-Ended Survey Responses

This appendix displays the transcribed comments of respondents to the EPA survey.

A significant proportion of the 353 questionnaires that included respondent comments indicated some type of problem with the survey or posed a validity issue. 46% of the comments indicated such problems, and 42% of these problematic comments were complaints about the survey itself while 33% were complaints about the EPA and/or government regulations in general.

The tables below provide a list of responses to the open-ended survey question. We have grouped them according to whether or not they are supportive of the survey (positive, negative) and in a general group.

Table A-1. Summary of Negative Open-Ended Survey Comments

WHILE I STRONGLY BELIEVE IN AQUATIC CONSERVATION,TH E COST OF SOME PLANS SEEMED HIGH GIVEN VERY SMALL EXPECTED %CHANGES. (41)

SURVEY WAS VERY DIFFICULT TO UNDERSTAND AND FOLLOW. (64)

UNCLEAR WHAT MAKES 4-6 DIFFERENT. ARE THERE 6 DIFFERENT POLICIES? YOU KNEW THEY WERE CONFUSING SO WHY NOT WRITE THEM SO THEY ARE NOT. (65)

THIS SURVEY WAS OBVIOUSLY DONE AT CONSIDERABLE EXPENSE AND IS MUCH TOO COMFUSING TO HAVE ANY VALUE. (76)

POORLY DESIGNED (240)

THIS SURVEY IS POORLY CONSTRUCTED AND I DO NOT TRUST IT. (247)

THIS SURVEY IS TOO CONFUSING. (264)

ARGUEMNT WAS BIASED-DATA PRESENTED WAS SKETCHY,DID NOT PRESENT A REAL BASIS ON HOW IT IS PROBED THAT INTAKES KILL FISH LARVAE. (274)

Q8, NOT SURE THE SURVEY QUESTIONS ALLOWED FOR FINER POINTS OF AN ANSWER.EX Q8/5 EASY TO ANSWER,WELL,YES EASY TO DECIDE ON AN ANSWER BUT NOT EASY IF ASKING ABOUT THE LEVEL OF CONSIDERATION TO DECIDE ON AN ANSWER THAT BALANCED MORAL OBLIGATION WITH COSTS,ETC. SURVEY DESIGN NOT AS SHARP AS IT COULD HAVE BEEN TO DETERM INE PROCESS VS RESULT TO ANSWERS. (291)

A POORLY WRITTEN SURVEY. (308)

TRY AND MAKE THE QUESTION & BACKGROUND MATERIAL EASIER TO DIGEST IF POSSIBLE. (333)

I DID NOT FULLY UNDERSTAND THIS SURVEY (387)

FOR THE LAY PERSON,THIS SURVEY WAS A LITTLE CONFUSI NG. (427)

SURVEY FELT BIASED IN FAVOR OF AGENDA.. (530)

CONFUSING SURVEY! (678)

I HAVE A BS IN BIOLOGY & THE WORDING OF THIS SURVEY/LAYOUT WERE STILL INCREDIBLY OPAQUE! (707)

THE QUESTIONS ASKED WERE DIFFICULT TO UNDERSTAND AND MADE IT DIFFICULT TO UNDERSTAND THE END RESULT OF THE SURVEY. (799)

BIASED POOR SURVEY! (968)

IT WOULD BE NICE IF YOU MADE THIS MORE SIMPLE TO UNDERSTAND FOR THE SURVEY. I AGREE WITH USING DIFFERENT FILTERS AND CLOSED CYCLE COOLING. IF ITS NOT GOING TO AFFECT COST TO THE PUBLIC OR IF IT HELPS WITH WORKING THINGS BETTER FOR THE FISH LIFE. (1139)

THIS SURVEY WAS HIGHLY BIASED TO PROMOTE PRO ENVIRONMENTAL RESPONSES. (1326)

THIS IS AN IMPORTANT ISSUE THAT COULD HAVE BEEN PRESENTED IN A MUCH SIMPLER FASHION. THIS WAS CONFUSING AND I DON'T THINK YOU WILL GET THE INFORMED ANSWERS FROM THE PUBLIC THAT YOU NEED. (1420)

THIS SURVEY IS HIGHLY DIFFICULT TO FOLLOW-PAGES 3AND6 SURVEY QUESTIONS ARE NOT WELL PREPARED FROM INFORMATION GIVEN-ALMOST A DOUBLE NEGATIVE IN TRYING (1508)

QUESTIONS 4-6 NEAR IMPOSSIBLE TO UNDERSTAND (1569)

Q4,5,6 WERE RATHER UNCLEAR. (1673)

I WOULD HAVE APPRECIATED MORE INFORMATION REGARDING METHODS. (1727)

IT WAS NOT WRITTEN CLEARLY. I AM IN THE LEGAL PROFESSION & I FOUND IT TO BE CONFUSING. (1782)

I THOUGHT THIS WAS VERY POORLY WRITTEN. THE DESCRIP TIONS WERE VERY CONFUSING AND DIDN'T CLEARLY EXPLAIN THE SITUATION. (1858)

QUESTION 11 WAS VERY CONFUSING AND MADE THE REST OF THE SURVEY SEEM DAUNTING (2053)

SOME QUESTIONS WERE CONFUSING. (2099)

Notes: Numbers in parentheses indicate the row in the spreadsheet provided by EPA.
Source: EPA 2012 Survey Data ("survey data.xls").

Table A-2. Summary of Positive Open-Ended Survey Comments

SURVEY PRETTY WELL DESIGNED,DO MORE OF THEM IN OTHER EPA AREAS LIKE AIR POLLUTION,DRINKING WATER IF YOU CAN. THANKS (119)

EXCELLENT -SORRY THIS IS LATE-I WAS AWAY. (165)

THIS SURVEY WAS VERY WELL DONE. THANKS FOR INCLUDING OUR HOUSEHOLD. (347)

VERY GOOD INFO. HOPE THAT WE PRESERVE AQUATIC ECOSYSTEM FOR FUTURE GENERATIONS. (416)

THANK YOU FOR GIVING US A VOICE! (424)

THE STATE DOES A GOOD JOB AT REGULATING THE INDUSTRY. (523)

THANK YOU FOR ASKING THE PUBLIC FOR OUR OPINIONS ON POLICY. I DEFINITELY SUPPORT CLOSED WATER SYSTEMS-GREATEST FISH PROTECTION AND RECYCLING H20 USED (649)

THANK YOU FOR THE OPPORTUNITY TO LEARN MORE ABOUT PROTECTING OUR WATER ENVIRONMENT AND ALLOWING ME TO VOICE MY OPINION. (703)

THE INFORMATION WAS A LITTLE SIMPLISTIC,NEVER THE LESS,YOU DID A GOOD JOB. (740)

THANK YOU FOR INFORMING THE SOCIETY OF THE FISH LOSS,I NEVER KNEW WE WERE LOSING FISH. (760)

THANK YOU FOR PROTECTING OUR ECO SYSTEM! (782)

EXCELLENT SURVEY! (868)

INTERESTING-IMPORTANT SURVEY. (934)

HOPED I HELP MAKE A POSITIVE CHANGE BY PARTICIPATING IN THIS SURVEY. I HAVE STRONGLY THOUGHT ABOUT PURSUING A DEGREE IN ECONOMICS NOW I HAVE HAD A CHANCE TO PLAY A PART IN DOING SO. (998)

THANK YOU FOR LETTING ME PARTICIPATE. I REALIZE I WAS ANSWERING YOUR QUESTIONS AND THERE IS MUCHMORE TO THIS ISSUE. (1024)

PLEASE KEEP UP THE GREAT WORK TO PROTECT OUR BEAUTIFUL COUNTRY. (1200)

I REALLY APPRECIATE THE EPS'S CONCERN FOR FISH POPULAR ROWS. GOOD JOB GENTLEMAN & LADIES. (1340)

GOOD LUCK WITH YOUR EFFORTS AND ANALYSIS! (1410)

GOOD JOB! (1543)

THANK YOU FOR ASKING FOR MY OPINION. (1822)

I SINCERELY HOPE THAT THE RESPONSE TO THIS SURVEY YIELDS POSITIVE RESULTS FOR THIS VITALLY IMPORTANT ISSUE. AQUATIC ECOSYSTEMS ARE NOT ONLY CRUCIAL SOURCES OF RECREATION AND COMMERCIAL FISHING BUT AS KEY ELEMENTS OF THE NATURAL BEAUTY AND WEALTH AROUND US. FURTHERMORE,THEY HAVE THEIR OWN NATURE GIVEN RIGHT TO EXIST REGARDLESS OF THEIR VALUE TO US. THESE ORGANISIMS AND ECOSYSTEMS ARE THE RESULT OF MILLIONS OF YEARS OF EVALUATION. THEY WERE HERE FIRST,WE HAVE NO RIGHT TO DESTROY THEM. (1882)

VERY GOOD EFFORT TO EDUCATE THE PUBLIC AND PROVIDE OPPORTUNITY TO CONTRIBUTE OPINIONS. WE NEED MORE OF THIS. (1952)

I HOPE AND PRAY FOR THE SUCCESS OF THE PROPOSED POLICIES THAT WOULD REDUCE FISH LOSSES. (1965)

SURVEYS ARE USEFUL,BUT LESS IMPORTANT THAN EXPERT OPINION. (2088)

THANK YOU FOR ASKING TO PARTICIPATE,OUR ECO-LIFE IS IMPORTANT TODAY,TOMORROW AND FUTURE. IF WE WANT FUTURE WE NEED TO PLAN FOR IT AND PAY FOR IT. (2158)

THANKS FOR THE OPPORTUNITY TO BE A PART OF THIS SURVEY. I LOVE FISHING AND AM CONCERNED. (2246)

VERY INFORMATIVE & A PLEASURE TO PARTICIPATE. THANK YOU (2312)

Notes: Numbers in parentheses indicate the row in the spreadsheet provided by EPA.
Source: EPA 2012 Survey Data ("survey data.xls").

Table A-3. Summary of Other Survey Comments with Validity Concerns

THIS COUNTRY IS ON A SLIPPERY SLOPE TO SOCIALISM/CO MMUNISM. (29)

I DON' T KNOW WHY I GOT THIS BUT I HAVE LOTS OF NEIGHBORS WHO FISH ALL THE TIME & THEY NEVER GOT THESE?? (72)

THIS WHOLE EXERCISE IS A WASTE OF PUBLIC MONEY BY THE EPA. (90)

IF FISH AND SEAFOOD GOES THE WAY OF WHEAT AND CORN FOR FAKE FUEL (I.E. ETHANOL) WE (THE PEOPLE) ALL WILL STARVE TO DEATH AND MONEY WON' T BE NECESSARY (111)

I HAVE LITTLE FAITH IN BIG GOVERNMENT. (112)

JOKE - LEAVE OUR ECOSYSTEM ALONE, NO MORE REGS, GOD IS IN CONTROL, ALL WILL GO WELL WITH FISH (125)

IS THE GOV REALLY CONCERNED ABOUT THIS SURVEY? THEY ARE NOT TOO CONCERNED ABOUT MY COUNTRY RIGHT NOW. (138)

THIS IS A BULLSHIT SURVEY. (233)

VERY CONFUSING TO UNDERSTAND. ENJOY SEAFOOD VERY MUCH. (295)

YOU COULD HAVE SAVED MONEY BY NOT SENDING GHESE SURVEYS IN THE MAIL AND SAVE ON POSTAGE BY NOT SENDING ME MULTIPLE REMINDERS! USE THIS $$$ TO SAVE THE FISH. SAVE THE MONEY YOU USE TO SEND THESE SURVEYS TO SAVE THE FISH & ENVIORNMENT. YOU ALSO SENT ME MULTIPLE REMINDERS VIA THE USPS-WHICH THE $ COULD ALSO BE USED SOMEWHERE ELSE! SAVE PAPER $$-SEND THE SURVEYS VIA EMAIL. (370)

WAS A WASTE OF MY TIME HAVE TWINS 2 THREE MO OLD BABIES TO TAKE CARE OF. (382)

WHY DO YOU PLAY GOD? (384)

THE EPA HAS SCREWED UP ENOUGH (479)

I DO NOT UNDERSTAND THIS SURVEY. I THINK THIS IS ANOTHER WAY FOR THE GOVERNMENT TO INVADE MY PRIVACY LIFE. (514)

THOSE PEOPLE WHO CAUSED PROBLEMS SHOULD PAY ALL COSTS TO CORRECT ALL PROBLEMS. (536)

THIS IS A GARGANTUAN WASTE OF TAXPAYER DOLLARS!!! (552)

BY SAVING THE FISH YOU SAVE THE FUTURE. (559)

EPA NEEDS TO BE ABOLISHED! (614)

MAN CANNOT DESTROY WHAT GOD CREATED,GOVERNMENT CAN DESTROY MAN! (636)

EPA DOESN' T WANT TO READ MY COMMENTS! (662)

I DO NOT HAVE ANY COMMENTS-I DO NOT WISH TO DO THIS ANY MORE. (669)

WE JUDGE ANCIENT CIVILIZATIONS BY THE QUALITY OF THEIR WATER AND WASTE SYSTEMS! SOMEONE WILL JUDGE OURS DON' T YOU THINK (677)

AS A BOY SCOUT LEADER I UNDERSTAND ABOUT NATURE AND IT IS OUR SACRIFICE WE ALL MUST MAKE TO KEEP OUR PLANET HEALTHY. (691)

NO MORE GOVERNMENT REGULATIONS! (753)

THANK YOU FOR INFORMING THE SOCIETY OF THE FISH LOSS,I NEVER KNEW WE WERE LOSING FISH. (760)

IF WE DON' T GET THIS RIGHT NOW WE WILL ALL GO EXTINCT. (793)

Notes: Numbers in parentheses indicate the row in the spreadsheet provided by EPA.
Source: EPA 2012 Survey Data ("survey data.xls").

References

U.S. Environmental Protection Agency (EPA). 2012. "316(b) SP Survey Data." Washington, DC: EPA, May 25.

Appendix B: Overview of the Mixed Logit Framework

This appendix provides information on the mixed logit model used by EPA in its econometric analysis.

A. The Random Utility Model

The EPA econometric analysis is based on the random utility model, in which the utility of a survey respondent is assumed to be "the sum of systematic [or observed] and random [or unobserved] components" (Holmes and Adamowicz 2003, p. 189). It is common in the stated preference literature to use the random utility model to convert survey responses into welfare measures.

B. The Mixed Logit Framework

Willingness-to-pay for environmental attributes in all four survey regions (as well as for the national survey) is estimated using maximum likelihood mixed logit models. The mixed logit model is a generalization of the multinomial logit model which "obviates the three limitations of standard logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time" (Train, 2003). The model can be written in standard statistical form as:

$$
\begin{aligned}
& y_{it} = j \Leftrightarrow u_{ijt} = \max_k u_{ikt} \\
& u_{ijt} = x_{ijt}\beta_i + \varepsilon_{ijt} \\
& \varepsilon_{ijt} \sim Gumbel \quad)1,0(\\
& \beta_i \sim f(\beta_i \quad \theta)|
\end{aligned}
$$

where i indexes decision-makers, j indexes options (i.e. available choices), and t indexes choice situations faced by each decision-maker. The chosen policy for each decision-maker and choice situation is given by y_{it}. Both ε_{ijt} and β_i are assumed to be independent and identically distributed with a unit-scale Gumbel distribution and a general, continuous, usually parametric multivariate distribution given by $f(\beta_i \quad \theta)|$, respectively. In the simplest case, $f(\beta_i \quad \theta)|$ is specified to be multivariate normal with a diagonal covariance matrix, but many other joint distributions can be used for the β_i parameters.

Marginalizing over the ε_{ijt} in this model gives rise to the familiar expression for the simple logit choice probabilities:

$$
L_{ijt} = \frac{e^{x_{ijt}\beta_i}}{\sum_k e^{x_{ikt}\beta_i}}
$$

where for some l, $x_{ilt}\beta_i$ is restricted to be zero for identification. This is often accomplished by differencing all of the x_{ijt}'s from x_{ilt}. Thus the *marginal* choice probabilities for each individual are mixtures of standard logit choice probabilities, i.e.:

$$P_{ijt}(\theta) = \int L_{ijt} f(\beta_i \mid \theta) d\beta_i$$

This model is known as "mixed logit" because the choice probabilities are a mixture of standard logit choice probabilities. Parameter inference generally focuses on the parameters of the mixing distribution, indicated above by θ. In the case where the random coefficients are taken to have a multivariate normal distribution, $\theta = (\mu, \Sigma)$, the mean vector and covariance matrix of the distribution.

Estimation of this model is usually achieved using simulated maximum likelihood (see Train, 2003). In brief, this involves sampling random numbers for each decision-maker, corresponding to samples from the distribution $f(\beta_i \mid \theta)$, and taking the mean of the logit choice probabilities calculated at each of these sampled values. It follows that the estimation of a mixed model is more complex than the estimation of a simple logit model, because one must calculate a simulation-based approximation to a multidimensional integral for each iteration of the optimization algorithm.

References

Holmes, Thomas P. and Adamowicz, Wiktor L. 2003. "Attribute-Based Methods." In *A Primer on Nonmarket Valuation*. Kluwer Academic Publishers: Dordrecht.

Train, Kenneth E. 2009. *Discrete Choice Methods with Simulation: Second Edition*. New York, NY: Cambridge University Press.

Appendix C: Comparison of Mixed Logit Software Packages

Using the EPA survey data, we conducted our econometric analyses with two software packages (LIMDEP and STATA). This appendix provides information on the software packages that have been developed to estimate mixed logit models, and it explains why it may be important to use more than one package when conducting such analyses.

A. Recent Literature on the Mixed Logit Software Packages

The statistics literature has included discussions recently regarding software choice for estimating mixed logit models. In a 2010 paper in the "Software Reviews" section of *Journal of Applied Econometrics*, Jae Bong Chang of the Korea Rural Economics Institute and Jayson Lusk of Oklahoma State compare LIMDEP, the mixlogit package in STATA, and SAS for estimating mixed logit models. A cursory reading of this paper gives the impression that LIMDEP performed the best of the three packages. However, more careful examination makes it clear that this conclusion was based on the inclusion of results from the mixlogit package in which STATA indicated that the model did not converge. Inclusion of such results makes no sense. The authors themselves write that:

> In smaller sample sizes, Hole's module for Stata either performs best or worst depending upon how one wants to treat cases where Stata indicated non-convergence (recall that the same datasets were used in all three packages, so SAS and NLOGIT sometimes indicated that convergence was achieved when Stata did not).

Thus, when compared only across cases where all three models indicated convergence, the mixlogit package slightly outperforms NLOGIT (LIMDEP) and both outperform SAS. Notably, the Chang and Lusk paper did not assess the performance of the estimation algorithms for models in which random effects were correlated, as they are in EPA's chosen specification. The authors also point out a troubling fact: in some cases, LIMDEP indicates convergence when STATA does not converge. It is possible that in these cases we are observing false convergence in LIMDEP. Note that the mixlogit package uses the built-in optimization routines in STATA, which are used for all of the base STATA functions and are considered highly reliable. Moreover, the authors themselves concede that STATA performs the best when considering only models for which all packages converged. Since all of the models we ran converged in both STATA and LIMDEP, we conclude that the literature supports our own conclusion that the mixlogit package in STATA performs at least as well as LIMDEP.

A final point from the Chang and Lusk paper that is relevant to this study is the authors' conclusion that "when the sample size is small...there may be insufficient variation to model the kind of distributional information being assumed by the ML [Mixed Logit]. People may be asking 'too much' of their data when trying to fit an ML model to small-sized datasets." This comment was in reference to simulation studies carried out by the authors in which they generated synthetic datasets with 200 decision-makers and four choice experiments per decision-maker. This is comparable in size to EPA's regional datasets, which have three (and sometimes

fewer than three because of nonresponse) choice experiments per decision-maker and between 270 and 752 decision-makers. Thus, the size of EPA's sample may be insufficient to estimate such complex models, particularly for the regions with a smaller number of responses (national, pacific, and northeast regions).

In a response to the Chang and Lusk paper, Arne Risa Hole, the author of the mixlogit package, points out that the simulated data used by Chang and Lusk was probably not sufficient for a meaningful model comparison. Hole finds that some of the simulated data used by Chang and Lusk did not contain "sufficient variation to identify the model empirically" and that their experiment thus is "not well-suited to evaluate the accuracy of different mixed logit routines."

B. Conclusions from the Recent Literature

The discussion above support four general conclusions regarding the importance of software choice in estimation of mixed logit models:

1. The performance of different software packages remains controversial. The Chang and Lusk study suggests that, at least where meaningful comparisons can be made (i.e. where all models converged), the mixlogit package for STATA performs slightly better than LIMDEP.

2. Chang and Lusk caution researchers about the unreliability of mixed logit models estimated on "small samples." In context this referred to samples of 200 decision-makers and four choice situations per decision-maker. This is comparable to the size of the samples gathered by EPA for the Northeast, Pacific, and National surveys.

3. Hole's research paper suggests that the Chang and Lusk study is probably not conclusive regarding comparisons about software, but does not question Chang and Lusk's comments about the potential inadequacy of small sample sizes for estimating mixed logits.

4. In light of the ongoing controversy regarding the accuracy of mixed logit estimation algorithms in different software packages, a thorough analysis should estimate the model in multiple packages and compare results across the different pckages to look for signs of problems with the estimation.

Consistent with our point four above, we carried out estimation of identical mixed logit models on the northeast survey data using both LIMDEP and STATA as well as the original MATLAB code for mixed logit estimation using simulated maximum likelihood written by Kenneth Train at UC Berkeley, the originator of the simulated maximum likelihood estimation method, which is used by both STATA and LIMDEP. Note that the study authors have collaborated with Professor Train on projects involving the estimation of mixed logit models in the past and are highly experienced in the estimation and interpretation of such models. Our results are provided in the following section.

C. Comparison of Mixed Logit Models Estimated in LIMDEP, STATA, and MATLAB

To further investigate the accuracy and robustness of mixed logit estimation routines in LIMDEP and STATA, we estimated the same model in both packages as well as using Train's MATLAB code. The MATLAB code is the original mixed logit implementation and is generally considered a benchmark. Because the MATLAB code can only estimate models with the random coefficients independent, we compare the model for the northeast with a diagonal covariance matrix across all three packages. The results are comparable for the three packages, with the agreement slightly better between LIMDEP and MATLAB. This suggests that the problems with estimation in NLOGIT are probably restricted to models with unrestricted covariance matrices for the random coefficients. The estimation of correlations is generally more difficult than the estimation of variances, and optimization-based estimation of these parameters is notoriously difficult, particularly on small sample sizes. Based on this result, we estimate alternative specifications in at least two software packages wherever possible.

Table C-1. Results from STATA, LIMDEP, and MATLAB for models with random coefficients independent.

	LIMDEP		STATA		MATLAB	
Log likelihood	-895.75		-897.30		-894.73	
Parameter	**estimate**	**std error**	**estimate**	**std error**	**estimate**	**std error**
Constant	-0.048	0.011	-0.045	0.010	-0.047	0.010
Com Fish	0.111	0.040	0.108	0.038	0.110	0.040
Fish Pop	0.004	0.062	0.001	0.062	0.010	0.062
Fish Saved	0.025	0.003	0.024	0.003	0.026	0.004
Aquatic Cond	0.180	0.062	0.175	0.062	0.166	0.062
Cost	-0.027	0.004	-0.026	0.004	-0.027	0.004
sd Constant	0.095	0.016	0.085	0.014	0.088	0.014
sd Com Fish	0.191	0.095	0.141	0.142	0.196	0.106
sd Fish Pop	0.280	0.158	0.295	0.184	0.268	0.189
sd Fish Saved	0.027	0.005	0.026	0.005	0.029	0.005
sd Aquatic Cond	0.359	0.126	0.337	0.143	0.341	0.133

References

Chang, Jae Bong and Jayson L. Lusk. 2010. "Mixed logit models: Accuracy and software choice." *Journal of Applied Econometrics.* 26(1):167-172.

Hole, Arne Risa. 2011. "A comment on 'Mixed logit models: Accuracy and software choice.'" *The University of Sheffield, Deparment of Economics*. Working paper.

Train, Kenneth E. 2009. *Discrete Choice Methods with Simulation: Second Edition*. New York, NY: Cambridge University Press.

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Date: July 11, 2012

To: The Utility Water Act Group

From: Lawrence W. Barnthouse, Ph. D.

Subject: Review of Attribute Calculations Within EPA § 316(b) Stated Preference Survey

---

At your request, I have reviewed the April 16, 2012 memorandum by Abt Associates to EPA[1], termed here the "Attributes Calculation Memorandum," with regard to the scientific validity and suitability of the attributes for communicating potential benefits of entrainment and impingement (I&E) reductions to participants in EPA's Stated Preference Survey ("SP Survey"). I focused primarily on the "Fish Saved" attribute, because this attribute was the most fully developed by EPA and the only one for which "willingness to pay" estimates can be calculated from information provided in the memorandum[2] that documents preliminary results of the survey. Given time constraints and the fact that some of the relevant documentation was not provided to UWAG until July 2, 2012,[3] I have provided less detailed comments on the other three attributes included in the survey materials.

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[1] Memorandum on "Attribute Calculations within the 316(b) Stated Preference (SP) Survey," from James Palardy of Abt Associates to Erik Helm and Tom Born of the U.S. Environmental Protection Agency, dated April, 16, 2012, with June 13, 2012 cover memo from Erik Helm to the Section 316(b) Existing Facilities Rule Record. DCN 11-4533, EPA-HQ-OW-2008-0667-2005.

[2] Memorandum on "316(b) Stated Preference Survey – Survey Methods and Model Result" from Erik Helm to the Section 316(b) Existing Facilities Record. DCN 11-4525, EPA-HQ-OW-2008-0667.

[3] The documents EPA provided July 2 are the following: Abt Associates, Inc., 316(b) SP survey - design values_11.09.11.xls, DCN 11-4523, EPA-HQ-OW-2008-0667-2757 (updated 11/09/11) (posted June 11, 2012); Memorandum, E. Helm to Record, "Overview of Preliminary Modeling Exercises for Attribute Values," DCN 11-4534, EPA-HQ-OW-2008-0667-2932 (July 2, 2012); Memorandum, E. Helm to Record, "Documentation for Survey Design Values Spreadsheet," DCN 11-4535, EPA-HQ-OW-2008-0667-2933 (July 2, 2012); Memorandum, J. Palardy et al. (Abt) to T. Born et al. (EPA), "WA 2-09 Task 4: Ecopath Simulations of Chesapeake Bay," DCN 11-4542, EPA-HQ-OW-2008-0667-2934 (November 18, 2009); Memorandum, J. Palardy et al. (Abt) to T. Born et al. (EPA), "WA 2-09 Task 4 - Matrix models of I & E effects on fish populations," DCN 11-4543, EPA-HQ-OW-2008-0667-2935 (December 16, 2009).

In addition to the above memoranda, I relied on EPA's report on Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule (USEPA 2011) ("2011 EEBA") and on EPA's 2004 and 2006 Regional Case Study documents (USEPA 2004, 2006). I relied on these documents because neither the Survey Support Document[4] nor the memoranda discussed above describes the data and methods used to calculate the numbers of age-1 equivalent fish entrained or impinged under baseline conditions in the four survey regions.[5]

"Fish Saved" Attribute

For this attribute, given time constraints imposed by the 30-day comment period, I focused on the Northeast survey, but my comments apply equally to all of the regional surveys. The statement that "...scientists estimate that the equivalent of about 1.1 billion young adult fish (the equivalent of one year old) are lost each year in Northeast coastal and fresh waters due to cooling water use" is questionable at best and highly misleading at worst. As discussed below, the assumptions required to calculate this value were rejected by scientists commissioned by the Atlantic States Marine Fisheries Commission to evaluate the feasibility of performing coast-wide assessments of impacts of I&E on fish populations. Moreover, even if the value used by EPA in the survey materials is accepted, EPA presentation of that value without any meaningful population information to provide context makes it highly misleading.

<u>Calculation of the number of "young fish" lost</u>

The steps EPA followed (EPA 2006, Chapter A1) to arrive at the number "1.1 billion young fish" include:

1. Compiling impingement and entrainment (I&E) data, by species and life stage, for facilities at which monitoring has been conducted.
2. Extrapolating I&E estimates for facilities at which no monitoring has been conducted from data for facilities that have been monitored.
3. Using the "equivalent age-1" model to convert life-stage-specific estimates of total entrainment at all facilities to equivalent numbers of 1-year-old fish (described as "young fish" in the survey documents).

To perform the between-facility extrapolations (step 2), EPA first calculated average annual numbers of fish entrained and impinged per unit of water withdrawal (by species and life stage) for the facilities in the Northeast for which I&E data were provided to the Agency. To obtain estimates of I&E for facilities that did not provide data, EPA multiplied the annual water withdrawal rates of these facilities by the average I&E rate calculated for facilities that provided data.

[4] U.S. Environmental Protection Agency, Survey Support Document, in Support of Section 316(b) Stated Preference Survey Notice of Data Availability, June 2012. DCN 11-4524, EPA-HQ-OW-2008-0667-2860.
[5] I also received several documents and emails by EPA to UWAG on July 2, 2012. See n.3 above.

There are two problems with this procedure. First, the assumption that entrainment and impingement rates are similar for all facilities within a given region is clearly not true. Facilities within the Northeast region as defined in the survey document[6] – the entire Atlantic coast from Maine to Maryland – withdraw water from a wide variety of environments ranging from the open coast to freshwater lakes and rivers. Even within a single system, *e.g.*, the Hudson or Delaware Rivers, densities and species compositions of entrainment and impingement collections at different facilities vary greatly due to variations in habitat characteristics such as salinity regime, meaning that actual entrainment or impingement values will vary widely from place-to-place based on factors other than intake flow. Second, *most* of the I&E estimates used to derive the "1.1 billion fish" value were obtained by extrapolation rather than monitoring.

The 2011 EEBA stated that, nationwide, I&E data were available for only 97 out of a total of 871 in-scope facilities. Although the 2011 EEBA did not provide a breakdown by region, the 2004 Regional Case Study did. According to Table C2-4 of the North Atlantic Regional Case Study (USEPA 2004), of the 22 in-scope facilities addressed in that study, I&E monitoring data were available for only 4. I&E estimates for the remaining 18 facilities were extrapolated from these 4 facilities. For the purposes of the SP Survey, the "Northeastern US" was expanded beyond the North Atlantic states to include New York, Pennsylvania, New Jersey, Delaware, and Maryland. Information on data sources for these states is available from Table D2-3 of the Mid-Atlantic Regional Case Study (USEPA 2004). Of the 38 in-scope facilities located in those states, I&E monitoring data were available for only 6. Moreover, for 3 of those 6 facilities, all of the available data were collected before 1980. This means that I&E estimates for 49 of the 59 facilities were obtained by extrapolation of data collected at only 10 facilities, only 7 of which had data collected after 1980.

Scientists charged by the Atlantic States Fisheries Management Commission ("ASFMC") to examine the I&E issue refused to make this type of extrapolation. In 2001, the ASFMC established a committee of fisheries scientists representing state fisheries management agencies and industry experts to evaluate the feasibility of performing an assessment of coast-wide impacts of I&E on fish populations managed by the Commission. Atlantic menhaden was chosen as the test species. The committee developed a method for linking I&E mortality estimates to the population model used by the ASFMC to establish biological thresholds and harvest policies for menhaden, and hired a subcontractor to compile I&E data for power plants in the mid-Atlantic and southeast regions. The subcontractor found that data were available for only a small fraction of power plants, and for many of these plants data were collected only during the 1970s. The committee chose not to perform between-plant extrapolations of the kind used by EPA and concluded instead that "available data entrainment and impingement were not

[6] U.S. Environmental Protection Agency, Fish and Aquatic Habitat: A Survey of Northeast Residents, OMB Control No. 2840-0283.

adequate to support defensible coast-wide estimates of the annual numbers killed by entrainment and impingement" (Heimbuch et al. 2007). Consequently, no assessment was performed.

Misleading presentation of the number of "young fish" lost

Even if the number "1.1 billion young fish" is accepted as a plausible estimate of I&E mortality attributable to facilities in the Northeastern states, EPA's presentation of this number in the survey materials, without any delineation as to the type of fish or their place in or among the overall population(s), is misleading. The following discussion illustrates the problem.

Although many species of fish are impinged or entrained at Northeastern facilities that use cooling water, according to EPA's estimates (flawed though they may be), the majority of the 1.1 billion age-1 equivalents cited in the survey materials belong to a single species: bay anchovy. The 2011 EEBA provides age-1 equivalent loss estimates only for all forage species combined. However, Tables C2-5 and C2-6 of the 2004 Regional Case Study provide species-specific estimates of age-1 equivalents for species impinged and entrained in the North Atlantic Region. Tables D2-4 and D2-5 of the 2004 Regional Case Study provide corresponding estimates for the Mid-Atlantic Region. It is not possible to break out estimates for New York, New Jersey, Delaware and Maryland from the total for all mid-Atlantic states. However, Table D2-5 shows that a single species, bay anchovy, accounts for more than 937 million age-1 equivalent fish. Combining EPA's estimates of bay anchovy I&E losses for both regions, bay anchovy alone accounts for 62% of all age-1 equivalent losses of finfish in the Northeast. These values are consistent with the total entrainment (not age-1 equivalent) losses provided in Tables C-4 and C-6 of the 2011 EEBA, which show that bay anchovy entrainment accounted for approximately 40% of all entrainment in the North Atlantic region and 65% of all entrainment in the mid-Atlantic region. For the reasons explained above, it is not clear whether this value reflects the actual magnitude of bay anchovy I&E losses in the North Atlantic and mid-Atlantic states or whether it is an artifact of extrapolating values from a small number of facilities that happen to entrain large numbers of bay anchovy to a large number of facilities for which no data are available. Even assuming EPA's values are approximately correct; however, this result clearly implies that "saving fish" really means "saving mostly bay anchovies."

As discussed in the 2004 Regional Case Study (Chapters C2 and D2), 1-year-old bay anchovies are reproducing adult fish, each weighing 0.00381 pounds (2004 Regional Case Study, Table D1-9). No estimates of the total coast-wide abundance of this very common forage species are available. However, some insight into the ecological or economic significance of saving 937 million age-1 bay anchovies can be gained by comparing the total annual number of pounds of bay anchovy that could potentially be saved through entrainment and impingement technologies to the total annual number of pounds of fish harvested in waters of the northeast states (http://www.st.nmfs.noaa.gov/ st1/commercial/index.html). At a weight of 0.000381 pounds per

fish, the total biomass of age-1 equivalent bay anchovies estimated to be entrained and impinged at power plants in the Northeast is 3,728,872 pounds. By comparison, the total weight of all fish species landed in 2010 by commercial fishermen in the Northeastern states covered in EPA's stated preference survey was 759,327,566 pounds, or more than 200 times higher than the total weight of age-1 equivalent anchovies that EPA estimates could be saved if all I&E were eliminated. If we assume an exploitation rate of 50%, *i.e.*, that 50% of the standing biomass of each of these harvested populations is caught each year, then the total biomass of commercially harvested fish present in the coastal waters of the Northeastern states must be at least 1.5 billion pounds. This value is actually conservative, because exploitation rates of most harvested species are lower than 50%. If all 3.7 million pounds of bay anchovies were directly consumed by harvested predators such as striped bass, weakfish, and bluefish, then they could produce, using the 0.1 trophic transfer efficiency assumption used in the 2011 EEBA, 370,000 pounds of additional harvestable biomass, or 0.025% of the total estimated abundance of commercially harvested fish.

Uncertainty concerning actual increase in abundance due to reduction of I&E

Regardless of any of the above calculations, it is not at all clear how many, if any, fish are actually being "saved." The survey implies that reducing entrainment and impingement by a given amount will increase the abundance of age-1 fish by a proportionate amount. So, for example, the SP Survey implies that reducing entrainment and impingement of a given species by 20% expressed in age-1 equivalents will increase the actual abundance of one-year-old fish by 20%. This result is implicit in the mathematics of the age-1 equivalence model, which uses linear conversion factors (survival rates) to convert raw numbers of fish entrained or impinged to equivalent age-1 fish. However, these calculations greatly oversimplify biological reality. In fact, mortality rates of fish eggs and larvae vary greatly from year to year, from place to place, and even from week to week within a spawning season, as acknowledged by EPA in the 2011 EEBA (Section 3.4.3) and in the earlier Phase II (EPA 2004, Chapter A5-4.2) and Phase III (EPA 2005, Chapter A) regional case studies.

Because of the extremely high variability of early life stage mortality rates, estimates of the abundance of fish eggs and larvae are often very poor predictors of the subsequent abundance of juvenile and older fish. For example, Barnthouse et al., (2003, 2009) investigated correlations between estimates of the abundances of early life stages of white perch and striped bass using a 30-year data set collected by the Hudson River Monitoring Program (ASA 2011). This program provides annual river-wide measurements of the abundances of eggs, yolk-sac larvae, post yolk-sac larvae, juveniles, and age-1 and older fish using a consistent sampling program that has been conducted continuously since 1974. Barnthouse et al., (2009) found that river-wide abundances of white perch eggs and larvae were uncorrelated with the subsequent abundances of juveniles and age-1 and older fish, although the indices of juvenile and age-1 and older fish were

significantly correlated. In other words, abundances of juvenile fish sampled in the late summer and fall were good predictors of the abundance of age-1 fish collected the next year; however, abundances of eggs and larvae were poor predictors of juvenile abundance. Barnthouse et al., (2003) found that abundances of striped bass eggs and larvae were *negatively* correlated with abundances of juvenile and older fish, likely indicating density-dependent mortality of striped bass larvae. If the abundance of fish eggs and larvae is uncorrelated or negatively correlated with the abundance of older fish, then "saving" eggs and larvae by reducing entrainment will not produce more one-year-old fish.

Conclusion regarding "fish saved" attribute

Equivalent age-1 estimates like those calculated by EPA for the 2011 EEBA and the earlier Regional Case Studies are useful for economic analyses and technology evaluations, where the many uncertainties involved can be understood and accounted for by knowledgeable experts. It is highly misleading, however, to represent these values to lay participants in the SP Survey as demonstrated scientific facts.

Commercial Fish Populations Attribute

Given the time constraints imposed by EPA's 30-day comment period, as well as the paucity of specific record data supporting EPA's projected changes in commercial fish populations, my review of EPA's derivation of this attribute is necessarily general. Because EPA used different procedures for developing the Commercial Fish Attribute for marine and inland stocks, I review each in turn.

Marine stocks

According to the information presented in the Attributes Calculation Memorandum (pp. 2-3), the source of EPA's marine Commercial Fish Population attribute is the National Oceanic and Atmospheric Administration (NOAA) 2009 report on the status of U.S. commercial fisheries (NOAA 2010). EPA states in this memorandum that the baseline attribute score is based on the percentage of fish stocks for which the estimated total biomass is greater than 80% of the value believed to produce maximum sustainable yield (MSY) (which, for purposes of this review, I will refer to as the "80% threshold"). The survey materials lead respondents to believe that reducing I&E could measurably increase the percentage of stocks for which total biomass is above this threshold.

This attribute is particularly problematic because there is no published, peer-reviewed evidence that I&E mortality has measurably reduced the abundance of any commercial fish stock (Barnthouse 2011), and therefore no evidence that reducing I&E mortality will increase the

abundance of any commercial fish stock. Moreover, many of the commercially harvested species that are most commonly entrained or impinged, including striped bass, Atlantic menhaden, Gulf menhaden, weakfish, Atlantic croaker, spot, and red drum, are near-coastal species that are managed by regional fishery commissions (*e.g.*, Atlantic States Marine Fisheries Commission, Gulf States Marine Fisheries Commission) rather than by the National Marine Fisheries Services (NMFS) and are not included in the annual NOAA status reports. Nonetheless, the survey documents suggest that substantial increases in the number of commercial fish populations above the 80% MSY threshold could occur if I&E mortality were reduced. For the Northeast region, for example, the survey documents state an increase of 1%, 3%, or 6% in the percentage of Northeastern fish stocks exceeding the 80% threshold is possible depending on which policy option is chosen. These are additive percent increases over a baseline value of 42%, meaning that reducing I&E could increase the percentage of Northeastern fish stocks above the 80% threshold to 43%, 45%, or 48%. Because the fisheries encompassed by the NMFS survey for the Northeast region include 67 stocks (Attributes Calculation Memorandum, Table 1), the percentage increase EPA assumed would imply an increase in the number of stocks above the MSY threshold of anywhere from 1 (1% increase) to 4 (6% increase).

According to a July 2, 2012 EPA memorandum[7] purporting to explain the maximum changes in the baseline attribute values used in the SP Survey, the maximum change for the marine commercial fish populations attribute was established through a combination of population modeling and evaluation of the NOAA 2010 stock status data discussed above. The modeling exercise is documented in a December 16, 2009 memorandum[8], also provided with EPA's July 2, 2012 memorandum. By modeling the projected impacts of I&E on eight commercially harvested fish stocks, EPA estimated that the maximum increase in regional stock abundance for any species would be approximately 5%. EPA then examined the NOAA (2010) report and identified seven commercially targeted stocks for which an increase in abundance of 5% would raise the estimated stock biomass values from below the 80% threshold to above the 80% threshold. It appears that EPA then determined that those seven stocks account for between 1.5% and 5.4% of all stocks for which biomass data are available. Therefore, to ensure that the full range of possible levels was encompassed in the survey, EPA raised the maximum estimate of this attribute to 6%.

Due to the time constraints imposed by the 30-day comment period and the fact that I did not receive this additional information until July 2nd, it was not possible for me to perform an in-

[7] Memorandum on "316(b) Stated Preference (SP) Survey – Overview of Preliminary Modeling Exercises for Attribute Values," from Erik Helm to the Section 316(b) Existing Facilities Record. July 2, 2012. DCN 11-4523, EPA-HQ-OW-2008-0667-2757.

[8] Memorandum on "WA 2-09 Task 4 – Matrix models of I&E Effects on fish populations," from James Palardy, David Mitchell and Elena Besedin of Abt Associates to Erik Helm, December 16, 2009. DCN 11-4543, EPA-HQ-OW-2008-0667-2935.

depth review of either document. However, the eight species evaluated in the modeling memorandum (American plaice, Atlantic cod, Atlantic herring, Atlantic mackerel, bluefish, striped bass, summer flounder, and winter flounder) are all North Atlantic and Mid-Atlantic species, and the species for which the greatest change was found (striped bass) is not managed by NMFS and is not included in the NOAA status report. Moreover, the I&E estimates used as inputs to the modeling exercise are highly uncertain, and affected by the same limitations noted above for the "fish saved" attribute, namely the extrapolation of I&E estimates from a few facilities to an entire region and the relative lack of correlation between early life stage abundance and juvenile or age 1 and older abundance. Hence, the results of the modeling study cannot be representative of effects on marine fish stocks nationwide, and provide little scientifically credible evidence to support EPA's conclusion that any fish stock could be increased by 5% by reducing I&E.

Table A of NOAA (2010) provides summary information on the status of all stocks included in the status report for 2009. I was unable to confirm from this table EPA's conclusion that there are 7 commercially harvested marine fish stocks for which a 5% increase in abundance would raise the stock biomass level above the 80% threshold. Within the North Atlantic and Mid-Atlantic regions, I could identify only the Acadian redfish, little skate, and summer flounder as having stock biomasses between 70% and 80% of the MSY level. Acadian redfish and little skate apparently are entrained and impinged in numbers too low to appear in any of EPA's assessments. According to Table C-5 of the 2011 EEBA, EPA estimated that 2,000 age-1 equivalent summer flounder are impinged or entrained annually. By comparison, according to the most recent NMFS stock assessment for this species (NEFSC 2008), approximately 30,000,000 young summer flounder are recruited into the population each year. It clearly is not plausible that adding 2,000 additional one-year-old fish (0.007% of the annual average) to this total would significantly improve the status of that stock.

Inland stocks

According to the Attribute Calculations Memorandum (pp. 2-3), the source of EPA's inland commercial fish population attribute was a literature search for information on the abundance of harvested freshwater fish populations. Because no nationally uniform stock assessments are performed for freshwater fish, EPA compiled data from a wide variety of sources of varying degrees of quantity and quality. A detailed review of the source literature used by EPA could not be performed in the time available for these comments, and EPA has not provided documentation of the methods used for data analysis. It is not even clear how many of the stocks evaluated by EPA are subject to significant levels of I&E at power plants.

That said, the published scientific literature clearly shows that inland fish populations, especially populations inhabiting the Great Lakes, have been affected by a great many stressors in addition

to harvesting, including eutrophication (Kerr and Ryder 1997) and invasions by non-native species such as sea lampreys, alewives, round gobies, and zebra mussels (Kerr and Ryder 1997, Jude 1997, Mills et al. 2003, Madenjian et al. 2003). Fish populations in inland rivers have similarly been affected by pollutant discharges, habitat destruction, and invasive species. There simply is no credible way to attribute historical changes in the abundance of freshwater fish populations to I&E mortality, or to provide defensible estimates of the improvements in these populations that might occur if I&E were reduced.

All Fish Populations Attribute

As discussed below, the sources of EPA's marine and inland "All Fish Populations" attributes are similar to the sources used for the Commercial Fish Population attribute and raise the same concerns.

Marine stocks

According to the Attribute Calculations Memorandum (pp 3-5), for marine species the sources of data are the same, but the numerical treatment is different. Rather than tabulating the percent of species for which the current stock biomass is greater than 80% of the biomass that would produce MSY, EPA estimated the ratio of the current biomass of each stock for which a biomass estimate was available to a hypothetical "carrying capacity," measured as the largest historical harvest, the current biomass, or 3 times the biomass at MSY. For inland stocks, the most recent estimate of relative abundance was divided by the maximum relative abundance value found within the time series. Insufficient information was provided concerning either the marine or the inland fish stock calculations to support a detailed review. However, a detailed review is not necessary to identify flaws in this attribute that render it useless for interpreting beneficial effects of reducing I&E.

A population abundance attribute calculated using data for harvested populations, many of which have been historically overfished, cannot possibly be representative of all populations, both harvested and non-harvested. EPA's estimate that the average abundance of harvested marine fish species nationwide is 30% of the average carrying capacity of these populations is not surprising, because management policies typically set target biomass levels at less than 50% of unfished stock biomass. The April 16, 2012 memorandum from Abt Associates claims that "…although available data may not be truly representative of all fish species, it is unlikely that relying upon stock assessments for commercially targeted fish species to estimate the population of all fish species will result in strongly biased attribute estimates." This statement cannot possibly be true, because harvested species are deliberately maintained at abundance levels far below their theoretical carrying capacity. In the absence of indirect beneficial effects of harvesting (*e.g.*, release from competition, reduced predation, etc.), and of adverse effects of

other stressors (*e.g.*, pollution or habitat destruction), one would expect non-harvested species to be at or near their maximum levels of abundance, not at lower levels comparable to those of harvested species.

Of course it is not implausible that factors such as pollution, habitat degradation, and invasive species have affected populations that are not harvested. Because fish populations that are not harvested receive very little attention from fisheries scientists, however, there is only limited information available on how many have become less abundant or more abundant over time. The only certainty is that the baseline attribute values of 26% to 30% used in the survey materials are meaningless as applied to "all fish populations." EPA's assertion that reducing I&E could result in a 2%-4% increase in average fish abundance (*e.g.*, from 26% to 28% or 30% of the maximum value) is similarly meaningless. According to the July 2, 2012 EPA memorandum, the maximum increase in the "all fish" attribute due to reducing I&E was selected simply by dividing the 5% value derived from the fish population modeling exercise (see the December 16, 2009 memorandum) by 2, rounding up to 3, and then adding an additional 1%. This procedure is completely arbitrary and has no defensible connection to actual responses of fish populations to I&E reductions.

Inland stocks

In the case of the inland "All Fish Populations" attribute, the problem is the same as discussed above for the "Commercial Fish Populations" attribute. Freshwater ecosystems have been affected by a wide variety of stressors in addition to fishing. In many cases, habitat destruction or the introduction of non-native species may have permanently reduced the abundance of native populations, so that reducing I&E could have no effect on average abundance relative to historical conditions. It is not clear from the information provided exactly what data EPA selected, or how those data were selected and analyzed calculate either the baseline value or the percent changes due to reducing I&E for this attribute. However, even if the 33% attribute value calculated by EPA were reasonable and applicable to freshwater species in general, there is no way to determine whether reducing I&E would measurably increase the average abundance of freshwater fish populations nationwide.

Condition of Aquatic Ecosystems Attribute

This attribute is based on measurements of "biotic indices," in which data on a wide variety of population and community characteristics are aggregated into one or more indices that are intended to characterize the overall ecological condition of aquatic ecosystems. The underlying rationale for the biotic index approach is that undisturbed natural communities are balanced, integrated, adaptive systems having a variety of species and trophic groups (*e.g.*, plants, herbovores, predators, and detrivores) that perform complementary ecological functions and are

well-adapted to their natural environment. Human disturbances, including harvesting, nutrient enrichment, toxic chemical discharges, and habitat alteration degrade these functions in ways that are detectable through measurement of key population and community metrics (Karr and Chu 1999). Biotic indices are calculated by comparing metrics measured in disturbed communities to corresponding metrics measured in undisturbed communities. The strength of the biotic index approach is that measurements of species composition, relative abundance, average organism size, feeding guild structure, and other community characteristics integrate information about the influence of a wide variety of anthropogenic stressors on aquatic systems (Karr and Chu 1999). The weakness of the biotic index approach is that it can be difficult to identify the causes of any observed adverse conditions. In particular, since biotic indices have historically been developed to measure responses of communities to pollution and habitat degradation, it is questionable whether any of the indices used by EPA reflect degradation caused by I&E.

Although some biotic indices are based on measurements of fish community characteristics, the great majority are based on studies of benthic invertebrate communities. EPA says in the Attributes Calculation Memorandum, p. 7, that it based its "Condition of Aquatic Ecosystems" attribute on 17 biotic index studies. Of these, only 5 relate to fish. EPA provided insufficient information to evaluate the calculations that were performed to reduce the data provided by these 17 studies to estimates of average ecosystem conditions in the four survey regions. But considering the diversity of studies and the diversity of ecosystems present in each region, it seems unlikely that the baseline conditions developed from these studies (42% to 50% of pristine conditions) could be scientifically meaningful.

According to the July 2, 2012 EPA memorandum, the Agency's consultants conducted an "exploratory modeling exercise" using a model of the Chesapeake Bay food web to support this attribute. The modeling exercise, documented in a memorandum dated November 18, 2009[9], was provided to me with EPA's July 2, 2012 memorandum. According to this memorandum, the modeling showed that "minor" changes to marine communities could occur as a result of the proposed rule. The July 2, 2012 memorandum also noted that several of the component metrics of the biotic indices used by EPA are unrelated to I&E mortality. Based on this fact and on the results of the modeling exercise, EPA estimated that changes in aquatic condition resulting from the proposed regulations were unlikely to exceed 2%, but arbitrarily assumed a value of 4% for the survey to account for the range of all possible values.

Even if the baseline attribute values could be considered rough approximations of the actual state of aquatic ecosystems nationwide (and EPA presents no evidence to suggest that they can be), such indices still represent degradation due to pollution, habitat change, invasive species,

overfishing, and perhaps other stressors. The contribution, if any, of I&E mortality to any of these indices is unknown and probably unknowable. Since the ecosystem modeling approach used by EPA is fundamentally unrelated to the biotic index approach – which is based strictly on field data and makes no assumptions concerning the causes of the measured biological conditions – it is not clear to me how the modeling supports the selection of any particular value for the expected change resulting from reducing I&E.

Consequently, there is no scientifically defensible way to link changes in EPA's ecosystem condition attribute to changes in I&E mortality.

Overall Conclusion

For survey participants to accurately understand the potential benefits of the alternative I&E policies described in the SP Survey materials, the attributes they are asked to value should have clear and scientifically defensible causal connections to the policies. Differences in attribute values associated with different policies should be supported with scientifically defensible models that link changes in I&E to changes in attribute values. Any uncertainties concerning the relationships between I&E reductions and attribute values should be clearly stated in language comprehensible to survey participants. EPA's SP survey does not satisfy these requirements. None of the four attributes used by EPA in the SP Survey provides scientifically valid information concerning the potential benefits to the public of reducing I&E mortality. Only one of the four – the "Fish Saved" attribute – has even a general causal connection to I&E. Equally important, the survey materials do not convey the very large uncertainties concerning the actual magnitude of I&E losses and about the effects of those losses on fish populations. These uncertainties are well-understood by experts, including EPA's own experts, who use I&E data in technology evaluations and economic benefits analyses. However, they are not understood by the general public. In describing estimates of numbers of "fish saved" by reducing I&E as established scientific facts rather than highly uncertain extrapolations from very limited data, EPA provided the survey participants with highly misleading information concerning the benefits of reducing I&E.

[9] Memorandum on WA 2-09 Task 4: Ecopath Simulation of Chesapeake Bay, from James Palardy, David Mitchel, and Elena Besedin of Abt Associates to Tom Born, Josh Hall, and Erik Helm of EPA, November 18, 2009. DCN 11-4766, EPA- HQ-OW-2008-0667-2906.

References

ASA Analysis & Communication, Inc. 2011. 2010 Year Class Report for the Hudson River Monitoring Program.

Barnthouse, L. W., D. Glaser, and J. Young. 2003. Effects of historic PCB exposures on the reproductive success of the Hudson River striped bass population. *Environmental Science and Technology* **37**:223-228.

Barnthouse, L. W., D. Glaser, and L. DeSantis. 2009. Polychlorinated biphenyls and Hudson River whiter perch: Implications for population-level risk assessment and risk management. *Integrated Environmental Assessment and Management* 5:435-444.

Barnthouse, L. W. 2011. Do power plant impingement and entrainment cause changes in fish populations? EPRI Report no. 1023094, Electric Power Research Institute, Palo Alto, CA.

Heimbuch, D. G., E. Lorda, D. Vaughan, L. W. Barnthouse, J. Uphoff, W. Van Winkle, A. Kahnle, B. Young, J. Young, and L. Kline. 2007. Assessing coastwide impacts of power plant entrainment and impingement on fish populations: Atlantic menhaden example. *North American Journal of Fisheries Management* **27**: 569-577.

Jude, D. J. 1997. Round gobies: cyberfish of the third millennium. *Great Lakes Research Review* **3**:27-34.

Kerr, S. R., and R. A. Ryder. 1997. The Laurentian Great Lakes experience: a prognosis for the fisheries of Atlantic Canada. *Canadian Journal of Fisheries and Aquatic Sciences* **54**:1190-1197.

Karr, J. R., and E. W. Chu. 1999. *Restoring life in Running Waters*. Island Press, Washington, D.C. 206 p.

Madenjian, C. P., J. D. Holuszko, and T. J. Desorcie. 2003. Growth and condition of alewives in Lake Michigan, 1984-2001. *Transactions of the American Fisheries Society* **132**:1104-1116.

Mills, E. L., J. M. Casselman, R. Dermott, J. D. Fitzsimons, G. Gal, K. T. Holeck, J. A. Hoyle, O. E. Johannsson, B. F. Lantry, J. C. Makarewicz, E. S. Millard, I. F. Munawar, M. Munawar, R. O'Gorman, R. W. Owens, L. G. Rudstam, T. Schaner, and T. J. Stewart. 2003. Lake Ontario food web dynamics in a changing ecosystem (1970-2000). *Canadian Journal of Fisheries and Aquatic Sciences* **60**:471-490.

National Oceanic and Atmospheric Administration (NOAA) 2010. Annual Report to Congress on the Status of U.S. Fisheries – 2009.

Northeast Fisheries Science Center (NEFSC). 2008. 47th Northeast Reagional Stock Assessment Workshop (47th SAW). Part A. Assessment Report. NEFSC Reference Document 08-12A.

U.S. Environmental Protection Agency (USEPA) 2004. Regional analysis document for the final Section 316(b) Phase II existing facilities rule. EPA 21-R-02-003

USEPA 2006. Regional benefits analysis for the final Section 316(b) Phase III existing facilities rule. EPA 21-R—4-007.

USEPA 2011. Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule. EPA 821-R-11-002.

Statement by Richard B. Stewart[1] on EPA Use of Stated Preference Survey to Justify 316(b) Cooling Water Intake Structure Regulation at Existing Facilities

At the request of the Edison Electric Institute and the Utility Water Act Group, I have prepared this statement on whether EPA's June 2012 stated preference survey results provide a sound and appropriate basis for EPA's proposed regulation of cooling water intake structures (CWIS) at existing facilities or for state CWIS regulation. My professional qualifications and experience are summarized in the Annex to this statement.

Executive Summary

EPA is seeking to justify costly cooling water intake structure regulation of over 1,260 power plants and industrial facilities nationwide on the basis of a public mail survey asking for the value a random group of individuals would place on reducing fish losses at intakes. This approach contrasts sharply with that followed by EPA in benefit analyses that it made in 2004 for a prior version of this regulation and in 2011 for the regulation that it now proposes. These analyses relied exclusively or primarily on widely accepted economic valuation methods using market prices and costs actually incurred by individuals, as opposed to hypothetical questions in a public survey. EPA's 2004 and 2011 analyses found annual benefits of $82.8 million and $16.3 million respectively. These benefits were dramatically lower than the regulations' costs. The costs of EPA's 2011 proposed regulation are over twenty times the benefits. EPA's new 2012 public survey generates benefits of $2.275 billion annually[2], or nearly 140 times greater than those determined by EPA a year ago using traditional methods. With the new $2.275 billion number, the benefits of regulation become more than five times the costs. This astronomical increase in calculated benefits defies credibility. It reflects fundamental defects in the EPA survey. The survey design and methodology for determining benefits have serious flaws. Also, the assertions in the survey regarding the environmental benefits of controls, which respondents were asked to value, are not properly supported by the facts and the science. Furthermore, survey techniques are not suitable for valuing the benefits of CWIS controls for fish in general on a national basis. Accordingly, EPA's 2012 survey and the benefit numbers that it generates are not a reliable or valid basis for EPA's proposed rule or for intake regulation generally.

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[2] All figures for the costs and benefits of the 2011 proposed rule are in 2011 dollars at a 7 percent discount rate.

Introduction

EPA has, since 1996, sought to develop a stated preference survey to provide evidence of economic benefits from CWIS regulation that could provide cost-benefit justification for retrofitting CWIS controls at 1,260 existing power plants and other facilities. Twice, in 2004 and 2011, EPA found costs for such regulations far exceeding their monetized environmental benefits. In 2004, EPA's benefit determinations for its final CWIS regulation were based exclusively on detailed studies of commercial and recreational use valuations using long established and accepted revealed preference methodologies. In its cost-benefit analysis for its 2011 proposed CWIS regulations, EPA added a very modest survey-based valuation of nonuse benefits in two regions to its use value determinations. On both occasions it concluded that it was unable reliably to determine fully potential nonuse benefits of the regulations. EPA has, however, persisted in its quest to develop a stated preference survey that might show sufficient benefits to bring CWIS regulation over the benefit/cost break-even point. In June 2012, after the close of the public comment period on its 2011 proposed regulations, EPA issued a notice of data availability (NODA) of preliminary results for a stated preference survey that generates massive benefits -- $2.275 billion annually -- for CWIS regulation. These new benefit figures are nearly 140 times the benefits that EPA calculated in 2011 for the same regulation. EPA now asks whether it should use this study to justify its proposed regulations. For the reasons discussed below, it should not.

EPA's 2012 stated preference survey suffers from serious flaws, including shortcomings in its design and analytic methods and a lack of record support for the survey's factual and scientific underpinnings. Because of these flaws, EPA should not seek to use this or any similar survey to justify its CWIS regulations at existing facilities, nor should it issue, endorse, or recommend such surveys as an appropriate basis for CWIS regulatory decisions by state officials. Further, OMB should not approve their use for either purpose. Using deeply flawed surveys for such purposes would be contrary to sound and wise regulatory policy and to the requirements of Executive Order 13563, the Information Quality Act, and EPA guidance.[3] These

[3] This order is supplemental to and reaffirms the principles, structures, and definitions governing contemporary regulatory review that were established in Executive Order 12866 of September 30, 1993. Specifically, use of the 2012 EPA survey to justify CWIS regulation would contravene the following requirements for federal agency rulemaking:

Under Section 1(b), an agency must (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor its regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations. Further, Section 1(c) provides that:

flaws would also render CWIS regulation based on EPA's survey vulnerable to judicial invalidation as arbitrary and capricious.

This is apparently the first significant instance in which the legal and regulatory cost-benefit justification for a major federal rule turns almost entirely on nonuse benefit valuations determined through a stated preference survey, and where the validity of that survey and the values that it generates have been persistently challenged by the regulated community. Accordingly, the decisions that EPA and OMB must make as to whether or not to use and approve the use of such a survey as the lynchpin for new and costly CWIS regulation may set an extremely damaging precedent. Validating such use of the new June 2012 survey in this context could encourage wider use of unreliable stated preference surveys, leading to unjustified expenditure and delay, excessive regulatory and litigation controversy, and potential harm to the federal regulatory cost-benefit analysis program. Given this situation, EPA and OMB should not approve EPA's use of the survey for any purpose unless they are highly confident of its validity and reliability.[4] There is no basis for such confidence.

Part I of this statement outlines that history of EPA Section 316(b) CWIS regulation and EPA's costs benefit studies and analyses. Part II summarizes the flaws in the study, drawing on reports by NERA Economic Consulting and W.H. Desvousges and Associates and by Dr. Larry Barnthouse that analyze its defects in greater details. Part III discusses the adverse implications for the federal regulatory cost-benefit program and for administrative law and governance of authorizing or encouraging use of flawed studies such as EPA's survey for regulatory decision-making.

I. EPA's Proposed Rule for Existing Facilities: A Regulation in Search of Benefits

EPA initiated the regulation of existing CWIS as a result of litigation by environmental groups and not because it determined, on its own initiative, that such systems were causing

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In applying these principles, each agency is directed to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible.

The Information Quality Act (IQA), 44 U.S.C.A. § 3516, requires that agencies "issue guidelines ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by the agency." Pursuant to the IQA, the EPA's Information Quality Guidelines require the EPA to ensure that its information "is accurate, reliable and unbiased... This involves the use of: (i) the best available science and supporting studies conducted in accordance with sound and objective scientific practices... and (ii) data collected by accepted methods or best available methods (if the reliability of the method and the nature of the decision justifies the use of the data)." Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity, of Information Disseminated by the Environmental Protection Agency, October 2002, p. 21.

[4] In the NODA, EPA properly cautions against use of the survey results for purposes of site-specific regulation because they are based on specific regional levels of baseline losses which may not hold at specific sites around the country.

extensive and serious environmental harms that warranted priority regulation. After the groups brought suit against EPA in 1993 to require it to issue CWIS regulations under section 316(b) of the Clean Water Act (CWA), EPA and the plaintiffs entered into a consent decree, originally issued in 1995 and amended thereafter, setting a timetable for three phases of Section 316(b) rulemaking.[5] As early as 1996, EPA initiated steps to develop stated preference surveys in order to measure the benefits of CWIS regulation.

In 2001, EPA finalized Phase I of its 316(b) rulemaking, which covered new facilities. In 2004, EPA issued Phase II rules establishing national performance standards for CWIS on existing electric generating facilities. It relied on a consideration of costs and benefits to reject a requirement to retrofit closed-cycle cooling at all facilities and instead adopted requirements that set baseline performance standards for impingement and entrainment mortality rates. EPA conducted a cost-benefit analysis comparing the expected costs of compliance with environmental benefits. EPA concluded that technology costs, installation downtime, annual operating and maintenance costs, regulatory administration costs, and permitting costs would total $389.2 million annually compared with $3.5 million in monetized benefits from commercial fisheries and $79.3 million from recreational fishing benefits.[6] Accordingly, costs were more than four times the benefits. In its analysis, EPA only monetized use benefits of regulation. While it recognized the importance of considering nonuse benefits as well, EPA determined that all of the methods that it considered for assessing such benefits (for instance, simply assuming that nonuse values were double the estimated use values) were too uncertain or suffered from methodological flaws that made them inappropriate for use in its cost benefit analysis.[7] Instead, EPA applied a break-even analysis to determine what the minimum amount that monetized indirect use and nonuse values would have to be in order for the rule to produce benefits equal to its costs; it determined that this figure was $306.5 million, or 79% of the regulation's costs.[8] EPA also included a brief list of nonuse benefits which could not be monetized and indicated that it would continue to evaluate various approaches for evaluating nonuse benefits of CWIS regulation. In particular, EPA expressed interest in conducting a stated preference survey for this purpose, but stated that it did not have sufficient time to fully develop and analyze this approach to monetizing nonuse values.[9]

Litigation brought by environmental and industry groups challenged the 2004 Phase II rule in the Second Circuit on a variety of grounds. In 2004, the Court of Appeals held, among

[5] Cronin v. Browner, 898 F.Supp. 1052 (S.D.N.Y. 1995).
[6] National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, 69 FR 41576, p. 41666.
[7] Id., at 41624. EPA made the same determination in its Phase III CWIS rulemaking. See National Pollutant Discharge Elimination System—Proposed Regulations To Establish Requirements for Cooling Water Intake Structures at Phase III Facilities; Proposed Rule, 69 FR 68444, p. 68527.
[8] See *supra* note 6, p. 41663-4.
[9] Id., at 41657.

other matters, that Section 316(b) preludes cost-benefit balancing, and set aside EPA's rule.[10] In 2009, the Supreme Court reversed the Second Circuit in part, holding that cost-benefit analysis is a permissible consideration in regulation under Section 316(b) and that EPA had *Chevron* authority and discretion to base CWIS regulatory decisions on such analysis.[11] Subsequently, the consent decree was further amended; EPA agreed to issue a notice of proposed rulemaking by mid-2011 and a final Phase II rule by July 27th, 2012.

EPA in July 2010 and again in January 2011 submitted to OMB successive Information Collection Requests (ICR) seeking authorization to conduct a stated preference survey to measure the benefits of CWIS regulation.[12] OMB granted the requested authorizations. In June, 2011, EPA published proposed section 316(b) regulations for CWIS at existing power plants and other industrial facilities. That proposal included as Option 1, EPA's preferred option, national performance standards for control of impingement mortality to larger aquatic organisms, based on EPA's estimate of the level of control achievable to advanced screens with fish returns. For entrainment of tiny aquatic organisms, the proposal provided for site-specific determinations of best CWIS technology available, weighing technical feasibility and costs with the benefits from reduced aquatic mortality. In rulemaking, EPA had considered four regulatory options that varied in their scope and applicability. EPA found a range of annual compliance costs for different regulatory options. The highest figure was $4.9 billion annually to require all existing facilities to retrofit to closed-cycle cooling. EPA estimated an annual cost of $466 million for its preferred option of modified traveling screens to reduce impingement losses.[13]

In determining benefits, EPA utilized a methodology similar to that of its 2004 report focused on monetizing the use benefits of various CWIS regulatory alternatives. Under this analysis, annual commercial and recreational fishing benefits totaled $37.7 million for retrofitting closed-cycle cooling compared to $15.8 million for EPA's preferred option.[14] In addition, EPA estimated nonuse benefits by using a benefits transfer approach based on a 2009 stated preference survey aimed at determining Rhode Island residents' willingness to pay for removing barriers to fish migration.[15] Drawing from this study, EPA calculated that annual nonuse benefits from reducing fish mortality in the North Atlantic and Mid-Atlantic regions would range from $59.4 million for retrofitting to closed-cycle cooling to $0.52 million for

[10] Riverkeeper, Inc. v. EPA, 358 F.3d 174 (2d. Cir. 2004).
[11] Entergy Corp. v. Riverkeeper, Inc., 129 S.Ct. 1498 (2009).
[12] In January 2007, EPA had submitted an Information Collection Request (ICR) to OMB seeking approval for a generic information collection request to conduct focus groups and interviews relating to projects including the valuation of ecosystems, which OMB approved.
[13] National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase I Facilities, 76 FR 22174, p. 22218. See also NERA/Desvousges Report at p. 12.
[14] Id., at 22241-2. See also NERA/Desvousges Report at p. 12.
[15] EPA also sought to estimated non-use benefits through a habitat-based methodology, but appears to have abandoned this approach.

EPA's preferred option.[16] It was unable to use the survey to estimate benefits in other regions. When the North Atlantic and Mid-Atlantic non-use valuations were combined with the use values derived from commercial and recreational fishing, above, EPA estimated total monetized annual environmental benefits ranging from $97.1 million for full closed-cycle cooling to $16.3 million for its preferred option.[17] Thus, for its preferred option, it estimated annual benefits (nonuse and use) of $16.3 million, relative to total costs of $466 million. Costs were thus 28 times benefits. To reach the break-even point, nonuse benefits in other regions would have to amount to $449.7 million, or 864 times those EPA found for in the North Atlantic and Mid-Atlantic, an extraordinarily implausible result. Closed-cycle cooling retrofit was calculated to provide $97.1 million in annual benefits and $4.9 billion in costs, or a cost-benefit ratio of 50:1. To reach the break-even point, nonuse benefits in other regions would have to amount to $4.836 billion, or 81 times those calculated by EPA for the North Atlantic and Mid-Atlantic.

In its 2011 Notice of Proposed Rulemaking, EPA stated that it was in the process of developing a nationwide/regional stated preference survey to estimate total willingness to pay (WTP) of households for reducing CWIS losses, without distinguishing use and nonuse benefits. In June 2012, EPA issued a notice of data availability (NODA) on its stated preference survey. In the NODA, EPA presented its survey format and experimental design as well as preliminary data collected from a mail survey conducted at both a national and four regional levels. The survey aims to elicit total stated preference valuations (use plus nonuse) for reducing CWIS fish losses rather than distinguishing between use and nonuse values. EPA had not yet completed all of its statistical analysis. However, as discussed below, the NERA Report was able to derive national WTP valuations for reducing fish losses from the EPA survey results and analysis to date, which indicate total annual use and nonuse values from CWIS controls ranging from $2.275 billion for EPA's preferred option to $7.449 billion for full closed-cycle cooling retrofit.[18] For EPA's preferred option, this $2.275 billion annual benefits figure (use and nonuse values) compares to EPA's 2004 Final Rule benefits figure of $82.8 million annually (use values only) and its 2011 Proposed Rule benefits figure of $16.3 million annually (use plus partial nonuse). For EPA's 2011 regulation, the benefits found by the 2012 survey are nearly 140 times the benefits EPA found for the same regulation last year. Under the new benefit figures, the ratio of benefits to costs for the 2011 proposed rule shifts from 1:28 to nearly 5:1.

A June 5th, 2012 memorandum by Erik Helm of EPA accompanying the NODA explains the design and current findings of the study and plans for its completion. It states that on completion of the survey, EPA will consider using the survey results by taking the valuations from the survey (which include both use and nonuse benefits) and substitute them for the use benefits determined in the proposed rule. Since EPA in no way impugns the validity of its prior

[16] National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase I Facilities, 76 FR 22174, p.22243. See also NERA/Desvousges Report at p. 12.
[17] Id., at 22247. See also NERA/Desvousges Report at p. 12.
[18] See NERA/Desvousges Report at p. 52.

determinations of use values, the logical implication of this strategy is that EPA believes that the survey will reliably determine nonuse value, equal to the difference between the total annual value elicited by the survey ($2.275 billion) and EPA's 2011 determination of use values ($15.8 million-). For EPA's preferred option, this logic would estimate existence values or other nonuse values of $2.259 billion for somewhat increasing the existing stock of generic forage fish nationally.[19]

These figures defy credibility. The total benefits of $2.275 billion generated by the 2012 survey are nearly 140 times the benefits calculated by EPA in 2011. The national nonuse values of $2.259 billion are astronomically greater, on a proportional basis, than the $0.52 million in nonuse benefits for North Atlantic and Mid-Atlantic regions estimated by EPA just last year. They confirm the fundamental defects in the 2012 survey, detailed in the NERA/Desvousges and Barnthouse reports and summarized below, and of EPA's efforts to elicit national nonuse benefits in the CWIS context.

II. Fundamental Defects in EPA's Survey and the Effort to Determine Nonuse Values for Generic Uncaught Fish in the CWIS Regulatory Context

The significant flaws in the most current version of EPA's CWIS stated preference survey and in the results that it has generated are explained and detailed in the reports by NERA/Desvousges and Dr. Barnthouse. In summary, these include:

- Basic defects in the design and content of the survey instrument that prevent it from generating reliable willingness-to-pay valuations.
- Lack of adequate actual and scientific support for the assumptions in the survey questions regarding the contributions of CWIS controls to reducing intake losses and enhancing fish populations and the condition of aquatic ecosystems. As a result, there is not an adequate basis for supposing that the benefits respondents valued would in fact be produced by the controls in question.
- Defects in the econometric methodologies used by EPA to derive willingness-to-pay (WTP) valuations from the survey responses, including lack of replicability, flaws in the selection of the econometric model selected, and the fact that the survey results generated by the model show irrational behavior on the part of respondents.

Basic flaws in the survey are also indicated by the extreme implausibility of the benefit figures that it generated. NERA's analysis of the 2012 NODA survey results has determined that the total national valuation of fish generated by the EPA survey WTP results would range from

[19] Erik Helm, "316(b) Stated Preference (SP) Survey – Survey Methods and Model Results." U.S. Environmental Protection Agency, June 5th, 2012, p. 9.

$2.275 billion to $7.449 billion depending on their regulatory option in question.[20] Since the use values (commercial and recreational fishing) resulting from reduced CWIS losses, as determined by EPA in 2011, range from $15.5 million to $37.7 million depending on the regulatory option, EPA's WTP valuations imply nonuse values for uncaught generic fish nationwide of $2.259 billion to $7.411 billion, or from 145 to 196 times the use values. These amounts dwarf the nonuse valuations offered by EPA in 2011; these amounted to $0.52 million for the North Atlantic and Mid-Atlantic regions for EPA's preferred option; any plausible national extrapolation of these results could hardly total more than several millions of dollars. A survey such as EPA's 2012 survey that finds such astronomical nonuse valuations for marginal reductions in the loss of widely available forage fish defies credibility; in the aggregate, such fish are neither threatened nor endangered, are not as a category unique, and are not threatened with irreversible injury from the continued operation of CWIS.

The defects in the current EPA survey and the extreme implausibility of its results indicate that there are fundamental systemic problems in reliably estimating highly aggregated nonuse values on a national or regional basis for reducing generic fish losses and related population and ecosystem attributes in the CWIS regulatory context through a stated preference survey, especially one that lumps together use and nonuse valuations.

One fundamental set of problems, as developed in the report of Dr. Barnthouse, consists in the faulty methodologies, disregard of uncertainties, and lack of record evidence for the survey's assertions of the environmental benefits that controls would produce. As a result, respondents' answers were based on unsupported factual assumptions, a flaw that negates the validity of the survey and its results. These problems stem from EPA's failure to deal properly with the daunting scientific complexities and uncertainties in determining the effects of controls on environmental attributes people are likely to value and serious limitations in available data. These shortcomings were further compounded by EPA's attempting to determine benefit valuations on an aggregate national or regional basis rather than a site-specific basis. For example, in order to generate aggregate estimates of "young fish" saved as a result of controls, EPA was forced to extrapolate from intake loss data, much of it seriously outdated, at a relatively few sites and apply it to a much larger number of facilities without any assurance that the limited number of sites for which data were available were representative of the whole. Independent scientists charged by the Atlantic States Fisheries Management Commission to examine the matter concluded that available data were insufficient to validly make such extrapolations; yet EPA did so. EPA also ignored a variety of scientific uncertainties in determining the numbers of fish losses avoided by controls and presented the figure calculated as unqualified scientific fact, without providing respondents with a context that would allow them to evaluate the significance of increases in raw numbers of individual generic fish. As also shown by Dr. Barnthouse, there is an even more serious lack of factual and scientific support in the record for the survey's

[20] See NERA/Desvousges Report at p. 52.

assumptions regarding the increases in populations of fish generally, increases in populations of commercial fish, and improvements in aquatic ecosystem that intake controls would produce --- the attributes likely to be of greatest interest to respondents. Yet accurately informing respondents of the inherent complexities and huge uncertainties in determining population-level and ecosystem effects, would challenge the cognitive capacities of the general public.[21] The survey sought to avoid this problem by disregarding many of these complexities. But this resulted in survey assertions about the resource benefits of regulation that were in many instances misleading and lacking in sound factual and scientific basis.

A second basic problem in EPA's 2012 survey, which underlies and compounds the problems just discussed, is that it attempts to determine aggregate valuations for forage fish on a national or regional scale, rather than seeking valuations for particular stocks in particular locations. By seeking to determine stated preference values for fish in general on a broad geographic basis, EPA failed to follow well established principles regarding the circumstances in which it is appropriate to conduct stated preference surveys aimed at eliciting non-use values. It is widely accepted that nonuse values are likely to be significant, and provide a justified basis for stated preference surveys, only when the resource in question is a threatened or endangered species, or where stressors threaten the sustainability of important population or the integrity of ecological community structures and functions. As summarized by A. Myrick Freeman III in a leading treatise:

> Another important question is when are nonuse values likely to be important? The long literature on nonuse values emphasizes the *uniqueness or specialness of the resource in question* and the *irreversibility of loss or injury*. For example, economists have suggested that there are important nonuse values in preserving the Grand Canyon in its natural state and in preventing the global or local extinction of species and the destruction of unique ecological communities. In contrast, resources such as ordinary streams and lakes or a *subpopulation of a widely dispersed wildlife species are not likely to generate significant nonuse values because of the availability of close substitutes*. Moreover, the literature does not suggest that nonuse values are likely to be important where recovery from an injury is quick and complete, either through natural processes or restoration.[22]

EPA itself recognized these principles in its 2004 Rule Preamble, where it disclaimed reliance on non-use valuations. EPA stated:

> In cases where an impingement mortality and entrainment characterization study identifies substantial harm to a threatened or endangered species, to the sustainability of populations of important species of fish, shellfish or wildlife,

[21] See NERA/Desvousges Report at p. 21

[22] A. Myrick Freeman, The Measurement of Environmental and Resource Values: Theory and Methods, Second Edition, Washington: Resources for the Future, 2003, p. 156-157 (emphasis added).

> or to the maintenance of community structure and function in a facility's water body or watershed, non-use benefits should be monetized. In cases where an impingement mortality and entrainment characterization study does not identify substantial harm to a threatened or endangered species, to the sustainability of populations of important species of fish, shellfish or wildlife, or to the maintenance of community structure and function in a facility's waterbody or watershed, monetization is not necessary.[23]

EPA, however, without explaining its change of position, disregarded these principles when it carried out and issued the results of its 2012 survey, which attempts to value fish in general, without regard to specific species and their status; without regard to specific sites and the specific characteristics of particular populations and aquatic communities; and without regard to the existence or not of threats of structural or irreversible harms.

Reductions in fish losses and maintenance of fish populations are likely to have the character of local public goods, of interest primarily to people in the vicinity. Valuations are likely to be largely a function of the specific types of local fish, their populations, and other local circumstances. This conclusion is consistent with most stated preference surveys, which implicitly assume that willingness to pay decreases with distance from a specific resource and thus limit their survey to a small geographical market.[24] EPA's survey, however, collects and compiles responses from both a national market and four very large regional markets. In attempting to conduct a valuation survey for the benefits of intake controls on a highly aggregated basis, lumping together many different fish populations in different locations facing differing conditions, EPA embarked on a course that was almost certain to fail. While it may be feasible to value the benefits of some types of environmental regulations on a highly aggregated national or regional basis, such an approach is not appropriate for CWIS regulation. This particular problem might be avoided to the extent EPA's final CWIS regulations for existing facilities were to allow state permitting authorities to exercise a greater degree of case-by-case flexibility in determining controls, based on a site specific determination of costs and benefits of controls at a given intake involving given fish populations, but the other basic flaws in EPA's survey study would remain.

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[23] National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, 69 FR 41576, p. 41648. EPA made the same statement in its Phase III CWIS rulemaking. See National Pollutant Discharge Elimination System—Proposed Regulations To Establish Requirements for Cooling Water Intake Structures at Phase III Facilities; Proposed Rule, 69 FR 68444, p. 68492.

[24] John C. Whitehead and Glenn C. Blomquist, "The Use of Contingent Valuation in Cost-Benefit Analysis." In Handbook on Contingent Valuation, Anna Alberini and James R. Kahn eds., Edward Elgar (Cheltenham, UK) 2006. This drop-off effect may be less for threatened and endangered species and other resources which respondents may regard as unique. See Loomis, Vertically Summing Public Good Demand Curves: An Empirical Comparison of Economic versus Political Jurisdictions, 76(2) Land Economics 312 (2000). But EPA's survey was based on obtaining valuations for fish and aquatic ecosystems in gross.

A third fundamental problem in EPA's approach is failure to distinguish use and nonuse valuations of increases in fish populations. It has persisted in this strategy notwithstanding that reliable methods exist for determining use values, which EPA has twice used to determine use benefits for CWIS regulations. Failing to distinguish use and nonuse valuations in the survey creates a serious risk that a high proportion of valuations are in fact use valuations, based on supposition that increased stocks of uncaught fish will support future uses. This is an especially significant risk because around half of the respondents are recreational fishers and around 90% consume commercially caught fish.[25] The risk that respondents would confuse and conflate use and nonuse values is exacerbated by the fact that one of attributes that respondents were asked to value in the survey was commercial fish populations. In its 2011 CWIS regulation proposal, EPA did seek to separately estimate nonuse valuations using a regional study involving dams and fish migration and benefits transfer methodology, but has apparently abandoned this effort. The total nonuse valuation found by EPA in 2011 for its preferred regulatory option was $0.52 million for the North Atlantic and Mid-Atlantic regions, dramatically lower on a proportional basis even when differences in geographic coverage are considered than the $2.259 billion in national nonuse values impliedly generated by the survey now embraced by EPA. The benefits generated by EPA's current survey lump together use and nonuse benefits, so it is conceivable that a substantial share of the total benefits could represent use benefits. If so, however, they would be dramatically higher than the $15.8 million to $37.7 million in use values generated by widely accepted revealed preference methods and adopted by EPA in its 2011 rulemaking, again indicating basic flaws in the 2012 survey and its results. If EPA substitutes the flawed survey-based benefit valuations, lumping together use and nonuse values, for the 2011 use benefits that were generated through use of well-established market-based and revealed preference methodologies, the consequence will be to diminish significantly the quality and impair the validity of the valuations.

A fourth fundamental problem in the 2012 EPA survey is the effort to elicit nonuse valuations for modest increases in a non-salient environmental resource, such as uncaught generic fish, in isolation. Cass Sunstein has argued that nonuse valuations for one category of good – in his example, cultural services – tend to be inflated when respondents consider only a single good within that category, without being asked to consider their responses in the context of another, potentially higher value category – health care in his example.[26] It is reasonable to suppose that the same problem arises among subcategories within a given category of goods, such as environmental resources. If the survey respondents had been asked to value marginal increases in forage fish populations, and at the same time value a subcategory of environmental

[25] Depending on the region in question, between 89% and 92% of survey respondents consume commercially caught fish or seafood, and between 46% and 61% of survey respondents consume recreationally caught fish or seafood. See Erik Helm, "316(b) Stated Preference (SP) Survey – Survey Methods and Model Results." U.S. Environmental Protection Agency, June 5th, 2012, p. 16.

[26] Cass R. Sunstein, Coherent and Incoherent Valuation: A Problem with Contingent Valuation of Cultural Amenities. Working Paper, The Cultural Policy Center at the University of Chicago (Feb. 2002).

goals that they could be expected to value more highly, such as preservation of an endangered species or a rare and beautiful ecosystem, one might expect appreciably lower uncaught forage fish valuations.

As a result of these several problems, EPA's survey illustrates many of the shortcomings against which the NOAA Panel on Contingent Valuation warned.[27] The survey "produce[s] results that appear inconsistent with rational choice." The survey results "seem implausibly large in view of the many programs for which individuals might be asked to contribute and the existence of both public and private goods that might be substitutes for the resources in questions." The national/regional scope of the survey has made it "difficult . . . to provide adequate information to respondents about the policy or program for which values are being elicited and to make sure that they have absorbed and accepted this information as the basis for their responses." And, "in generating aggregate estimates" it is "difficult to determine the extent of the market."

Because of these flaws, the EPA survey results do not provide valid or reliable benefit valuations, and should not be used as a basis by EPA or state regulators for imposing costly CWIS regulatory requirements.

III. EPA and OMB Should Not Approve a Precedent-Setting Use of Stated Preference Survey Valuations to Justify an Otherwise Cost-Unjustified Regulation without Ensuring that the Survey Meets High Standards of Validity and Reliability; EPA's 2012 Survey Fails to Meet Such Standards

The Proposed Rule for Existing Facilities is, it appears, the first major federal regulation subject to OMB review whose benefit-cost justification depends almost entirely on claimed nonuse valuations resulting from a stated preference survey. In this situation, EPA and OMB must exercise the utmost care to ensure that the survey meets the highest standards of reliability and validity, such as those articulated by the National Oceanic and Atmospheric Administration (NOAA) Blue Ribbon Panel. To allow far-reaching and costly regulatory requirements to be imposed without such assurances would establish a damaging precedent that could encourage agencies to use unreliable surveys to promote a wide variety of unjustified regulatory initiatives, with serious adverse consequences for regulatory policy and practice.

Although cost-benefit analysis for regulatory decision-making initially attracted extensive skepticism and, in some quarters, sharp hostility, over the past forty years it has evolved to the point where it has become a central element in the system of US regulatory and administrative governance. Although controversy over its use, especially in the area of environmental, health

[27] Report of the NOAA Panel on Contingent Valuation, p. 9-10 (1993).

and safety regulation, has not entirely abated, cost-benefit analysis has gradually won general acceptance as a useful, indeed indispensable tool.

Regulatory cost-benefit analysis was originally targeted at market measures of value, but evolved to include use values based on revealed preference methods, including compensating wage differentials for the statistical value of life, hedonic pricing for environmental amenities, and travel cost methods for recreational benefits. Although they originally encountered skepticism and resistance, their use has become well-established and widely accepted.[28] Use of stated preference surveys to determine nonuse values has not, however, won similar acceptance, notwithstanding that such surveys were initially developed more than 50 years ago, and enjoyed a great upsurge in interest due to the Exxon Valdez oil spill and the development of natural resource damages assessments (NRDA) and claims.

In connection with developing NRDA regulations, NOAA convened a panel of distinguished economists that concluded that while stated preference survey studies are vulnerable to upward bias, application of a series of stringent guidelines for the conduct of stated preference surveys can allow them to convey useful and reliable information.[29] Since that time, many stated preference surveys have been conducted and the state of the art has developed considerably, most notably through the development of choice experiment formats in addition to contingent valuation methodologies (CVM) and increased sophistication in survey design and testing.[30] There is an energetic community of economists who have designed and conducted numerous surveys to estimate both use and nonuse values and advocated their use in a variety of applications, including assessing damages liability and devising regulations as well as with regard to government project and program investments and decisions.[31]

But strong doubts about the reliability of survey results especially for nonuse valuations persist among a substantial number of economists, regulatory policy advocates, and scholars. Skepticism can be found across the spectrum of informed opinion. Some economists do not believe that surveys based on hypotheticals can approach the reliability of nonuse valuations based on revealed preferences, where economic actors must actually expend resources.[32] Some

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[28] V. Kerry Smith, "Nonmarket Valuations of Environmental Resources: An Interpretiv e Appraisal." Land Economics 69(1), p.1-26 (February 1993).
[29] K. Arrow, R. Solow, P. Portnoy, E. Leamer, R. Radner, and H. Schuman. Report of the NOAA Panel on Contingent Valuation. Federal Register 58(1993), p. 4601-14.
[30] Jeff Bennett and Russell Blamey, Eds., The Choice Modeling Approach to Environmental Valuation. Edward Elgar: Northampton (2001).
[31] See, for example, Richard T. Carson and W. Michael Hanemann, "Contingent Valuation." In Handbook of Environmental Economics, K.G. Maler and J.R. Vincent, eds, (North Holland, 2005), p. 821-936.
[32] James J. Murphy and Thomas H. Stevens, "Contingent Valuation, Hypothetical Bias, and Experimental Economics." Agricultural and Resource Economics Review 33:2 (2004), p. 182-192; Peter A. Diamond and Jerry A. Hausman, "Contingent Valuation Measurement of Nonuse Values." In Natural Resource Damages: A Legal, Economic, and Policy Analysis, Richard B. Stewart ed., National Legal Center for the Public Interest (Washington) 1995, p. 61-84.

doubt that surveys are actually measuring economic value rather than eliciting expressions by respondents of commitment or support for ideological or moral good causes.[33] Critics believe that these flaws systematically produce highly inflated nonuse valuations, but there is also concern that study estimates could be unrealistically low, or simply arbitrary.[34] Other critics resist what they perceive to be improper commodification of moral values.[35] Significant doubts have also been expressed by mainstream scholars of administrative law and regulatory policy.[36] These concerns are likely to grow with the application of cost-benefit analysis and nonuse valuation surveys to fields of social policy other than environmental health and safety, such as prison rape.[37] Such applications will only intensify criticism of the reliability of nonuse valuation surveys and protests against commodification of moral values.[38]

Both OMB and EPA guidance acknowledge that stated preference surveys may play a potentially useful role in regulatory decision-making, but evince a decidedly cautious and conservative stance towards their use. While OMB generally recognizes the use of stated preference surveys, it cautions against uncritical reliance upon them, especially as a measure of nonuse and unfamiliar use values. OMB guidance provides that agencies "should prefer revealed preference data over stated preference data because revealed preference data are based on actual decisions, where market participants enjoy or suffer the consequences of their decisions" and that while a stated preference survey might be the only way to obtain quantitative information about nonuse values, "a number based on a poor quality study is not necessarily superior to no number at all."[39] While OMB guidance does not provide a concrete approach to determine whether a particular stated preference study is of sufficient quality to be used in regulatory analysis, it

[33] J. Andreoni, "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving", Economic Journal 100 (1990), p. 464–477; Daniel Kahneman and Jack L. Knetsch, "Valuing Public Goods: The Purchase of Moral Satisfaction," Journal of Environmental Economics and Management 22 (1992), p. 57-70.

[34] Peter A. Diamond and Jerry A. Hausman, "Contingent Value: Is Some Number Better than No Number?", Journal of Economic Perspectives 8(4) (1994), p. 45-64; Peter A. Diamond and Jerry A. Hausman, "On Contingent Valuation Measurement of Nonuse Values." In Jerry Hausman, Ed., Contingent Valuation: A Critical Assessment. Amsterdam: North Holland Press, 1993, p. 3-38.

[35] Frank Ackerman and Lisa Heinzerling. Priceless: On Knowing the Price of Everything and the Value of Nothing. The New Press (New York) 2004; Clive L. Spash, "Multiple Value Expression in Contingent Valuation: Economics and Ethics." Environmental Science & Technology 34:8 (2000), p. 1433-1438.

[36] See Richard H. Pildes & Cass R. Sunstein, Reinventing the Regulatory State, 62 U. Chi. L. Rev. 1, p. 82-83 (1995); Cass R. Sunstein, Coherent and Incoherent Valuation: A Problem with Contingent Valuation of Cultural Amenities. Working Paper, The Cultural Policy Center at the University of Chicago (Feb. 2002); and Peter A. Diamond and Jerry A. Hausman, "Contingent Valuation Measurement of Nonuse Values." In Natural Resource Damages: A Legal, Economic, and Policy Analysis, Richard B. Stewart ed., National Legal Center for the Public Interest (Washington) 1995, p. 61-84.

[37] Institute for Policy Integrity, Comments on Advance Notice of Proposed Rulemaking for National Standards to Prevent, Detect, and Respond to Prison Rape, 75 Fed. Reg. 11077 (Mar. 10, 2010), Docket No. OAG–131; AG Order No. 3143– 2010, RIN 1105–AB34.

[38] Lisa Heinzerling, "Cost-Benefit Jumps the Shark." Georgetown Law Faculty Blog, June 13th, 2012. http://gulcfac.typepad.com/georgetown_university_law/2012/06/cost-benefit-jumps-the-shark.html; Frank Ackerman and Lisa Heinzerling. Priceless: On Knowing the Price of Everything and the Value of Nothing. The New Press (New York) 2004.

[39] OMB. Circular A-4, *Regulatory Analysis*, (Sept. 17, 2003).

states that a study with too many methodological weaknesses or uncertainty should not be used and nonuse values that cannot quantified should be presented instead as an "intangible."[40]

Similarly, EPA guidelines allow the use of stated preference surveys, but warn that "they may be subject to systemic biases that are difficult to test for and correct."[41] Use of stated preference surveys in regulation should thus be made as consistent as possible with market transactions, and reasonable consistency with market transactions must be a "guiding criterion for ensuring the validity of stated preference value estimates."[42] EPA recognizes that market data are a more reliable estimate of willingness to pay than stated preference surveys and says that, optimally, stated preference survey results would be compared to actual market data.[43] When evaluating stated preference survey results, EPA asks researchers to consider potential biases such as framing issues and strategic behavior and asks researchers to test the reliability and validity of data when applying them to policy decisions.[44] Like OMB, EPA states that "it is better to acknowledge gaps in information by discussing them qualitatively or by reporting physical measures … than to employ conceptually flawed methods of monetization."[45]

These strictures reflect and implement the requirement in Section 1(c) of EO 13563 that federal agencies base regulatory decisions on "the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible." Given these strictures, it is essential that both EPA and OMB ensure that the use of stated preference surveys as the basis for cost-benefit analysis and decision-making on major regulations be carefully examined and satisfy high standards of validity, reliability, and relevance. These requirements are especially critical in the case of EPA's CWIS regulations, which would apparently represent (if EPA relies on the results of its survey) the first instance where the cost-benefit case for a major controversial regulation turns wholly on a stated preference survey.

Accepting flawed stated preference surveys like EPA's CWIS survey as a proper basis for regulatory decisions will encourage wider use of such studies. Such studies have costs and other disadvantages that substantially exceed their benefits in terms of improved regulatory decisions. These costs include not only the costs and delays incurred by the government preparing studies and reviewing them, but the costs incurred by interested members of the public in reviewing them, commenting on them and, potentially, preparing counter studies.

In addition, in cases where an agency is legally required to make decisions based on a balancing of costs and benefits or, as in the case of EPA's CWIS regulation, where an agency

[40] Id.
[41] EPA, Guidelines for Preparing Economic Analyses, 7-35 (December 17, 2010).
[42] Id., at 7-36.
[43] Id., at 7-42.
[44] Id., at 7-41.
[45] Id., at 7-20.

chooses to exercise statutory discretion to do so, the agency's determinations of benefits and costs are subject to judicial review. Challenges to and defenses of agency reliance on stated preference survey estimations of nonuse values will burn up additional resources and further prolong and complicate judicial review proceedings and determinations. They can also lead to "ossification" of the regulatory rulemaking process.[46] These various burdens and costs ought to be incurred only in cases where the likely nonuse values are great enough to justify the uses of stated preference survey and a high degree of reliability in the valuations can be assured.

In recognition of these considerations, stated preference survey experts have, as discussed above, recommended use of stated preference surveys to determine nonuse valuations in cases of unique environmental resources and where serious irreversible harms are threatened. As also discussed above, EPA acknowledged this principle in connection with its 2004 Phase II rule and 2006 Phase III rule, where it declined to estimate non-use values for reducing intake fish losses nationwide. This principle is plainly not satisfied here. Forage fish, considered generically and on a regional or national scale, are not a unique resource like an endangered species, and any adverse impacts on their aggregate populations in the range potentially involved with CWIS would be readily reversible. As further discussed above, EPA's attempt to elicit public willingness to pay for fish in the aggregate on a national or regional basis—as contrasted with valuation of endangered or exceptional fish species in specific locations—fatally compromises the validity of the survey and the reliability of its results.

Accordingly EPA's nationwide CWIS regulation is not the sort of situation where the costs and delay involved in a stated preference survey would be justified by any added value that it would bring to regulatory decision-making. Moreover, if EPA's survey is endorsed as a basis for the EPA CWIS regulation, the wildly implausible WTP estimates that it yields could well be invoked by advocates of stringent CWIS controls in various state proceedings, multiplying transaction costs without assurance of better decisions, indeed, creating a high likelihood of worse decisions.

The drawbacks of using unreliable nonuse surveys like EPA's CWIS survey as a basis for regulation are by no means limited to the circumstance where they involve high costs for little or negative benefit. Unreliable nonuse surveys would also threaten regulatory decision-making with arbitrariness and unpredictability. The credibility of regulatory cost-benefit analysis would be undermined by implausibly high or low nonuse valuations or erratic swings in the results obtained. These consequences would undermine the perceived legitimacy of stated survey methods and valuations, even in cases where their use might be warranted, and could undermine public acceptance of the regulatory cost-benefit analysis program generally.

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[46] See Pierce, Seven Ways to Deossify Agency Rulemaking, 47 Ad. L. Rev 49 (1995); McGarity, Some Thoughts on "Deossifying" the Rulemaking Process 41 Duke L.J. 1385 (1991-1992).

The judicial reception of regulatory reliance on stated preference survey nonuse valuations by federal agencies must also be considered. Courts in the natural resources damage assessment (NRDA) context upheld, in general terms, agency regulations authorizing use of stated preference surveys to determine nonuse values that would enjoy presumptive validity, but added the important caveat that specific studies would enjoy this status only "when properly applied" or "performed correctly."[47] And, when confronted in specific cases where plaintiffs relied upon stated preference surveys to establish damages based on nonuse values, courts have held them not sufficiently reliable to be admissible into evidence or otherwise serve as a basis for claims.

Courts initially addressed these issues in the context of reviewing agency regulations authorizing use of contingent valuation surveys to assess natural resources damages. In *Ohio v. U.S. Department of Interior*, the D.C. Circuit upheld provisions of Department of the Interior's (DOI) regulations under CERCLA authorizing use by natural resource trustees of contingent valuation survey results to assess nonuse values for natural resource damages.[48] Nonuse values were determined to be an element of restoration cost, which the court concluded was the appropriate measure for damages under CERCLA unless restoration was infeasible or the cost was grossly disproportionate to use value.[49] The court also upheld DOI's rule that damage assessments enjoy a rebuttable presumption of validity under CERCLA.[50] The court found "no cause to overturn DOI's considered judgment that CV methodology, *when properly applied, can be structured so as to eliminate undue upward bias*."[51] In 1995, the National Oceanic and Atmospheric Administration (NOAA) issued a rule listing contingent valuation as one of many permissible techniques for calculating damages under the Oil Pollution Act of 1990. In *General Electric v. U.S. Department of Commerce*, the court upheld the regulation, finding that "*if performed correctly*, contingent valuation can produce both useful and reliable results."[52]

These decisions involved generic facial challenges to agency regulations authorizing use of nonuse surveys. When confronted with attempts by plaintiffs to use specific nonuse value surveys to recover damages in specific cases, however, federal judges have repeatedly rejected their use. In *Mercado v. Ahmed*, a wrongful-death suit, the court granted the defendant's motion to bar an economist's testimony relying on a series of contingent valuation surveys as a basis for life valuation.[53] The court described the survey as a consensus "of persons who are no more

[47] State of Ohio v. U.S. Dept. of the Interior, 880 F.2d 432, 478 (D.C. Cir. 1989); Gen. Elec. Co. v. U.S. Dept. of Commerce, 128 F.3d 767, 774 (D.C. Cir. 1997).
[48] 880 F.2d 432, 474-76 (D.C. Cir 1989). The DOI regulations had limited the assessment of nonuse values to situations where market or other measures of use valuation were not available. The court invalidated this restriction as contrary to CERCLA. Id., at 462.
[49] Id., at 459.
[50] Id., at 480.
[51] Id., at 478(emphasis added).
[52] 128 F.3d 767, 774 (D.C. Cir. 1997) (emphasis added).
[53] 756 F. Supp. 1097, 1103 (N.D. Ill. 1991).

expert than are the jurors on the value of the lost pleasure of life" and thus expressed skepticism of its usefulness "[e]ven if reliable and valid."[54] In *Idaho v. Southern Refrigerated Transport, Inc.*, the court dismissed damages claims for the existence value of steelhead fish based on a contingent valuation study because "Idaho must prove its damages with reasonable certainty and [the] study does not do so."[55] The court particularly objected to the use of a study originally designed to determine how to increase steelhead runs. The court emphasized that steelhead may have an existence value, but the survey was "legally insufficient to establish existence value in this case."[56] And in *United States v. Montrose Chemical Corp.*, the court granted the defendants' motion to exclude a contingent valuation study measuring damages caused by discharge of DDT in Los Angeles Harbor.[57] Unlike in *Southern Refrigerated*, the survey was commissioned for the litigation and was site-specific and state of the art.[58] The court, however, determined that questions in the survey did not accurately convey the scientific evidence concerning the resulting injuries.[59]

The reliability required for studies used by agencies as the basis for imposition by government of burdensome and costly regulatory controls on private actors should be no less than those used by juries and courts to impose damages liability. In both cases, there must be adequate assurance that use of the coercive powers of the government to impose burdens or deprivations on private actors has a rational basis, consistent with the rule of law. In the case of regulatory impositions, federal regulatory agencies, OMB, and the federal courts all bear this responsibility. While federal courts generally accord substantial deference to administrators in reviewing regulatory decisions by federal agencies dealing with technical and policy matters within their statutory authority, they will insist, especially in the case of high-stake decisions, that agencies justify their determinations through reasoned analysis adequately supported by the facts of record. Under generally prevailing standards of judicial review, EPA would be vulnerable to litigation challenge if it sought to use its 2012 survey to justify its proposed CWIS regulations. The lack of record support for the survey's factual assertions regarding the current regional and national baseline values and the environmental benefits of regulation and the methodological flaws in its model and analyses would likely render agency regulations on the basis of such a study arbitrary and capricious.[60] Like EPA's use of a faulty leachate model, a

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[54] Id.
[55] No. 88-1279, 1991 U.S. Dist. LEXIS 1869, at *55-56 (D. Idaho Jan. 24, 1991).
[56] Id.
[57] United States v. Montrose Chem. Corp., No. CV 90-3122-R (C.D. Cal. Apr. 17, 2000) (No. 1914)..See Thompson, Dale B. "Valuing the Environment: Courts' Struggles with Natural Resource Damages." 32 Envtl. L. 57, 84 (2002).
[58] Id.,
[59] Id.
[60] See, e.g., Chem. Mfrs. Ass'n v. E.P.A., 28 F.3d 1259 (D.C. Cir. 1994); Columbia Falls Aluminum Co. v. E.P.A., 139 F.3d 914 (D.C. Cir. 1998). See also Pac. Coast Fed'n of Fishermen's Associations v. Gutierrez, 606 F. Supp. 2d 1122 (E.D. Cal. 2008) (faulty biological opinion); Greenpeace v. Nat'l Marine Fisheries Serv., 80 F. Supp. 2d 1137 (W.D. Wash. 2000 (same); Greenpeace v. Nat'l Marine Fisheries Serv., 106 F. Supp. 2d 1066 (W.D. Wash. 2000) (same).

court would find EPA reliance on a stated preference survey arbitrary if it "bears no rational relationship to the reality it purports to represent."[61]

Moreover, courts can exercise a far more demanding approach to review when, as Judge Harold Leventhal noted, they see "danger signals" in an agency's actions and reasoning.[62] In the present context, such a "danger signal" would be use of stated preference survey nonuse valuations by agencies to significantly expand regulatory controls in areas that they have been unable to justify on other grounds. It appears that the EPA Water Office may be embarking on such a strategy. It is apparently developing a stated preference survey for Chesapeake Bay that might be used not only to justify CWIS controls but additional forms of regulation aimed at protection of aquatic ecosystems.[63] Courts as well as the public may well view such efforts as an attempt to shortcut the normal regulatory process of establishing concrete benefits sufficient to justify new regulations and use nonuse surveys as a *passe-partout* for regulatory aggrandizement, raising concerns about the potential for arbitrary exercise of administrative power. Such a perception would reinforce the judicial skepticism of stated preference nonuse methodologies reflected in some of the cases discussed above, and could lead to judicial rejection of stated preference surveys even in instances where their use might be warranted. It could also provoke development by courts of a more intrusive approach to reviewing regulatory cost-benefit analyses of the sort displayed in *Corrosion Proof Fittings*.[64]

In order to discipline broad delegations of regulatory power to agencies, courts demand that agencies provide reasoned justifications for their decisions backed by reliable and probative evidence of record. But these tools are difficult to apply where agencies invoke non-use valuations as the ground for regulatory action, for judicially manageable standards of validity for stated preference nonuse value surveys have yet to be developed. Agency invocation of such surveys to supply the gap in proof of benefits sufficient to justify regulation creates the danger of a "science charade," leading to overbroad delegations of regulatory authority and camouflaging of policy choices.[65] Authorizing agencies to impose sweeping new, costly requirements on the basis of such surveys would give agencies wide and largely unchecked regulatory license and open the door to regulation that is arbitrary. The courts are not likely to acquiesce in this course, nor should they.

EPA's use of its nonuse valuation survey to justify nationwide CWIS regulation is similar to the situation confronted by the Supreme Court in the *Benzene* case. The Court blocked what it

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[61] Columbia Falls Aluminum Co. v. E.P.A., 139 F.3d 914, 923 (D.C. Cir. 1998), quoting American Iron & Steel Inst. v. EPA, 115 F.3d 979, 1005 (D.C.Cir.1997).
[62] Greater Boston Television Corp. v. FCC, 444 F.2d 841, 851 (D.C. Cir. 1970).
[63] See Memorandum, *WA 2-09 Task 4: Ecopath simulations of Chesapeake Bay, from* James Palardy, David Mitchell, and Elena Besedin, Abt Associates, Inc., to Tom Born, Josh Hall, and Erik Helm, U.S. Environmental Protection Agency (Nov. 18 2009).
[64] Corrosion Proof Fittings v. EPA, 947 F. 2d 1201 (5th Cir. 1991).
[65] Wagner, The Science Charade in Toxic Risk Regulation, 95 Colum. L. Rev. 1613 (1995).

regarded as OSHA's regulatory overreaching through the use of unverified methodologies and assumptions regarding environmental health and safety risks by imposition of a quantitative risk assessment requirement.[66] To cabin far-reaching, undisciplined regulatory power and prevent an overbroad delegation of regulatory authority, it insisted that OSHA establish through quantitative risk assessments existence of a "significant risk" before imposing new regulations.[67] Subsequently, when OSHA attempted to adopt new regulations on generic determinations of a significant risk for large numbers of toxic substances, the Eleventh Circuit set aside OSHA's attempt at "wholesale" justification on a finding of significant risk in the aggregate.[68] Use of EPA's stated preference survey to justify its nationwide regulatory rule, based on non-use values for forage fish in the aggregate, is a similar and equally flawed effort to avoid making a concrete case for controls that unjustifiedly short-circuits accountability.

Conclusion

As discussed in this statement, EPA's 2012 survey to determine CWIS regulatory benefits suffers from a number of significant, fundamental flaws. Because of these flaws, the survey results do not constitute a reliable or valid basis for CWIS regulatory controls. Accordingly, they should not be used by EPA or approved by OMB as a basis for EPA's CWIS regulation for existing facilities, or for state CWIS regulation.

[66] Industrial Union Department v. American Petroleum Institute, Inc. 448 U.S. 607 (1980).
[67] See Sunstein, Nondelegation Canons, 67 U. Chi. L. Rev. 315 (2000).
[68] AFL-CIA v. OSHA, 945 F. 2d 962 (11th Cir. 1992).

Annex

Professional Qualifications of Richard B. Stewart

Richard B. Stewart is University Professor and John Edward Sexton Professor of Law at New York University, and Director of NYU's Center on Environmental and Land Use Law. He is an internationally recognized scholar in environmental law and policy and administrative law and regulation. He has published over a dozen books and more than 80 articles in these fields.

During 1989-1991 Stewart served as Assistant Attorney General for Environment and Natural Resources at the U.S. Department of Justice, where he led the prosecution of Exxon for the Exxon Valdez Oil Spill and the development of the U.S. position on the 1992 Framework Convention on Climate Change. Prior to joining the Justice Department, he taught at the Harvard Law School and Kennedy School of Government for 18 years, and practiced law with the Washington D.C. firm of Covington & Burling. He also served as Special Counsel to the Senate Watergate Committee and as a law clerk to Justice Potter Stewart of the U.S. Supreme Court. He was formerly Chairman and currently serves as Advisory Trustee of Environmental Defense Fund.

In connection with his lead of the federal government's case against Exxon for the Exxon Valdez oil spill, Stewart became closely involved in the potential use of stated preference survey techniques to assess natural resource damages claims. Subsequently he edited a book and published several book chapters discussing the role of stated preference surveys in the natural resource damages context.

Résumés

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Dr. David Harrison is Senior Vice President and head of NERA's global environment practice. He has extensive experience evaluating a wide range of energy and environmental policies as a consultant, academic and government official.

Dr. Harrison has extensive experience over more than two decades evaluating the costs and benefits of air quality regulations and other social regulatory policies, including various health and safety regulations. These studies have been done for a large number of sectors, including electricity, automobile, trucking, marine, chemical, iron and steel, petroleum, pulp and paper, small utility engines, small handheld equipment, snowmobiles, construction equipment, and others. He and his colleagues have worked closely with company officials and collaborated with various technical consultants in the development of information on these programs. The results of these analyses have been presented to company officials, government agencies, and the media.

Dr. Harrison has been active in the development and economic assessment of climate change policies around the world. Building upon more than two decades of experience with emissions trading programs, he has participated in the development or evaluation of major greenhouse gas emission trading programs and proposals in the United States, including those in California, the Northeast, the Midwest and various federal initiatives, as well as programs in Europe and Australia. He and his colleagues have assisted the European Commission and the UK government with the design and implementation of the European Union Emissions Trading Scheme and national European programs related to climate change, renewable policies, and energy efficiency policies. He also has directed numerous projects for individual companies and trade associations—including those in electricity, oil and gas, refining, petrochemical, pulp and paper, cement, iron and steel, chemical, aluminum and other sectors—using the NERA Carbon Financial Impacts Model, which combines a national state-of-the-art model of energy and related sectors with detailed information on potential climate change policies and company-specific information. Dr. Harrison and his colleagues have used the NERA Carbon Financial Impacts

Model to evaluate the impacts of climate change, renewable and energy efficiency policies on company and sector revenues and costs and to assess company investment and other strategies in light of climate change policies. He has lectured frequently on climate change and related topics at numerous conferences in the U.S. and abroad.

Dr. Harrison has directed benefit-cost analyses for numerous facilities under Section 316(b) of the Clean Water Act. These have included facilities on the major water bodies, including the Atlantic Coast, the Great Lakes, the Pacific Coast, and various rivers. The power plants have included numerous nuclear and fossil units. These assessments have included estimates of the potential impacts on electricity cost and reliability using detailed electricity market models in various electricity regions of the United States. Dr. Harrison has testified regarding these cost-benefit assessments in numerous state workshops and administrative hearings. He also has assisted the Utility Water Act Group (UWAG), the Edison Electric Institute (EEI) and individual utilities in their evaluation of the EPA 316(b) regulations. He has presented the results of these assessments to senior EPA and OMB officials. Dr. Harrison was a co-signer of an Amicus Brief submitted to the Supreme Court of the United States regarding the comparison of benefits and costs under Section 316(b) of the Clean Water Act.

Dr. Harrison has led approximately 50 assessments of the impacts of major economic activities and policies on local, state, regional and national economic metrics, including employment, gross regional product, personal income and tax revenues. These assessments include direct effects as well as the multiplier effects of these activities on the various economies. Dr. Harrison has directed studies of the economic impacts of major energy infrastructure (power plants, natural gas pipelines and others), transportation infrastructure (airports, highways), manufacturing activities (including chemical, petrochemical, automotive and many others), and large commercial and retail developments. In addition, he has directed studies evaluating the economic impacts of numerous energy and environment policies. These assessments have used a wide range of economic models, including state-of-the-art regional models such as that developed by Regional Economic Models, Inc. (REMI) as well as customized models based upon available data. The projects have been developed for numerous areas in the U.S. and abroad including Arkansas, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin as well as the U.S. as a whole and various countries and sub-regions in Africa, Europe, and the Caribbean.

Before joining NERA, Dr. Harrison was an Associate Professor at the John F. Kennedy School of Government at Harvard University, where he taught microeconomics, energy and environmental policy, cost-benefit analysis, transportation policy, regional economic development, and other courses for more than a decade. He also served as a Senior Staff Economist on the U.S. government's President's Council of Economic Advisors, where he had responsibility for environment and energy policy issues. He is the author or co-author of two books on environmental policy and numerous articles on various topics in professional journals.

Dr. Harrison received a Ph.D. in Economics from Harvard University, where he was a Graduate Prize Fellow. He holds a B.A. *magna cum laude* in Economics from Harvard College, where he was a member of Phi Beta Kappa, and a M.Sc. in Economics from the London School of Economics, where he was the Rees Jeffreys Scholar.

Education

Harvard University
Ph.D., Economics
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Professional Experience

National Economic Research Associates, Inc.
1988- *Senior Vice President, Vice President.* Directs projects in the economics of the environment, energy, transportation, regional economic development and other areas.

Putnam, Hayes & Bartlett, Inc.
1987-1988 *Senior Associate.* Directed projects in the economics of energy, antitrust, and other areas.

Dun & Bradstreet Technical Economic Services
1985-1987 *Director of Product Development*. Directed economic studies in energy, transportation, and industrial location.

John F. Kennedy School of Government, Harvard University
1980-1985 *Associate Professor*. Areas of instruction: microeconomics; benefit-cost analysis; environment; energy; natural resource economics; urban economics; transportation; law and economics. Participant, Harvard Faculty Project on Regulation. Faculty Steering Committee, Energy and Environmental Policy Center. Principal investigator in research grants.

President's Council of Economic Advisors
1979-1980 *Senior Staff Economist.* Worked with other White House staff and agency officials on domestic issues. Areas of responsibility included energy, environment, transportation, and antitrust. Principal staff on the Regulatory Analysis Review Group. Principal White House staff for the review of Administration policy regarding the automotive industry.

Department of City and Regional Planning, Harvard University

1974-1979 *Assistant and Associate Professor*. Areas of instruction: microeconomics; statistics; econometrics; transportation; environment; urban development; and housing policy. Participant, MIT-Harvard Joint Center for Urban Studies. Faculty Chairman, Concentration in Land Use and Environment.

National Bureau of Economic Research

1974 *Research Associate*. Co-author of benefit-cost study of automotive air pollution prepared by the National Academy of Sciences for the Committee on Public Works, U.S. Senate.

U.S. Department of Transportation

1973-1974 *Economist*. Performed economic studies of transportation issues, including urban mass transportation, automobile emission and safety programs, and highway finance.

Department of Economics, Harvard University

1970-1974 *Teaching Fellow and Assistant Head Tutor*. Areas of instruction: microeconomics; macroeconomics; econometrics; transportation; public finance; environmental policy; and housing policy.

The Urban Institute

1971 *Research Economist*. Participated in econometric studies as participant in the Program on Local Public Finance.

U.S. Department of Housing and Urban Development

1969 *Economist*. Participated in economic evaluations of HUD infrastructure programs, primarily the water and sewer grant program.

Honors and Professional Activities

Summa Cum Laude, Senior Honors Thesis, Harvard University.

Phi Beta Kappa, Harvard University.

Rees Jeffreys Scholar in the Economics of Transport, London School of Economics.

Graduate Prize Fellowship, Harvard University.

Member, American Economic Association.

Member, Association of Environmental and Resource Economists.

Member, International Association of Energy Economists.

Member, Public Policy for Surface Freight Transportation Study, Transportation Research Board, National Research Council.

Member, Advisory Committee, Massachusetts Department of Environmental Quality Engineering.

Member, Peer Review Panel, National Acid Precipitation Assessment Program.

Member, Public Health and Socio-Economic Task Force, South Coast Air Quality Management District (Los Angeles).

Member, Marketable Permits Advisory Committee, South Coast Air Quality Management District (Los Angeles).

Member, Socioeconomic Technical Review Committee, South Coast Air Quality Management District (Los Angeles).

Member, Harvard Graduate Society Council.

Member, RECLAIM Advisory Committee (Los Angeles).

Member, Board of Trustees, Cambridge Health Alliance (Harvard Medical School Teaching Hospital).

Participant, Aspen Institute Dialog on Climate Change.

Member, U.S. Government Accountability Office Expert Panel on International Greenhouse Gas Emissions Trading.

Consultant to the following public and private organizations:

U.S. Environmental Protection Agency; U.S. Department of Transportation; Massachusetts Port Authority; Organization for Economic Cooperation and Development (OECD, Paris); European Commission Directorate-General Environment; Civil Aeronautics Board; Italian Ministry of Environment; Massachusetts Department of Environmental Protection; UK Department of Transport; UK Department for Environment, Food and Rural Affairs, UK Department of Trade and Industry, City of Chicago Department of Aviation; Conference Board of Canada; South Coast Air Quality Management District; Massachusetts Department of Environmental Management; and numerous state and local governments, trade associations, and private firms.

Reviewer for the following professional journals:

American Economic Review; Review of Economics and Statistics; Journal of Political Economy; Journal of Environmental Economics and Management; Journal of Urban Economics; Journal of Regional Science; Journal of Policy Analysis and Management; and Public Policy.

I. Publications

A. Books

Who Pays for Clean Air. Cambridge, MA: Ballinger Publishing Company, 1975.

The Automobile and the Regulation of Its Impact on the Environment (co-author). Norman, OK: Oklahoma University Press, 1975.

B. Articles and Published Reports

"Economic Policy Instruments for Reducing Greenhouse Gas Emissions" (with Andrew Foss, Per Klevnas, and Daniel Radov), chapter in *Oxford Handbook of Climate Change*, edited by David Schlosberg, John Dryzek, and Richard Norgaard, August 2011.

Climate Change Risks and Opportunities: How Companies Can Develop Information to Comply with SEC Guidance Regarding Climate Change Disclosure (with Andrew Foss), NERA Economic Consulting, February 2010.

A Victory for Economic and Environmental Rationality: Supreme Court Allows Cost-Benefit Analysis in Setting Important Clean Water Act Standards, NERA Economic Consulting, May 2009.

What Every Company Should Do to Prepare for a Mandatory US Greenhouse Gas Cap-and-Trade Program, in *Climate Policy Economics Insights*, NERA Economic Consulting, March 2009.

Now the Hard Work: How to Get the "Biggest Bang for the Buck" from the Federal Economic Stimulus Package, NERA Economic Consulting, February 2009.

Evaluation of Borrowing as a Method to Contain Costs in a Greenhouse Gas Emissions Cap-and-Trade Program (with Albert Nichols), Electric Power Research Institute, December 2008.

"Using Emissions Trading to Combat Climate Change: Programs and Key Issues" (with Per Klevnas, Albert Nichols and Dan Radov) in *Environmental Law Reporter*, June 2008.

Complexities of Allocation Choices in a Greenhouse Gas Emissions Trading Program (with Per Klevnas and Dan Radov), International Emissions Trading Association (IETA), September 2007.

"State Restrictions on Mercury Trading Could Prove Expensive, Ineffective" (with James Johndrow) in *Natural Gas Electricity, Volume 24, Number 2.* Isabelle Cohen, Hoboken, NJ: Wiley Periodicals, Inc., September 2007.

"Experience for Member States in Allocating Allowances: United Kingdom" (with Dan Radov) in *Allocation in the European Emissions Trading Scheme.* A. Denny Ellerman, Barbara K. Buchner and Carlo Carraro, Cambridge, UK: Cambridge University Press, 2007.

Interactions of Cost-Containment Measures and Linking of Greenhouse Gas Emissions Cap-and-Trade Programs, Electric Power Research Institute, November 2006.

Interactions of Greenhouse Gas Emission Allowance Trading with Green and White Certificate Schemes, European Commission Directorate-General Environment, November 2005.

Carbon Markets, Electricity Prices and "Windfall Profits"—Emerging Information from the European Union Emissions Trading Scheme, Electric Power Research Institute, September 2005.

Economic Instruments for Reducing Ship Emissions in the European Union, European Commission, Directorate-General Environment, June 2005.

Evaluation of the Feasibility of Alternative Market-Based Mechanisms to Promote Low-Emission Shipping in European Union Sea Areas, European Commission, Directorate-General Environment, March 2004.

"Assessing the Financial Consequences to Firms and Households of a Downstream Cap-And-Trade Program to Reduce U.S. Greenhouse Gas Emissions" in *A Climate Policy Framework: Balancing Policy and Politics*, John A. Riggs, ed., Washington, DC: The Aspen Institute, 2004.

Alternatives for Implementing the UK's National Allocation Plan, Department for Environment, Food and Rural Affairs, with AEA Technology and SPRU, August 2003.

Report on UK's Implementation of the CO_2 National Allocation Plan Under the European Union Greenhouse Gas Emissions Trading Programme, Department for Environment, Food and Rural Affairs, with AEA Technology and SPRU, July 2003.

"Ex Post Evaluation of the RECLAIM Emissions Trading Program for the Los Angeles Air Basin," National Policies Division, OECD Environment Directorate, June 2003.

Emission Trading in the U.S.: Experience, Lessons, and Considerations for Greenhouse Gases. (with Denny Ellerman and Paul Joskow). Pew Center on Global Climate Change, May 2003.

"Carbon Emission Trading: Creating a New Traded Commodity Market in Europe," in *WorldPower*, October 2002.

"A Groundbreaking Proposal: European Greenhouse Gas Emissions Trading," in *Infrastructure Journal*, August 2002.

"Europe Warms to Emissions Trading," in *Energy Regulation Brief*, NERA Economic Consulting, April 2002.

Evaluation of Alternative Initial Allocation Methods in a European Union Greenhouse Gas Emissions Cap-and-Trade Programme, European Commission Directorate-General Environment, March 2002.

"Economics Issues In Section 316(B) Decisions," in *A Towering Challenge*, C. Richard Bozek, Electric Perspectives, January/February 2002.

"Tradable Permit Programs for Air Quality and Climate Change," in *International Yearbook of Environmental and Resource Economics, Volume VI*, Henk Folmer and Thomas Tietenberg (Eds.). London: Edward Elgar, 2002.

Energy-Environment Policy Integration and Coordination Study (contributor), Palo Alto, CA: Electric Power Research Institute, December 2000.

Critical Issues in International Greenhouse Gas Emissions Trading: Setting Baselines for Credit-Based Trading Programs-Lessons Learned from Relevant Experience. Palo Alto, CA, Electric Power Research Institute, June 2000.

"Tradable Permits for Air Pollution Control: The United States Experience," in *Domestic Tradable Permit Systems for Environmental Management: Issues and Challenges*, J.P. Barde and T. Jones (Eds.). Paris: Organization for Economic Cooperation and Development, 1999.

"Emissions Trading: Turning Theory Into Practice in the Los Angeles Air Basin," in *Pollution for Sale: Emissions Trading and Joint Implementation*, S. Sorrell and J. Skea (Eds.). London: Edward Elgar, 1999.

"Commentary: International Greenhouse Gas Trading and the Kyoto Protocol," in *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality*, C. Walker, M. Bloomfield and M. Thorning (Eds.). Washington, DC: The American Council for Capital Formation Center for Policy Research, May 1999

"Priorities for the Development of GHG Trading Programs: Implications of the U.S. Experience," in Global *Climate Change: Science, Policy, and Mitigation/Adaptation Strategies*, C.V. Mathai and J. Kinsman (Eds.). Washington, DC: Air & Waste Management Association, October 1998.

"Commentary on 'Tradable Emissions Rights and Joint Implementation for Greenhouse Gas Abatement: A Look Under the Hood,'" in *The Impact of Climate Change Policy on Consumers: Can Tradable Permits Reduce the Cost?* C. Walker, M. Bloomfield, and M. Thorning (Eds.).

Washington, DC: The American Council for Capital Formation Center for Policy Research, April 1998.

"Considerations in Designing and Implementing an Effective International Greenhouse Gas Trading Program," Global Climate Coalition, October 1997.

"The Use of Externality Adders for Greenhouse Gas Emissions in Electric Utility Resource Planning," in *Internalization of Social Costs of Energy Conversion and Transportation in the United States and Europe for a Sustainable Development*, O. Hohmeyer and R. Ottinger (Eds.). Berlin: Springer-Verlag, 1996.

"Environmental Adders in the Real World," (with A. Nichols), in *Resources and Energy Economics*, December 1996.

"Recent Evidence on the Appropriate Timing of Reductions in Greenhouse Gas Emissions," (with A. Nichols), Global Climate Coalition, July 1996.

The Distributive Effects of Economic Instruments for Global Warming. Paris: Organization for Economic Cooperation and Development, 1996.

The Distributive Effects of Economic Instruments for Environmental Policy. Paris: Organization for Economic Cooperation and Development, 1994.

"The Socioeconomic Effects of Externality Adders for Electric Utility Emissions," in *Technical Review of Externalities Issues*. Electric Power Research Institute, December 1994.

"Utility Externalities and Emissions Trading: California is Developing a Better Way," in *Social Costs of Energy - Present Status and Future Trends*, R. Ottinger and O. Hohmeyer (Eds.). Berlin: Springer-Verlag 1994.

"Who Wins and Who Loses from Economic Instruments?" *The OECD Observer* 180:29-31, February/March 1993.

"Tradable Permits and Social Costing: The California Experience," prepared for the American Economic Association and Allied Social Science Association Meeting, Anaheim, California, January 6, 1993.

"Emissions Trading: A Better Way to Include Environmental Costs in Electric Utility Resource Planning," American Planning Association and Edison Electric Institute, March 1992.

"Economists' Contribution to the Environment," *Journal of Air and Waste Management Association*, October 1991.

"Potential Cost Savings and Environmental Effects of Using Emissions Trading to Manage NO_x in Ontario," (with A. Nichols), in *Air and Waste Management Through the 90's*, R. E. Clement (Ed.), Air and Waste Management Association, Ontario, Canada, April 1990.

"Market-Based Approaches for Environmental Protection: Implications for Business," (with A. Nichols), in *Special Report on Global Environmental Issues*, B. Gentry (Ed.). Washington, DC: The Bureau of National Affairs, 1990.

"Environmental Policy in Europe: Economic Lessons from the United States Experience," in *Environmental Damages*. Rome, V. Polidoro (Ed.). Italy: Italian Government Printing Office, August 1990.

Comments before the Department of Interior on Advanced Notice of Proposed Rulemaking Regarding Revision of Natural Resource Damage Assessment Regulations, 43 CFR Part 11, (with J. Hausman), November 1989.

"To Live and Breathe in L.A.," (with P. Portney, A. Krupnick, and H. Dowlatabadi), *Issues in Science and Technology* V(4):Summer 1989.

"Policy Approaches for Controlling Greenhouse Gases," Energy Research Group, May 1989.

"Yes to Clean Air, But at What Cost?" *The New York Times*, March 26, 1989.

"Realistic Air-Quality Goals Will Prevent Cost Explosion," *Los Angeles Times*, January 11, 1989.

"Put the Clock on Landing Fees," *The Journal of Commerce*, November 10, 1988.

"Reforming Airport Pricing to Reduce Congestion," Conference on Transportation Options for the 21st Century, Boston, Massachusetts, July 1988.

"Awaiting the Second Shoe at Congested Logan," *The Boston Globe*, March 29, 1988.

"Banning Hazardous Material from Land Disposal Facilities," *Hazardous Waste* 1(1984).

"Benefit-Cost Analysis of Environmental Regulation: Case Studies of Hazardous Air Pollutants," (with J. Haigh and A. Nichols), *Harvard Environmental Law Review* 8(1984).

Research and Demonstration of Improved Methods for Carrying Out Benefit-Cost Analysis of Individual Regulations, Volumes I - IV, (Principal Investigator), prepared for the U.S. Environmental Protection Agency, Final Report, November 1984.

"Using the Hedonic Housing Value Method to Estimate the Benefits of Hazardous Waste Cleanup," (with J. Stock), U.S. Environmental Protection Agency, November 1984.

"Using the Averting Cost Method to Estimate the Benefits of Hazardous Waste Cleanup," (with M. O'Keeffe), U.S. Environmental Agency, November 1984.

"The Value of Acquiring Information Under Section 8(a) of the Toxic Substances Control Act: A Decision-Analytic Approach," (with A. Nichols, L. Boden, and R. Terrell), U.S. Environmental Protection Agency, November 1984.

"Hedonic Housing Values, Local Public Goods, and the Benefits of Hazardous Waste Cleanup," (with J. Stock), Discussion Paper, Energy and Environmental Policy Center, Harvard University, November 1984.

"The Regulation of Aircraft Noise," in *Incentive Arrangements for Environmental Protection*, T. Schelling (Ed.). Cambridge, MA: MIT Press, 1983.

"Benefit-Based Flexibility in Environmental Regulation," (with A. Nichols), Discussion Paper, Energy and Environmental Policy Center, Harvard University, April 1983.

"Who Loses from Reform of Environmental Regulation," (with P. Portney), in *Reform of Environmental Regulation*, Wesley Magat (Ed.). Cambridge, MA: Ballinger Publishing Company, 1982.

"Regulatory Reform in the Large and in the Small," (with P. Portney), in *Reforming Government Regulation*, LeRoy Graymer (Ed.). Beverly Hills, CA: Sage Publications, 1982.

"Imports and the Future of the U.S. Automobile Industry," (with J. Gomez-Ibanez), *American Economic Review*, Papers and Proceedings 72 (May 1982).

"Regulation and Distribution: An Agenda for Research," in *Creating An Agenda for Regulatory Research*, A. Ferguson (Ed.). Cambridge, MA: Ballinger Publishing Company, 1981.

"Cost-Benefit Analysis and the Regulation of Environmental Carcinogens," in *Management of Carcinogenic Risk*, W. Nicholson (Ed.). New York: New York Academy of Sciences, 1981.

"Distributional Objectives in Health and Safety Regulation," in *The Benefits of Health and Safety Regulation*, A. Ferguson (Ed.). Lexington, MA: D.C. Heath and Company, 1981.

"The Local Government Role in Energy Policy," (with M. Shapiro), in *Energy and Environment: Conflict and Resolution*, R. Axelrod (Ed.). Lexington, MA: D.C. Heath and Company, 1981.

"Making Ready for the Clean Air Act," (with P. Portney), *Regulation* 5(March/April 1981).

"Discussion of Robert C. Ellickson, 'Public Property Rights: Vicarious Intergovernmental Rights and Liabilities as a Technique for Correcting Intergovernmental Spillovers," in *Essays on the Law and Economics of Local Government*, D. Rubinfeld (Ed.). Washington, D.C: The Urban Institute, 1979.

"Simulating the Impacts of Transportation Policy on Urban Land Use," Discussion Paper, Department of City and Regional Planning, Harvard University, April 1979. (Presented at meeting of the Eastern Economics Association, May 1979.)

"Income and Urban Development," Discussion Paper, Department of City and Regional Planning, Harvard University, April 1979.

"The Distribution of Benefits from Improvements in Urban Air Quality," (with D. Rubinfeld), Journal of Environmental Economics and Management 5(December 1978).

"The Impact of Transit Systems on Land Use Patterns in the Pre-Automobile Era," Discussion Paper, Department of City and Regional Planning, Harvard University, December 1978.

"The Air Pollution and Property Value Debate: Some Empirical Evidence," (with D. Rubinfeld), *Review of Economics and Statistics* 60(November 1978).

"Transportation Technology and the Dynamics of Urban Land Use Patterns," paper presented to the Conference on Urban Transportation, Planning, and the Dynamics of Land Use, Northwestern University, June 1978.

"Hedonic Housing Values and the Demand for Clean Air," (with D. Rubinfeld), *Journal of Environmental Economics and Management* 5(March 1978).

"Controlling Automotive Emissions: How to Save More Than $1 Billion per Year and Help the Poor Too," *Public Policy* 2 (Fall 1977).

"Reply to Michelle White's Comment on 'Cumulative Urban Growth and Urban Density Functions,'" (with J. Kain), *Journal of Urban Economics* 4(January 1977).

"Cumulative Urban Growth and Urban Density Functions," (with J. Kain), *Journal of Urban Economics* 1(January 1974).

II. Consulting Reports for Directed Projects

A. Climate Change

Evaluation of Incentives in International Sectoral Crediting Mechanisms, prepared for Enel S.p.A., October 2011.

Environmental and Economic Impacts of the First Amendment Supplemental Filing to the 2009 Integrated Resource Plan, prepared for Nevada Power Company, October 2011.

Environmental Costs and Economic Impacts of the Second Amendment to the 2009 Integrated Resource Plan, prepared for Nevada Power Company, August 2011.

Environmental Costs and Economic Impacts of the 2010 Integrated Resource Plan, prepared for Sierra Pacific Power Company, July 2010.

Environmental Costs and Economic Impacts of the 2009 Integrated Resource Plan, prepared for Nevada Power Company, February 2010.

Follow-up letter to US Environmental Protection Agency Clarifying Key Conclusions from Review of EPA's Approach to Aggregating Emissions Across Time in Proposed Revisions of Renewable Fuel Standards, prepared on behalf of Growth Energy, January 2010.

Review of EPA's Approach to Aggregating Emissions across Time in Proposed Revisions of Renewable Fuel Standards, prepared for Growth Energy for submission to U.S. EPA, Docket ID No. EPA-HQ-OAR-2005-0161, September 2009.

Differentiation among Batches of Conventional Biofuels based on Greenhouse Gas Emissions, prepared for Growth Energy, September 2009.

Impacts of Waxman-Markey Bill on US Refiners: Preliminary Estimates, prepared for major industrial sector, July 2009.

Effects of Waxman-Markey on Natural Gas and Electricity Businesses: Phase 1, prepared for a Midwest utility, July 2009.

Environmental Costs and Economic Benefits of Electric Utility Resource Selection, prepared for Nevada Power Company, March 2009.

Impacts of the California Greenhouse Gas Emission Standards on Motor Vehicle Sales, prepared for the Alliance of Automobile Manufacturers, April 2009.

Accounting for Differences in the Timing of Emissions in Calculating Carbon Intensity for the California Low Carbon Fuels Standard, prepared for the Renewable Fuels Association, April 2009.

Environmental Costs and Economic Benefits of Electric Utility Resource Selection, prepared for Nevada Power Company, March 2009.

Evaluation of Alternative Benchmarked Sector-Level Allocation Formulas, prepared for a major U.S. industrial trade group, October 2008.

Impacts of Climate Change Policies Using the NERA Carbon Financial Impacts Model (Phase 2 Study, prepared for a major U.S. industrial manufacturer, June 2008.

Effects of the Regional Greenhouse Gas Initiative on Regional Electricity Markets, prepared for AES and Dynegy, June 2008.

Environmental Costs and Economic Benefits of Electric Utility Resource Selection, prepared for Nevada Power Company, May 2008.

Impacts of Potential Climate Change Policy using the NERA Carbon Financial Impacts Model, prepared for a major U.S. trade association, April 2008.

Market Conditions and the Pass-Through of Compliance Costs in a Carbon Emission Cap-and-Trade Program, prepared for Conoco Phillips, January 2008.

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. industrial manufacturer, December 2007.

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. energy company, November 2007.

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. industrial manufacturer, October 2007.

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. energy company, September 2007.

Environmental Costs and Economic Benefits of Electric Utility Resource Selection, prepared for Sierra Pacific Power Company, June 2007.

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. energy company, March 2007.

Effectiveness of the California Light Duty Vehicle Regulations As Compared to Federal Regulations, in collaboration with Sierra Research, Inc. and Air Improvement Resource, Inc., prepared for the Alliance of Automobile Manufacturers, June 2007.

Financial Impacts of Potential Mandatory CO2 Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. trade association, January 2007.

Modeling the Fleet Population Effects of the Rhode Island Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, November 2005.

Review of Potential Expansion of the UK Phase II National Allocation Plan to the Petrochemical Sector, prepared for UK Department for the Environment, Food and Rural Affairs (DEFRA) and Department of Trade and Industry (DTI), November 2005.

The Impacts of CO_2 Prices on European Electricity Prices, prepared for Electricité de France (EDF), October 2005.

Modeling the Fleet Population Effects of the Massachusetts Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, October 2005.

Modeling the Fleet Population Effects of the Maine Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, October 2005.

Modeling the Fleet Population Effects of the New Jersey Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, September 2005.

Modeling the Fleet Population Effects of the Connecticut Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, September 2005.

Modeling the Fleet Population Effects of the Vermont Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, August 2005.

Modeling the Fleet Population Effects of the New York State Proposal to Reduce Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, July 2005.

Initial Review of Potential Expansion of the UK Phase 2 NAP to Additional CO_2 Sources, prepared for the Department for the Environment, Food and Rural Affairs, May 2005.

Environmental and Economic Impacts of the ARB Staff Proposal to Control Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, September 2004. Submitted to the California Air Resources Board.

Reviews of Studies Evaluating the Impacts of Motor Vehicle Greenhouse Gas Emissions Regulations in California, for the Alliance of Automobile Manufacturers, September 2004. Submitted to California Air Resources Board.

TXU Activities Regarding Actual and Potential US Air Emissions and Climate Change Policies, prepared for TXU Corporation, September 2004.

Strategies for Chubu Electric Power Co., Ltd., to Take Advantage of Opportunities Under Greenhouse Gas Emissions Trading Programs, in collaboration with Japan NUS Co., Lt, for Chubu Electric Power Co., Ltd, January 2004.

Impacts of ZEV Sales Mandate on California Motor Vehicle Emissions: Responses to Comments of Air Resource Board Staff and Related Documents Provided as Part of the 15-Day Notice (with Sierra Research, Inc.), prepared for the Alliance of Automobile Manufacturers, November 2001.

KEPCO's Role in a Greenhouse Gas Emissions Trading Program, prepared for Kansai Electric Power Company, February 2001.

International Carbon Emissions Trading Practices: Review of Recent Literature, prepared for Chubu Electric Power Company, February 2001.

The Timing of Plant Replacement and the Cost-Effectiveness of CO_2 Reductions from Two Canadian Utilities, prepared for Ontario Hydro and TransAlta Corporation, July 1996.

B. Air Quality

Environmental and Economic Impacts of the First Amendment Supplemental Filing to the 2009 Integrated Resource Plan, prepared for Nevada Power Company, October 2011.

Potential Impacts of EPA Air, Coal Combustion Residuals, and Cooling Water Regulations, prepared for the American Coalition for Clean Coal Electricity, September 2011.

Environmental Costs and Economic Impacts of the Second Amendment to the 2009 Integrated Resource Plan, prepared for Nevada Power Company, August 2011.

Environmental Costs and Economic Impacts of the 2010 Integrated Resource Plan, prepared for Sierra Pacific Power Company, July 2010.

Environmental Costs and Economic Impacts of the 2009 Integrated Resource Plan, prepared for Nevada Power Company, February 2010.

Economic Analysis of Proposed U.S. EPA Biocide Data Requirements, prepared for The American Chemistry Council, March 2009.

Evaluation of Potential Attainment Costs and Economic Impacts under a Potential Revised EPA 8-Hour Ozone Standard, prepared for the National Association of Manufacturers, January 2008.

Evaluation of a Voluntary SO_2 Trading Program for the Pulp and Paper Sector, prepared for the American Pulp and Paper Association, February 2007.

An Evaluation of Alternative Approaches to Reducing Pennsylvania Mercury Emissions, prepared for PPL Corporation, August 2006.

An Evaluation and Empirical Analysis of a National Cap-and-Trade Program to Reduce Montana Mercury Emissions, prepared for PPL Corporation, July 2006.

Environmental Costs and Economic Benefits of Electric Utility Resource Selection, prepared for Nevada Power Company, June 2006.

Economic Assessments of Alternative Emission Standards for Small Nonroad Engines, with Air Improvement Resource, Inc. and Sierra Research, Inc., prepared for Briggs and Stratton Corporation, June 2006.

Preliminary Sector Cost Estimates for Potential Emissions Abatement Regulation, prepared for the American Chemistry Council, January 2006.

Evaluation of the Costs of Potential National Caps on Sulphur Dioxide Emissions and Nitrogen Oxide Emissions from Facilities in the Pulp and Paper Industry, prepared for the American Forest & Paper Association, March 2004.

Cost-Effectiveness Analyses of Alternative California Air Resources Board Tier 3 Non-Handheld Exhaust Emission Proposals, prepared for Engine Manufacturers Association and Outdoor Power Equipment Institute, September 2003.

Fleetwide Emissions and Cost-Effectiveness of the Pull-Ahead Requirements for Heavy Heavy-Duty Diesel Engines: Response to Comments Provided by ICF Consulting and Sonoma Technology, Inc., prepared for Detroit Diesel Corporation, July 2002.

Economic Assessments of Alternative Emission Standards for Snowmobile Engines, prepared for International Snowmobile Manufacturers Association, July 2002.

Fleetwide Emissions and Cost-Effectiveness of the Consent Decree Pull-Ahead Requirements for Heavy-Duty Diesel Engines, prepared for Detroit Diesel Corporation, May 2002.

Agenda for the Future: Expanding Policy Innovations to Reconcile Energy and Environmental Objectives, prepared for Edison Electric Institute, March 2001.

Impact of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study (with Sierra Research, Inc.), prepared for the Alliance of Automobile Manufacturers and the Association of International Automobile Manufacturers, January 2001.

Impacts of the Zero Emission Vehicle Mandate on the California Economy, prepared for General Motors Corporation, January 2001.

Review of ADL and UCS Presentations to the California Air Resources Board Regarding the ZEV Mandate, prepared for the Alliance of Automobile Manufacturers and the Association of International Automobile Manufacturers, January 2001.

The Effects of Environmental Regulations on United States Nuclear Power Generation, prepared for Kansai Electric Power Company, January 2001.

Economic Assessment of the Cost-Effectiveness of Alternative MACT Standards for the Metal Coil Surface Coating Industry, prepared for National Coil Coater Association, September 2000.

Addendum Report: Economic Assessment of the Cost-Effectiveness of Alternative Phase 2 Regulations for Handheld Engines, prepared for Husqvarna AB, Husqvarna Forest & Garden Products Co., and Frigidaire Home Products, November 1999.

Economic Assessment of the Cost-Effectiveness of Alternative Phase 2 Regulations for Handheld Engines, prepared for Husqvarna AB, Husqvarna Forest & Garden Products Co., and Frigidaire Home Products, September 1999.

Energy-Environment Policy Integration and Coordination Study (E-EPIC) Phase 1 Executive Report (Contributor), prepared for the Electric Power Research Institute, February 1999.

Economic Analyses of Alternative California Standards for Exhaust Emissions from Marine Engines, prepared for the National Marine Manufacturers Association, October 1998.

Detailed Comments of the Alliance for Constructive Air Policy ("ACAP") on EPA's Supplemental Notice of Proposed Rulemaking Regarding a Model NO_X Cap-and-Trade Rule, submitted by ACAP, June 1998.

Comments on EPA's Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, prepared for the Equipment Manufacturers Institute, December 1997.

Economic Evaluation of Regulations on Exhaust Emissions from Large Nonroad, Compression Ignition Engines, prepared for the Engine Manufacturers Association and the Equipment Manufacturers Institute, October 1997.

Strategic Environmental Issues Facing Fossil-Fired Electric Generating Plants in Canada, draft prepared for Ontario Hydro and TransAlta Corporation, June 1996.

Economic Evaluation of Alternative Regulations of Exhaust Emissions from Small Utility Engines, prepared for Briggs & Stratton Corporation, February 1996

The New York State Environmental Externalities Cost Study: An Overview of Key Elements and Issues, prepared for the Electric Power Research Institute, April 1995.

External Benefits from Increasing Electric Vehicles in the Los Angeles Department of Water and Power Service Territory, prepared for the Los Angeles Department of Water and Power, January 1995.

Consideration of Environmental Externality Values in Minnesota Electric Utility Resource Planning, prepared for Northern States Power Company, November 1994.

Evaluation of Phase I Standards for Small Utility Engines, prepared for Briggs & Stratton Corporation, November 1994.

Evaluation of Additional Tier I Standards for 0-25 HP Engines, prepared for Briggs & Stratton Corporation, October 1994.

Key Issues in the Design of Emission Trading Programs to Reduce Ground-Level Ozone, prepared for Electric Power Research Institute, July 1994.

Environmental Externality Policies in New York State: Comments on the 1994 Draft State Energy Plan, prepared for the New York Power Pool, April 1994.

Environmental Considerations in Power Plant Licensing Decisions in Florida, prepared for the Center for Energy and Economic Development, April 1994.

The Benefits of Reducing Emissions of Nitrogen Oxides Under Title IV of the 1990 Clean Air Act Amendments, prepared for the U.S. Environmental Protection Agency Office of Policy, Planning and Evaluation, Air Policy Branch, March 1994.

Comments on RCG/Hagler, Bailly, Inc. Revised Draft Task 3 Methodological Report, prepared for Empire State Electric Energy Research Company, February 1994.

Scoping Study for a Regional Visibility Trading Program, prepared for Electric Power Research Institute, Energy Analysis Program, February 1994.

A Framework for the Empirical Evaluation of Externality Adders for Electric Utilities, prepared for Electric Power Research Institute, Integrated Systems Division, January 1994.

The Environmental and Economic Benefits of Electricity: Positive Externalities and Other Impacts, prepared for Electric Power Research Institute, Integrated Systems Division, December 1993.

External Costs of Electric Utility Resource Selection in Northern Nevada, prepared for Sierra Pacific Power Company with assistance from Systems Applications International, December 1993.

Economic Evaluation of Alternative Strategies for Regulating Marine Engine Emissions, prepared for the National Marine Manufacturers Association, October 1993.

Consideration of Environmental Externalities in New York Electric Utility Decisions, prepared for the New York Power Pool, October 1993.

Emissions Trading Options for Marine Engine Manufacturers, preliminary results prepared for National Marine Manufacturers Association, May 1993.

Comments on RCG/Hagler, Bailly, Inc. Draft Task 3 Methodological Report, prepared for Empire State Electric Energy Research Corporation, April 1993.

Internalization of Externalities from Electric Utility Generation in Alberta, draft prepared for TransAlta Utilities Corporation, March 1993.

External Costs of Electric Utility Resource Selection in Nevada, prepared for Nevada Power Company, March 1993.

Scoping Study to Assess the External Costs of Electric Utility Resource Selection in Minnesota, prepared for Otter Tail Power Company with assistance from Systems Applications International, March 1993.

Preliminary Draft Scoping Study to Assess Residual Emissions Valuation in Alberta, prepared for TransAlta Utilities Corporation, September 1992.

Distributional Effects of Economic Instruments for Environmental Policy, prepared for the U.S. Environmental Protection Agency and the Organization for Economic Cooperation and Development, May 1992.

Valuation of Air Pollution Damages, prepared for Southern California Edison Company, March 1992.

Adding Rail, Bus and Fleet Sources to the Regional Clean Air Incentives Market (RECLAIM) Program: A Preliminary Analysis, prepared for Southern California Edison, March 1992.

Market-Based Approaches to Managing Air Emissions in Alberta, prepared for Alberta Energy, Alberta Environment and Canadian Petroleum Association, February 1991.

Using Emissions Trading to Reduce Ground-Level Ozone in Canada: A Feasibility Analysis, prepared for Environment Canada, November 1990.

Market-Based Approaches to Reduce the Cost of Clean Air in California's South Coast Basin, prepared for California Council for Environmental and Economic Balance, November 1990.

Tradable Permits and Other Economic Incentives for Environmental Protection, prepared for The Canadian Electrical Association and presented at a Workshop on Tradable Permits, June 1990.

Addressing Canada's Ozone Problem: Recommendations for a Cost-Effective Strategy for Controlling Emissions of Nitrogen Oxides and Volatile Organic Compounds, prepared for TransAlta Utilities Corporation and submitted to the Federal/Provincial Long Range Transport of Air Pollutants Steering Committee, April 1990.

Benefits of the 1989 Air Quality Management Plan for the South Coast Air Basin: A Reassessment, prepared for the California Council for Environmental and Economic Balance, March 1990.

Preliminary Comments on Economic Assessment of the Health Benefits from Improvements in Air Quality in the South Coast Air Basin, prepared for California Council for Environmental and Economic Balance, August 1989.

"Response to 'Review of CCEEB-NERA Study' Concerning the Economic Impacts of the Draft Air Quality Management Plan," prepared for the California Council for Environmental and Economic Balance, submitted to the South Coast Air Quality Management District, March 1989.

Comments on the Draft 1988 Air Quality Management Plan and the Draft Environmental Impact Report Issued by the South Coast Air Quality Management District in September 1988, prepared for the California Council for Environmental and Economic Balance, submitted to the South Coast Air Quality Management District, October 1988.

C. Water Quality

Preliminary Economic Analysis of Cooling Water Intake Alternatives at Merrimack Station, prepared for Public Service of New Hampshire, February 2012.

Comments on Economic Issues Related to EPA's Proposed Regulations for Cooling Water Intake Structures at Existing Facilities, prepared for Utility Water Act Group, August 2011.

Cost-Benefit Comparisons of Fish-Protection Alternatives for AES Cayuga, prepared for AES Corporation, January 2011.

Comments on EPA's Proposed Survey to Estimate the Potential Benefits of Alternative Cooling Water Intake Policies, prepared for American Chemistry Council, American Forest & Paper Association, American Petroleum Institute, and Utility Water Act Group, September 2010.

Cost-Benefit Analysis for Fish Impingement and Entrainment Reduction at Pickering Nuclear Generating Station, prepared for Ontario Power Generation, Inc., December 2009.

Preliminary Costs and Benefits of Cooling Water Intake Alternatives for Mandalay and Ormond Beach Generating Stations, prepared for RRI Energy, Inc., September 2009.

Preliminary Costs and Benefits of California Draft Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, prepared for California Council for Environmental and Economic Balance, September 2009.

Economic Assessment of Installing Wedgewire Screens at Point Beach Nuclear Power Station, prepared for Florida Power & Light Point Beach Nuclear Station, February 2009.

AES Somerset Generating Station Comprehensive Biological Requirements and Technical Review Report, prepared for AES Somerset LLC, January 2009.

Economic Assessment of Fish-Protective Alternatives at Pilgrim Nuclear Power Station, prepared for Entergy Nuclear Generation Company, June 2008.

Social Costs of Alternative Cooling Procedures at Vermont Yankee Nuclear Power Station, prepared for Entergy Nuclear Vermont Yankee LLC, February 2007.

Assessment of Alternative Intake Technologies: Costs and Benefits of Fish Protection Alternatives at the Salem Facility, prepared for Public Service Electric & Gas Incorporated, January 2006.

White Paper on the Use of Benefit-Cost Analysis in Site-Specific 316(b) Decisions Under the Clean Water Act, prepared for PSEG and Entergy, May 2003.

Valuation of Power Costs in Assessing the Costs of Alternatives Under Section 316(b) of the Clean Water Act, prepared for Edison Electric Institute, August 2002.

Economic Evaluation of the Habitat Replacement Cost Methodology in the U.S. EPA's 316(b) Benefits Case Study for Pilgrim Station, prepared for Entergy Nuclear Generating Company, August 2002.

Economic Evaluation of the Delaware Estuary Case Study in the U.S. EPA's 316(b) Existing Facilities Benefits Case Studies, prepared for Public Service Electric and Gas Company, August 2002.

Mercer Generating Station Supplemental 316(b) Report, prepared for Public Service Electric and Gas Company, December 2000.

Economic Evaluation of EPA's Proposed Rules for Cooling Water Intake Structures for New Facilities, prepared for Utilities Water Act Group, November 2000.

Costs and Benefits of Fish Protection Alternatives at the Salem Facility, prepared for Public Service Electric and Gas Company, March 1999.

Costs and Benefits of Alternatives for Modifying Cooling Water Intake at the Hudson Facility, prepared for Public Service Electric and Gas Company, *November* 1998.

D. Economic Impact

Effects on State Economies of Tightening of 8-Hour Ozone NAAQS, prepared for American Petroleum Institute, May 2010.

Impacts of Continental Airlines Operations on the New York- New Jersey Regional Economy, prepared for Continental Airlines, November 2009.

Potential Jobs Impacts of Energy Efficiency Expenditures, prepared for Commonwealth Edison, December 2008.

Potential Jobs Impacts of "Smart Grid" Implementation, prepared for Commonwealth Edison, December 2008.

Potential Jobs Impacts of Electric Utility Asset Renewal, prepared for Commonwealth Edison, December 2008.

Economic Impact of Delta's JFK Presence, prepared for Delta Air Lines, July 2008.

The Flemings Strategy for Grand Bahama Island (contributor), prepared for Global Fulfillment Services Ltd., July 2008.

Estimated Attainment Costs and Economic Impacts in Selected Regions of Proposed Revisions to the EPA 8-Hour Ozone Standard , prepared for National Association of Manufacturers, January 2008.

The Economic Impacts of Attaining the 8-Hour Ozone Standard: Cleveland Case Study, prepared for the American Petroleum Institute, October 2005.

The Economic Impacts of Attaining the 8-Hour Ozone Standard: Philadelphia Case Study, prepared for the American Petroleum Institute, September 2005.

The Past, Present, and Future Socioeconomic Effects of the Niagara Power Project, prepared for the New York Power Authority, August 2005.

Economic and Environmental Impacts of EPA's 2007 Heavy-Duty Emissions Standards, prepared for the Engine Manufacturers Association, January 2005.

Environmental and Economic Impacts of the ARB Staff Proposal to Control Greenhouse Gas Emissions from Motor Vehicles, prepared for the Alliance of Automobile Manufacturers, September 2004. Submitted to California Air Resources Board.

Impacts of Alternative California Air Resources Board Tier 3 Non-Handheld Exhaust Emission Proposals on the California Economy, prepared for Briggs & Stratton Corporation, September 2003.

Impacts of Eliminating the Withholding Tax on International Wagering in U.S. Pools, prepared for National Thoroughbred Racing Association, May 2003.

Impacts of a Premature Shutdown of Indian Point: Updated Results and Comments on February 2003 Report by Synapse Energy Economics Inc., prepared for Entergy Nuclear General Company, April 2003.

Study of the Impact of the Future Chemicals Policy, prepared for Union des Industries Chimiques of France, April 2003.

Economic Projections Relevant to Traffic Demand Projections for the Chicago Skyway Project, prepared for Wilbur Smith Associates, March 2003.

Assessing the Potential Indirect Effects of Electricity Infrastructure on Regional Growth Patterns, prepared for Southern California Edison, November 2002.

Economic Benefits of PSEG Power Facilities to Bergen County, prepared for PSEG Power Development LLC, April 2002.

The Economic Benefits of the Whitecap Energy System to the Chicago Region, prepared for Whitecap Energy System LLC, January 2001

Evaluation of the Economic Impacts of Proposed Development of the Galleria at Long Wharf in New Haven, Connecticut, prepared for Cowdery, Ecker & Murphy, L.L.C., July 2000.

Contributions of Continental Airlines' Hopkins Hub to the Economy of the Cleveland Metropolitan Area, prepared for Continental Airlines, June 2000.

Contributions of Continental Airlines' Newark Hub to the Economy of Newark/New Jersey/New York City, prepared for Continental Airlines, March 2000.

Critical Review of, Economic Impacts of On Board Diagnostic Regulations, prepared for Alliance of Automobile Manufactures, January 2000.

Economic Benefits of Barajas Airport to the Madrid Region and the Neighboring Communities, prepared on behalf of the Spanish Government, January 1999.

Northwest Regional Jetport: Traffic Forecast and Economic Impact, prepared for and with Mercer Management Consulting, September 1998

Impacts on the Hawaii Economy of Alternative Resource Plans for Oahu, prepared for Hawaiian Electric Company, December 1997.

Economic and Environmental Effects of the Maritimes & Northeast Pipeline Project in New Hampshire, with assistance from the Center for Business and Economic Research at the University of Southern Maine, E.H. Pechan & Associates, Inc., and Rose Communications, Inc., prepared for The Maritimes & Northeast Pipeline Project, March 1997.

Economic and Environmental Effects of the Maritimes & Northeast Pipeline Project in Massachusetts, with assistance from the Center for Business and Economic Research at the University of Southern Maine, E.H. Pechan & Associates, Inc., and Rose Communications, Inc., prepared for The Maritimes & Northeast Pipeline Project, January 1997.

Economic and Environmental Effects of the Maritimes & Northeast Pipeline Project, with assistance from the Center for Business and Economic Research at the University of Southern Maine, E.H. Pechan & Associates, Inc., and Rose Communications, Inc., prepared for The Maritimes & Northeast Pipeline Project, November 1996.

Contributions of American Airlines to the Economy of Dade County, prepared for American Airlines, October 1996.

Socioeconomic Effects of Alternative Electric Utility Resources, prepared for Northern States Power Company, June 1995.

Contributions of the Chicago Airport System to the Chicago Regional Economy, prepared for the City of Chicago Department of Aviation, March 1993.

An Economic Analysis of the RECLAIM Trading Program for the South Coast Air Basin, prepared for the Regulatory Flexibility Group and the California Council for Environmental and Economic Balance, March 1992.

Tax Impacts of Alternative Future Airport Systems for the Chicago Region, prepared for the City of Chicago Department of Aviation, January 1992.

Economic Impacts of Alternative Airport Systems for the Chicago Region, prepared for the City of Chicago Department of Aviation, November 1991.

The Lake Calumet Airport and Chicago's Economic Future, prepared for the Lake Calumet Airport Advisory Committee, September 1991.

Updated Economic Impacts of Alternative Future Airport Systems, prepared for the City of Chicago Department of Aviation, September 1991.

The Impact on Ontario Hydro of Emissions Trading for Nitrogen Oxides: A Preliminary Analysis, prepared for Ontario Hydro, December 1990.

The Economic Impacts of Locating a New Airport in the Lake Calumet Area, prepared for the City of Chicago Department of Aviation, January 1990.

Economic Impacts of the Cranberry Industry in Massachusetts, prepared for The Cranberry Institute, November 1989.

Economic Impacts of Rule 1135 Proposed by the South Coast Air Quality Management District, prepared for the Southern California Utility Air Group, May 1989.

Economic Impacts of the Draft Air Quality Management Plan Proposed by the South Coast Air Quality Management District, prepared for the California Council for Environmental and Economic Balance, December 1988.

E. Transportation and Other Infrastructure

Forecasts of Transit Indices for the Indiana Toll Road Based on the CPI and Nominal GDP per Capita, prepared for potential bidder, December 2005.

Socioeconomic Forecasts for the Indiana Toll Road Service Area and the U.S., prepared for potential bidder, December 2005.

Values for Wetlands and Recreational Open Space Relevant to the Harrison, New Jersey Waterfront Site, prepared for AKRF, Inc., October 2005.

Fueling Electricity Growth for a Growing Economy, prepared for Edison Electric Institute, January 2001.

Prospects for the U.S. Nuclear Industry, prepared for Kansai Electric Power Company, January 2001.

Potential Impacts of Environmental Regulations on Diesel Fuel Prices: Evaluation of An Assessment of the Potential Impacts of Proposed Environmental Regulations on U.S. Refinery Supply of Diesel Fuel, prepared for American Petroleum Institute, August 2000, prepared for the Alliance of Automobile Manufacturers, December 2000.

Evaluation of the Economic Analysis of the Bureau of Land Management's Proposed Regulations on Hardrock Mining, prepared for National Mining Association, July 2000.

Evaluation of the Economic Analysis of the U.S. Forest Service Proposed Rule on Roadless Area Conservation, prepared for the National Mining Association, July 2000.

Benefits and Costs of Underground Conversion of Overhead Distribution Lines in New York State, prepared for New York Electric Utilities, July 1994.

Potential Impacts of the Clean Harbors Proposed Rotary Kiln Incinerator on Aesthetics, Recreation, Tourism and Property Values, prepared for Clean Harbors, Inc., June 1989.

Airport Congestion in the United States, prepared for the UK Department of Transport, May 1989.

III. Testimony in Regulatory and Judicial Proceedings

Before the Public Utilities Commission of Nevada, *Eleventh Amendment to its 2010-2029 Integrated Resource Plan, Pre-filed Direct Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, February 1, 2010.

Before the Public Utilities Commission of Nevada, *Eleventh Amendment to its 2007-2026 Integrated Resource Plan, Pre-filed Direct Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, March 3, 2009.

Before the Public Utilities Commission of Nevada, *Eighth Amendment to the 2006 - 2025 Integrated Resource Plan, Pre-filed Rebuttal Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, August 26, 2008.

Brief of Amicus Curiae the AEI Center for Regulatory and Market Studies and 33 Individual Economists in Support of Petitioners, submitted to the Supreme Court of the United States. Entergy Corp, PSEG Fossil LLC and PSEG Nuclear LLC, and the Utility Water Act Group, petitioners, v. Riverkeeper Inc. et al., respondents, on writs of certiorari to the United States Court of Appeals for the Second Circuit. July 21, 2008.

Affidavit of David Harrison, Jr., Ph.D., on behalf of AES and Dynegy, Regarding New York State Department Of Environmental Conservation's Proposed 6 NYCRR Part 242, CO_2 Budget Trading Program, Revisions To 6 NYCRR Part 200, June 16, 2008.

Before the Public Utilities Commission of Nevada, *Eighth Amendment to the 2007 - 2026 Integrated Resource Plan, Pre-filed Direct Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, May 16, 2008.

Before the Public Utilities Commission of Nevada, *Seventh Amendment to the 2006 Integrated Resource Plan, Pre-filed Direct Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, March 15, 2008.

Affidavit of David Harrison, Jr., Ph.D. in support of Public Service Company of New Hampshire's comments on Department of Environmental Service's Preliminary Responses to Requests for Bonus Carbon Dioxide and Nitrogen Oxides Allowances Pursuant to RSA 125-O and Env-A, September 12, 2007.

Prefiled Testimony of David Harrison, Jr., Ph.D. in support of Entergy Nuclear Vermont Yankee, LLC, on behalf of Entergy Nuclear Vermont Yankee LLC, June 22, 2007.

Before the Public Utilities Commission of Nevada, *Application for Approval of the 2008 – 2027 Integrated Resource Plan*, Pre-filed Direct Testimony of David Harrison, Jr. on behalf of Sierra Pacific Power Company, June 20, 2007.

Direct Testimony of David Harrison, Jr., Ph.D., in the Matter of Green Mountain Chrysler Plymouth Dodge Jeep, et al v. Thomas W. Torti, et al (Case No. 05-cv-302), on behalf of

Plaintiffs, April 19, 2007, before Hon. William K. Sessions III, Vermont District Court, Burlington, VT.

Affidavit of David Harrison, Jr., Ph.D. in support of Entergy Nuclear Vermont Yankee, LLC's Opposition to Motions to Renew Stay, on behalf of Entergy Nuclear Vermont Yankee LLC, February 27, 2007.

Rebuttal Testimony of David Harrison, Jr., Ph.D., in the Matter of Green Mountain Chrysler Plymouth Dodge Jeep, et al v. Thomas W. Torti, et al (Case No. 05-cv-302), on behalf of Plaintiffs, October 9, 2006.

Supplemental Testimony of David Harrison, Jr., Ph.D., in the Matter of Central Valley Chrysler Jeep, Inc. et al. v. Witherspoon, on behalf of Plaintiffs, October 9, 2006.

Before the Public Utilities Commission of Nevada, *Application for Approval of the Thirteenth Amendment to the 2005 – 2024 Integrated Resource Plan, Environmental Costs and Economic Benefits of Proposed Expansion Plans,* Direct Testimony of David Harrison, Jr. on behalf of Nevada Power Company and Sierra Pacific Power Company, October 3, 2006.

Before the Public Utilities Commission of Nevada, *Application for Approval of the 2007-2026 Integrated Resource Plan, Rebuttal Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, Sept 20, 2006.

Before the Public Utilities Commission of Nevada, *Application for Approval of the 2007-2026 Integrated Resource Plan, Supplemental Testimony of David Harrison, Jr.* on behalf of Nevada Power Company, Sept 8, 2006.

Before the Public Utilities Commission of Nevada, *Application for Approval of the Thirteenth Amendment to the 2005 – 2024 Integrated Resource Plan, Environmental Costs and Economic Benefits of Proposed Expansion Plans,* Pre-filed Direct Testimony of David Harrison, Jr. on behalf of Sierra Pacific Power Company, July 14, 2006.

Before the Public Utilities Commission of Nevada, *Application for Approval of the 2007 – 2026 Integrated Resource Plan, Environmental Costs and Economic Benefits of Proposed Expansion Plans,* Pre-filed Direct Testimony of David Harrison, Jr. on behalf of Nevada Power Company, Docket No. 06-06051, June 30, 2006.

Rebuttal Testimony of David Harrison, Jr., Ph.D., in the Matter of Central Valley Chrysler Jeep, Inc. et al. v. Witherspoon, on behalf of Plaintiffs, June 12, 2006.

Testimony of David Harrison, Jr., Ph.D., in the Matter of Green Mountain Chrysler Plymouth Dodge Jeep, et al v. Thomas W. Torti, et al (Case No. 05-cv-302), on behalf of Plaintiffs, May 18, 2006.

Testimony of David Harrison, Jr., Ph.D., in the Matter of Central Valley Chrysler Jeep, Inc. et al. v. Witherspoon, on behalf of Plaintiffs, May 2, 2006.

Rebuttal Testimony of David Harrison, Jr., Ph.D., in the Matter of the Renewal/Modification of the State Pollution Discharge Elimination System Permit of Dynegy Danskammer Generation Station, on behalf of Dynegy Northeast Generation, Inc., November 7, 2005.

Direct Testimony of David Harrison, Jr., Ph.D., in the Matter of the Renewal/Modification of the State Pollution Discharge Elimination System Permit of Dynegy Danskammer Generation Station, on behalf of Dynegy Northeast Generation, Inc., October 17, 2005.

Prepared Direct Testimony of David Harrison, Jr., Ph.D., on Behalf of the American Electric Power System. In the Matter of the American Electric Power Company, Inc.: File No. 3-11616. December 7, 2004.

Testimony of David Harrison, Jr., in the Matter of the Arbitration Between BASF Corp., Claimant, and Albaugh, Respondent, prepared on behalf of BASF, February 22, 2002.

Affidavit of David Harrison, Jr., on behalf of PSEG Power New York, Inc., Regarding an Application for a Certificate of Environmental Compatibility and Public Need to Construct and Operate a 750 Megawatt Natural Gas-Fired Combined Cycle, Combustion Turbine Generating Facility in the Town of Bethlehem, Albany County, November 30, 2001.

Second Declaration of David Harrison, Jr., in Response to Notice of Availability of Modified Text and Supporting Documents and Information Released on October 31, 2001, prepared on behalf of General Motors, November 2001.

Declaration of David Harrison, Jr., Regarding the Environmental Disbenefits of the California Zero Emission Vehicle Mandate, prepared on behalf of General Motors Corporation, January 2001.

Oral testimony on behalf of plaintiff Stewart Hutchings, et al vs. Connecticut Department of Economic and Community Development and Office of Policy and Management, Superior Court J. D. of Hartford, March 20, 2000.

Supplemental Report Relating to Damages Incurred to Investigate and Remediate the Bound Brook, New Jersey Site on behalf of Cyanamid Co., et al. V. The Aetna Casualty & Surety Co., et al., Civil Action No. PAS-L-8275-91 (NJ Super. Ct. Law Div), December 3, 1999.

Assessment of Economic Values Associated with Alternative Hydrocarbon Emissions Scenarios, prepared on behalf of Toyota Motor Corporation, in the Matter of the Accusation Against Toyota Motor Corporation (MY 1996-1998 Passenger Cars and Light-Duty Trucks with Evaporative Leak Check Diagnostic Systems) Before the California Air Resources Board, Case No. 519, August 30, 1999.

Affidavit of David Harrison, Jr. on behalf of Tecumseh Products Company regarding remedy proposed by EPA Region V for the Sheboygan River and Harbor Site, August 1999.

Reply Comments Submitted to DOT in Response to *Advance Notice of Proposed Policy Regarding Airport Rates and Charges, Docket No. 29303*, prepared on behalf of the Airport Council International-North America, March 1, 1999.

Airports and Competition: Comments Submitted to DOT Request for Comments on Policy Statement, prepared on behalf of the Airport Council International-North America in response to *Advance Notice of Proposed Policy Regarding Airport Rates and Charges*, Docket No. 29303, February 1, 1999.

Rebuttal Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Piney River, Virginia Site," December 21, 1998.

Rebuttal Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Nascolite Site, Cumberland County, New Jersey," December 21, 1998.

Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Piney River, Virginia Site," October 28, 1998.

Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Nascolite Site, Cumberland County, New Jersey," October 28, 1998.

Rebuttal Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Wallingford, Connecticut Site," October 9, 1998.

Rebuttal Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Bound Brook, New Jersey Site," September 16, 1998.

Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to

Damages Incurred to Investigate and Remediate the Wallingford, Connecticut Site," August 4, 1998.

Report of Plaintiff's Expert in *American Cyanamid Co. et al. v. The Aetna Casualty & Surety Co., et al.*, Civil Action No. PAS-L-8275-91 (N.J. Superior Court Law Division), "Relating to Damages Incurred to Investigate and Remediate the Bound Brook, New Jersey Site," July 16, 1998.

Affidavit on Behalf of Briggs & Stratton Corporation, *Petition for Alternative Emission Standards for Small (0-25 hp) Gasoline Powered Engines*, submitted to the California Air Resources Board, July 1995.

Before the Minnesota Public Utilities Commission, *Considerations in the Development of Externality Values for Greenhouse Gas Emissions,* surrebuttal testimony prepared on behalf of Northern States Power Company In the Matter of the Establishment of Environmental Cost Values, Docket No. E-999/CI-93-583, April 1995.

Before the Minnesota Public Utilities Commission, *Considerations in the Development of Externality Values,* rebuttal testimony prepared on behalf of Northern States Power Company In the Matter of the Establishment of Environmental Cost Values, Docket No. E-999/CI-93-583, March 1995.

Before the Public Service Commission of Nevada, *Environmental Externality Cost Values,* prepared testimony on behalf of Nevada Power Company, Docket No. 94-7001, February 1995.

Before the Minnesota Public Utilities Commission, *Considerations in the Development of Externality Values,* direct testimony on behalf of Northern States Power Company In the Matter of the Establishment of Environmental Cost Values, Docket No. E-999/CI-93-583, November 1994.

Before the Public Utilities Commission of the State of California, *External Benefits from Increasing Electric Vehicles in the Southern California Edison Service Territory,* testimony prepared on behalf of Southern California Edison Company In the Matter of the Order Instituting Investigation and Order Instituting Rulemaking to Develop Rules, Procedures, and Policies Governing Utility Involvement in the Market for Low-Emissions Vehicles, October 1993.

Before the Public Utilities Commission of the State of California, *External Benefits from Increasing Electric Vehicles in the Pacific Gas & Electric Service Territory,* testimony prepared on behalf of Pacific Gas & Electric Company In the Matter of the Order Instituting Investigation and Order Instituting Rulemaking to Develop Rules, Procedures, and Policies Governing Utility Involvement in the Market for Low-Emissions Vehicles, October 1993.

Before the Public Utilities Commission of the State of California, *External Benefits from Increasing Electric Vehicles in the San Diego Gas & Electric Service Territory,* testimony prepared on behalf of San Diego Gas & Electric Company In the Matter of the Order Instituting

Investigation and Order Instituting Rulemaking to Develop Rules, Procedures, and Policies Governing Utility Involvement in the Market for Low-Emissions Vehicles, October 1993.

Affidavit on the Economic Impacts of Chicago Area Airports on the Chicago Regional Economy, prepared on behalf of The City of Chicago in the *People of the State of Illinois et al. v. The City of Chicago et al.*, in the Circuit Court for the Eighteenth Judicial Circuit, DuPage County, Wheaton, Illinois, December 1992.

Before the Public Utilities Commission of the State of California, *Air Quality Issues and Disaggregation of LEV Benefits by Rate Class,* rebuttal testimony prepared on behalf of Southern California Edison Company in the Matter of the Order Instituting Investigation and Order Instituting Rulemaking to Develop Rules, Procedures, and Policies Governing Utility Involvement in the Market for Low-Emissions Vehicles, Docket Nos. I.91-10-029 and R.91-10-028, August 1992.

Before the California Energy Commission ER-92 Hearing on Valuing Air Quality Impacts of Energy Resources, *Revised Damage-Based Values for Residual Emissions Valuation, (with M. B. Deming),* testimony prepared on behalf of Southern California Edison Company, Sacramento, California, May 1992.

Before the State of California Energy Resources Conservation and Development Commission, *Valuing Air Quality Impacts of Alternative Energy Resources,* testimony prepared on behalf of Southern California Edison Company, Docket No. 90-ER-2, March 1992.

Before the California Energy Commission ER-92, *Group I Hearing Issues: Air Quality, (with Southern California Edison), 1992 Electricity Report,* testimony prepared on behalf of Southern California Edison Company, Docket No. 90-ER-92, submitted by Southern California Edison, November 1991.

Affidavit on Landing Fees at Logan International Airport, prepared on behalf of the defendant in *New England Legal Foundation, et al. v. Massachusetts Port Authority and National Business Aircraft Association, Inc., et al.*, United States District Court, District of Massachusetts, June 1988. (Also submitted to the U.S. Department of Transportation.)

Defendant's Expert Witness Disclosure on Summary of Damages Claimed by the State of Michigan for Fish Killed by the Luddington Pumped Storage Plant, prepared on behalf of Consumers Power Company and The Detroit Edison Company in *Frank J. Kelley, ex rel Michigan Natural Resources Commission; Michigan Department of Natural Resources; and Gordon Guyer, Director of the Michigan Department of Natural Resources v. Consumers Power Company and The Detroit Edison Company*, Case No. 86-57075-CE in the Circuit Court for the County of Ingham, June 1988.

IV. Presentations

A. Climate Change

"Incentives for International Sectoral Crediting Mechanisms," presented at the Workshop on New Market Mechanisms organized by the International Emissions Trading Association and Enel S.p.A., Brussels, October 13, 2011

"The Copenhagen Conference: International Climate Policy and Implications for US Policy," presented at the Fenway Colleges Climate Change Teach-In, Washington, DC, February 25, 2010.

"U.S. Greenhouse Gas Cap-and-Trade Programs and Cost Containment," presented at the EUEC 2010 Energy & Environment Conference, AZ, Phoenix, February 1, 2010.

"Financial Implications of a US Cap-and-Trade Program for Sectors and Companies," presented at 2nd Annual Carbon Trading Summit, New York City, January 13, 2010.

"Lessons Learned from the European Union Emissions Trading Scheme," presented to California State Senate Select Committee on Climate Change and AB 32 Implementation, Sacramento, CA, January 7, 2010.

"Greenhouse Gas Emissions Cap-and-Trade Program: Key Design Elements," presented at the IETA Fall 2009 Symposium, Washington, DC, November 3, 2009.

"Compliance Flexibility in Domestic Greenhouse Gas Cap-and-Trade Programs," presented to the 9th Annual Workshop on Greenhouse Gas Emissions Trading sponsored by the Electric Power Research Institute, the International Energy Agency, and the International Emissions Trading Association, Paris, September 14, 2009.

"Allocation Decisions in the European Union Emissions Trading Scheme," presented to the California Economic and Allocation Advisory Committee, July 1, 2009.

"Economic Analysis of Waxman-Markey Climate Bill (ACES)," presented as part of Environmental Markets Association Webinar, June 4, 2009.

"Climate Policy Risks for Electric Utilities: Economic Modeling to Assist Utilities in Responding to Climate Change Programs," presented at the Utility Rate Case Conference organized by Law Seminars International, Las Vegas, NV, February 6, 2009.

"Cost-Containment in a U.S. Greenhouse Gas Cap-and-Trade Program," presented at the EEI Fall 2008 Legal Conference, Boston, October 30, 2008.

"Climate Change and Electricity Prices: What Should Electricity Companies Do," presented at the EUCI Conference on Electricity, Chicago, September 30, 2008.

"The EU Energy and Climate Package: Interactions between EU Policies and Targets and Implications for CO2 Price Uncertainty," presented at the IEA/IETA/EPRI 8th Annual Workshop on Greenhouse Gas Emissions Trading, Paris, September 23, 2008.

"European Union Emissions Trading Scheme: Overview and Implications for the U.S.," presented at the Second Carbon Trading Summit, New York, NY, June 24, 2008.

"Carbon Emissions Trading and Allocation: Complexities of Policy Choices," presented at the IETA/AIGN Workshop, Canberra, Australia, March 5, 2008.

"Climate Change: What Every Company Should Do to Get Ready for a Mandatory Emissions Trading Program," presented at NERA Economic Consulting Workshop, Sydney, Australia, March 4, 2008.

"Workshop on Carbon Emissions Trading: EU and US Experience and Implications for IP/Australia," presented before International Power, Melbourne, Australia, March 3, 2008.

"Design Elements for Potential Canadian GHG Cap-and-Trade Program," presented at the Cap and Trade Working Group Retreat, Toronto, Ontario, January 31, 2008.

"Allocation in the EU ETS: What Have We Learned?" presented at the MIT workshop on EU ETS, Washington, DC, January 24, 2008.

"Emissions Trading: Background, Prior Programs and Implications for a U.S. Carbon Cap-and-Trade Program," presented at ALI-ABA Course on Clean Air: Law, Policy and Practice, Washington, DC, November 9, 2007.

"Overview of the European Union Emissions Trading Scheme for Carbon Dioxide," presented at EEI's 2007 Fall Legal Conference, Napa, California, October 4, 2007.

"Evaluating the Financial Impacts of Potential Carbon Cap-and-Trade Programs on Electricity Companies: What Every Electricity Company Should Do to Get Ready for Mandatory Climate Change Policy," presented at the Carbon Constraint Conference, Chicago, September 13, 2007.

"EU ETS Allocation Options: Reconciling Complexities and Simplicity/Transparency," presented before the IETA-CEPS Climate Change Conference, Brussels, Belgium, June 26, 2007.

"Overview of Allocation Methodologies and Principles," presented before the European Climate Change Programme working group on emissions trading, Brussels, Belgium, May 21, 2007.

"Allocation Choices for a Carbon Trading Program," presented at the Carbon Expo, Cologne, Germany, May 3, 2007.

"Allocation Choices and International Considerations," presented to Senate staff members, Washington, DC, February 2, 2007.

"Carbon Financial Analyses for Electricity Companies," presented at the Electric Utilities Environmental Conference, Tucson, Arizona, January 23, 2007.

"Carbon Emissions and State Electric Utility Regulation," presented at the Electric Utilities Environmental Conference, Tucson, Arizona, January 22, 2007.

"European Union Emissions Trading Scheme for Carbon Dioxide: Lessons and Implications," presented at North America and The Carbon Markets Conference hosted by Point Carbon and Pew Center on Global Climate Change, Washington, DC, January 18, 2007.

"Policy Design Side By Side: What Elements Matter," presented at North America and the Carbon Markets Conference hosted by Point Carbon and Pew Center on Global Climate Change, Washington, DC, January 17, 2007.

"European Union," presented at North America and the Carbon Markets Conference hosted by Point Carbon and Pew Center on Global Climate Change, Washington, DC, January 17, 2007.

"Carbon Markets, Linking, and Cost Containment," presented at the IEA/IETA/EPRI 6th Annual Emissions Trading Workshop, Paris, France, September 27, 2006.

"Auctioning Experience in Other Sectors and Implications for Designing a Carbon Auction," presented at the IETA Workshop on Allocation Methodologies, Paris, France, September 25, 2006.

"European Carbon Markets and Implications for a US Carbon Constrained Future," presented at Preparing for a Carbon Constrained Future Conference hosted by Electric Utility Consultants, Inc., Arlington, Virginia, June 28, 2006.

"Overview of the European Union Emissions Trading Scheme," presented to staff of the Senate Committee on Energy and Natural Resources, Washington, DC, June 16, 2006.

"Policies to Address Potential EU ETS Impacts on Power Prices and Industrial Competitiveness," presented at the CEPS/IETA Climate Change Conference, Brussels, Belgium, May 30, 2006.

"Learning from Experience: First Year of the European CO_2 Emissions Trading Scheme," presented to New Prospects for Climate Change Regulation Panel organized by Harvard Law School, March 10, 2006.

"Carbon Policies and Electric Utility Rate Cases," presented at the Managing the Modern Utility Rate Case Conference organized by Law Seminars International, Las Vegas, NV, February 14, 2006.

"Beyond Cost: Carbon Markets, Electricity Prices and 'Windfall Profits,'" presented to Electric Utilities Environmental Conference, Tucson, AZ, January 23, 2006.

"European CO_2 Emissions Trading Scheme: First Year Accomplishments and Implications," presented at an International Emissions Trading Association side event at the 11th Conference of the Parties to the Kyoto Protocol, Montreal, December 5, 2005.

"Allocation Choices for a U.S. Carbon Dioxide Emissions Trading Scheme," presented to National Commission on Energy Policy, Workshop on Allowance Allocation, Washington, DC, September 30, 2005.

"Carbon Markets, Electricity Prices and Windfall Profits: Emerging Information on the European Union Emissions Trading Scheme" presented to IEA-IETA-EPRI Emissions Trading Workshop, Paris, September 27, 2005.

"U.S. State-level Climate Regimes: Lessons from the U.S. and Europe, presented to Fourth Annual Green Trading Summit, New York, NY, May 2, 2005.

"Overview of Allocation Choices: Alternatives and Implications," presented to Stakeholder Workshop, Regional Greenhouse Gas Initiative, Boston, MA, October 14, 2004.

"Emissions Trading: Concepts, Experience, Lessons, and Implications Greenhouse Gas Programs," presented to Iberdrola, Cambridge, MA, March 25, 2004.

"How CEPCO Can Gain from CO_2 Trading," presented to Chubu Electric Power Co., Inc., Nagoya, Japan, November 25, 2003.

"The Rise of Emissions Trading in Air Quality and Climate Change Policy," presented to EPRI Environmental Sector Council, San Antonio, Texas, September 12, 2003.

"Greenhouse Gas Emissions Trading and Firm Risk Management Behavior", presented to the ARPEL-IPIECA Workshop, A Practical Approach to Identifying Emission Reduction Opportunities: Examples under the Kyoto Mechanisms in Latin America and the Caribbean, San Jose, Costa Rica, December 3, 2002.

"Initial Allocations in Various Systems of Emissions Trading" presented to the Exploring New Approaches in Regulating Industrial Installations (ENAP) Workshop on Emissions Trading for NO_X and SOx in Europe, The Hague, Netherlands, November 22, 2002.

"Overview of Alternative Allocations for European GHG Trading Program," presented to IEA-EPRI-IETA Workshop on Greenhouse Gas Emissions Trading, Paris, September 17, 2002.

"Evaluation of Alternative Allocations for European GHG Trading Program," presented to IEA-EPRI-IETA Expert Meeting: Allocation of GHG Objectives, Paris, September 16, 2002.

"Greenhouse Gas Emission Trading Programs," presented to Chubu Electric Company, Cambridge, MA, July 16, 2002.

"Evaluation of Alternative Allocations for European GHG Trading Program," presented to Chubu Electric Company, Cambridge, MA, July 16, 2002.

"Corporate Strategies and Practices for GHG Emission Reduction," presented to Chubu Electric Company, Cambridge, MA, July 15, 2002.

"Emission Trading: Concepts, Experience, and Lessons from Non-Greenhouse Gas Programs," presented to Chubu Electric Company, Cambridge, MA, July 15, 2002.

"Prospects for the EU Greenhouse Gas Trading Program," presented to EPRI Global Climate Change Research Seminar, Washington, DC, June 4, 2002.

"Evaluation of Alternative Allocations for European GHG Trading Program," presented to European Commission, Brussels, Belgium, November 13, 2001.

"Evaluation of Alternative Allocations for European GHG Trading Program," presented to ENVECO, Brussels, Belgium, November 13, 2001.

"CO_2 Permit Allocations: Evaluation of Alternatives for the EC," presented to the European Commission, Brussels, Belgium, March 5, 2001.

"Setting Baselines for Greenhouse Gas Trading: Lessons from Experience," presented to United Nations Framework Convention on Climate Change, Bonn, Germany, June 10, 2000.

"Setting Baselines for Greenhouse Gas Programs: Lessons from Experience," presented at the EPRI Global Climate Change Research Seminar, Washington, DC, May 18, 2000.

"Emissions Trading and Developing Countries: Implications of U.S. Experience and World Bank Role," presented at World Bank – Energy Week 2000, Washington, DC, April 13, 2000.

"Domestic GHG Trading: Assessing Impacts on Electric Utilities," presented to Electric Power Research Institute, Washington, DC, February 17, 2000.

"Energy-Environmental Policy Integration & Coordination (E-EPIC), U.S. Economic Growth & Health," presented to Electric Power Research Institute, Washington, DC, May 13, 1999.

"Priorities for the Development of GHG Trading Programs: Implications of the United States Experience," presented to the EPRI Global Climate Change Area Meeting, San Diego, California, January 26, 1999.

"Priorities for the Development of GHG Trading Programs: Implications of the United States Experience," presented to the Air & Waste Management Association Specialty Conference on Global Climate Change, Washington, DC, October 14, 1998.

"International Greenhouse Gas Trading," presented to the American Council for Capital Formation, Washington, DC, September 23, 1998.

"International Greenhouse Gas Emission Trading: Promise and Performance," presented to the EPRI Global Climate Change Research Seminar, Washington, DC, May 27, 1998.

"International Greenhouse Gas Trading: A 'Silver Bullet' Train?" presented to Sidebar Meeting, United Nations Framework Convention on Climate Change, Bonn, Germany, October 23, 1997.

"International Greenhouse Gas Trading," presented to the American Council for Capital Formation Conference on Global Warming, Washington, DC, September 24, 1997.

"International Greenhouse Gas Trading," presented to the National Association of Manufacturers, Washington, DC, September 17, 1997.

"International Greenhouse Gas Trading," presented to the American Automobile Manufacturers Association, Washington, DC, May 1, 1997.

"Emission Trading: Alternative Approaches, Experience and Implications for CO_2," prepared for the AAMA Climate Change Task Force, Washington, DC, September 27, 1996.

"Treatment of Greenhouse Gas Emissions in Electric Utility Resource Planning," prepared for the Third Conference on External Costs, *Internalization of Social Costs of Energy Conservation and Transportation in the United States and Europe for a Sustainable Development*, Ladenburg, Germany, May 29, 1995.

"Distributive Impacts of Economic Instruments for Greenhouse Gas Abatement," presented at the Air & Waste Management Association International Specialty Conference *Global Climate Change: Science, Policy and Mitigation Studies*, Phoenix, Arizona, April 6, 1994.

"New Approaches for Controlling Global Warming," presented to the Conference on Global Warming, Vermont Law School, South Royalton, Vermont, February 16, 1990.

B. Air Quality

"Potential Impacts of EPA Air, Coal Combustion Residuals, and Cooling Water Regulations," presented to the U.S. Environmental Protection Agency, November 21, 2011.

"Potential Impacts of EPA Air, Coal Combustion Residuals, and Cooling Water Regulations," presented to the U.S. Office of Management and Budget, November 8, 2011.

"Potential Impacts of EPA Air, Coal Combustion Residuals, and Cooling Water Regulations," presented to the U.S. Treasury Department, October 26, 2011.

"Potential Impacts of EPA Air, Coal Combustion Residuals, and Cooling Water Regulations," presented to the White House Office of Public Engagement, October 25, 2011.

"Economic Effects of State Restrictions on Interstate Mercury Trading," presented at the Electric Utilities Environmental Conference, Tucson, Arizona, January 22, 2007.

"Using Emissions Trading to Regulate Mercury Emissions in Montana," presented at a Public Hearing, Billings, Montana, June 1, 2006.

"Developing an Emissions Trading Program for Regional Haze," presented to Midwest RPO Regional Air Quality Workshop, Chicago, IL, June 28, 2005.

"Developing an Emissions Trading Program for Regional Haze," presented to the Visibility Improvement State and Tribal Association of the Southeast (VISTAS), via conference call from Boston, MA, June 1, 2005.

"Economic and Environmental Analyses of CARB Tier 3 Non-Handheld Exhaust Emission Regulations," presented to the California Air Resources Board staff in Sacramento, CA via videoconference from Boston, MA, September 18, 2003.

"Market Based Instruments and Shipping Emissions," presented to conference sponsored by DG Environment, Brussels, September 5, 2003.

"Economic and Environmental Analyses of CARB Tier 3 Non-Handheld Emission Regulations: Status Report and Preliminary Results", presented to Outdoor Power Equipment Institute and Engine Manufacturers Association (OPEI & EMA), Washington, DC, August 26, 2003.

"Ex Post Evaluation of the RECLAIM Emissions Trading Program for the Los Angeles Air Basin", presented to OECD Workshop on Ex Post Evaluation of Tradable Permits: Methodological and Policy Issues, Paris, January 21, 2003.

"Emissions and Cost-Effectiveness of the Pull-Ahead Requirements for Heavy Heavy-Duty Diesel Engines," presented to U.S. Office of Management and Budget, Washington, DC, July 24, 2002.

"Economic Analysis of Alternative EPA Snowmobile Regulations," presented to U.S. Environmental Protection Agency Office of Mobile Sources, Ann Arbor, Michigan, May 1, 2002.

"Impacts of ZEV Sales Mandate on California Fleet Emissions," presented to the California Air Resource Board, Sacramento, CA, September 7, 2000.

"Economic Assessment of the Cost-Effectiveness of Alternative MACT Standards for the Metal Coil Surface Coating Industry," presentation to the U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, August 2, 2000.

"Economics and Environmental Regulation: Opportunities and Obstacles," presented to Crowell & Moring, LLP, Washington, DC, March 22, 2000.

"RECLAIM: A Comprehensive Approach to Air Quality Regulation," presented to Edison Electric Institute, Washington, DC, March 6, 2000.

"Economic Assessment of the Cost-Effectiveness of Alternative Phase 2 Regulations for Handheld Engines," presented to the U.S. Environmental Protection Agency and Office of Management and Budget, Washington, DC, February 14, 2000.

"Economic Assessment of the Cost-Effectiveness of Alternative Phase 2 Regulations for Handheld Engines," presented to the U.S. Environmental Protection Agency, Office of Mobile Sources, Washington, DC, October 12, 1999.

"Economic Assessment of the Cost-Effectiveness of Alternative Phase 2 Regulations for Handheld Engines," presented to the U.S. Environmental Protection Agency, Office of Mobile Sources, Ann Arbor, Michigan, October 8, 1999.

"Costs & Benefits of Fish Protection Alternatives at the Salem Generating Facility," presented to the New Jersey Department Environmental Protection, Trenton, New Jersey, May 4, 1999.

"Economic Impacts of ARB Staff Proposed Marine Emission Standards," presented to the California Air Resources Board Hearing, Sacramento, California, December 10, 1998.

"Cost-Benefit Analysis of MACT Standards for Boat Manufacturing," presented to the National Marine Manufacturers Association, Tampa, Florida, October 15, 1998.

"Economic Analyses of Alternative California Standards for Exhaust Emissions from Marine Engines," presented to California Air Resources Board, Sacramento, California, October 9, 1998.

"Tradable Permits for Air Pollution Control: The United States Experience," presented to the Organization for Economic Cooperation and Development Workshop on Domestic Tradable Permit Systems for Environmental Management, Paris, September 24, 1998.

"NO_X Trading Program to Implement EPA's SIP Call," presented to Indiana Department of Environmental Management, Indianapolis, Indiana, May 4, 1998.

"Economic Analysis of Alternative EPA Standards for Large CI Non-Road Engines: Draft NERA Results," presented to the Engine Manufacturers Association and the Equipment Manufacturers Institute, Chicago, Illinois, September 4, 1997.

"Cost-Effectiveness of ARB Small Off-Road Engine Regulations: Preliminary Results," presented to the California Air Resources Board, Sacramento, California, May 2, 1997.

"RECLAIM: Turning Theory Into Practice for Emissions Trading in the Los Angeles Air Basin," presented to the NERA Seminar on Tradable Permits, London, United Kingdom, April 11, 1997.

"RECLAIM: Turning Theory Into Practice for Emissions Trading in the Los Angeles Basin," presented to the *International Workshop on Tradable Permits, Tradable Quotas and Joint Implementation*, University of Sussex, Brighton, United Kingdom, April 9, 1997.

"Economic Analyses of Alternative ARB Regulatory Requirements for Small SI Non-Handheld Engines," presented to the California Air Resources Board staff, El Monte, California, February 4, 1997.

"Cost-Effectiveness of Alternative Emission Control Technologies for Small Utility Engines," presented to California Air Resources Board staff, El Monte, California, December 18, 1996.

"Emission Regulations for Non-Road Engines," presentation to the U.S. Environmental Protection Agency, Ann Arbor, Michigan, July 17, 1996.

"Valuation of Externalities: Methods and Examples," presented to the PSP&ED Advisory Group of the Hawaiian Electric Company, Honolulu, Hawaii, April 3, 1996.

"Valuation of Externalities: Experience and Methods," presented to the Hawaiian Electric Company Externalities Advisory Group, Honolulu, Hawaii, January 31, 1996.

"Emission Regulations for Small Utility Engines," presented to Small Non-Road Engine Regulatory Negotiations, Ann Arbor, Michigan, December 13, 1995.

"Economic Evaluation of Alternative Regulations of Exhaust Emissions from Small Utility Engines," presented to U.S. Environmental Protection Agency, Ann Arbor, Michigan, November 28, 1995.

"Emission Regulations for Small Utility Engines," presented to California Air Resources Board staff, El Monte, California, October 3, 1995.

"Briggs & Stratton/NERA Phase 2 Economic Study," presented to U.S. Environmental Protection Agency, Ann Arbor, Michigan, September 22, 1995.

"RECLAIM: Turning Theory Into Practice for Emissions Trading in the Los Angeles Basin," presented to the Stanford Law School Environmental Markets Seminar, Stanford, California, March 8, 1995.

"Emission Trading for NO_X: Experience with RECLAIM," presented to Edison Electric Institute, Washington, DC, May 26, 1994.

"Emission Trading for NO_X: The RECLAIM Experience," presented to Edison Electric Institute, May 13, 1994.

"Projecting the Price of RECLAIM Trading Credits for NO_X," presented at a California Energy Commission Workshop, Sacramento, California, February 4, 1994.

Comments on "Presumptive Pigouvian Tax: Complementing Regulation to Mimic an Emissions Fee," presented to the Conference on Market Approaches to Environmental Protection, Stanford University, Palo Alto, California, December 3, 1993.

"Economic Effects of Regulatory Requirements to Protect Grand Canyon Visibility," presented to the Grand Canyon Visibility Transport Commission, Salt Lake City, Utah, October 21, 1993.

"Evolving Role of Externalities in Utility Activities," presented to the Electric Power Research Institute Energy Analysis Task Force, Nashville, Tennessee, September 29, 1993.

"External Costs of Electricity Generation in Southern Nevada," presented on behalf of Nevada Power Company, at a workshop sponsored by the Nevada Public Service Commission, Las Vegas, Nevada, May 19, 1993.

"Environmental Externalities," presented to Central and Southwest Corporation, Dallas, Texas, May 4, 1993.

"Creating Markets for Environmental Protection: Overview of Experience with Tradable Permit Systems," presented at The Claremont Institute

Conference *Environmental Protection Through Market Incentives: A Strategy for the Future*, Los Angeles, California, January 20-21, 1993.

"Tradable Permits and Social Costing: The California Experience," presented at the American Economic Association and Allied Social Science Association Meetings, Anaheim, California, January 6, 1993.

"The Distributive Impacts of Economic Instruments for Environmental Policy," presented to the OECD Group on Economic and Environmental Policy Integration, Paris, November 19, 1992.

"Emissions Trading: A Better Way to Incorporate Environmental Costs in Electric Utilities Resource Planning," presented at the Pace University

Center for Environmental Legal Studies Conference on *Incorporation of Social Costs of Energy in Resource Acquisition Decisions*, Racine, Wisconsin, September 8-11, 1992.

"Banking and Trading of Air Emission Reduction Credits," presented to the State of Connecticut Office of Policy and Management Meeting on Emissions Trading, Hartford, Connecticut, July 22, 1992.

"The Distributive Effects of Economic Instruments for Environmental Policy," presented to the OECD Group on Economic and Environmental Coordination, Paris, June 18, 1992.

"A Marketable Permits Program for the Los Angeles Air Basin," prepared for MIT Center for Energy and Environmental Policy Research *1992 New Developments Workshop*, Cambridge, Massachusetts, April 30, 1992.

"The Road From Theory to Practice: Developing a Marketable Permits Program for the Los Angeles Air Basin," seminar presented to the MIT Center for Energy and Environmental Policy Research, Cambridge, Massachusetts, March 11, 1992.

"Southern California Edison Damage-Based Values for Residual Emissions Valuation," presented to the California Energy Commission ER 92 Committee Workshop on Air Emission Damage Functions, Sacramento, California, January 29, 1992.

"Turning Theory Into Practice: Developing a Marketable Permits Program for the Los Angeles Basin," prepared for Project 88 -- Round II Seminar, John F. Kennedy School of Government, Harvard University, Cambridge, Massachusetts, December 11, 1991.

"Workshop on Economic Instruments," prepared for Imperial Oil Ltd., Toronto, Canada, October 1-2, 1991.

"Market-Based Approaches to Air Quality Improvement," presented to the Board of Directors of the California Council for Environmental and Economic Balance, San Diego, California, July 1991.

"Environment and Equity," presented to the Board of Directors of the California Council for Environmental and Economic Balance, San Diego, California, July 1991.

"Contribution of Economists to Environmental Policy: Comments on the Gruenspect-Lave Critical Review," presented to the Air and Waste Management Association, Vancouver, British Columbia, June 19, 1991.

"Airports and Economic Development," presented to the Southeast Chicago Development Commission, Chicago, Illinois, May 24, 1991.

"Environmental Economics in the 1990s," presented to the OECD Group of Economic Experts, Paris, May 16, 1991.

"The Clean Air Act: How to Make the Mandate Worth the Effort," presented to the Workshop on Emerging Environmental Policies and Business, North Carolina State University, Raleigh, North Carolina, April 18, 1991.

"Market-Based Approaches to Managing Air Emissions in California's South Coast Basin," presented to Workshop on Market Incentives, South Coast Air Quality Management District, El Monte, California, January 29, 1991.

"Market-Based Approaches to Managing Air Emissions in California's South Coast Basin," presented to the Steering/Advisory Committee on Market Incentives, South Coast Air Quality Management District, Los Angeles, California, December 11, 1990.

"How Environmental Policies Influence Natural Gas Markets," presented to the Conference on Emerging Competition in California Gas Markets, sponsored by the California Energy Commission, San Diego, California, November 9, 1990.

"Air Quality and Electric Vehicles," presented to the Electric Vehicle Symposium, sponsored by the Western Energy Supply and Transmission Associates, Ontario, California, November 8, 1990.

"Incorporating Environmental Impacts in Public Utility Commission Regulation," presented to the Energy Research Group, Washington, DC, November 6, 1990.

"The Promise and Performance of the Acid Rain Allowance Program," presented to the Conference on the New Acid Rain Legislation: Capitalizing on a Market-Based Approach, sponsored by Public Utilities Reports, Inc., Washington, DC, October 24, 1990.

"What Environmental Legislation Means for Crude Oil Marketers: A U.S. Overview," prepared for the Oxford College of Petroleum Studies, Long Beach, California, presented October 1, 1990.

"Market-Based Approaches for Environmental Improvement," presented to the Eleventh Annual Antitrust and Trade Regulation Seminar, sponsored by National Economic Research Associates, Santa Fe, New Mexico, July 5-7, 1990.

"Using Market-Based Approaches in the Energy Sector," presented to the OECD Economic Incentives Working Group, Paris, June 19-20, 1990.

"Emissions Trading: Concepts and Experience," prepared for The Canadian Electrical Association and presented at the *Workshop on Tradable Permits*, Toronto, Canada, June 13, 1990.

"Prototypical Trading Policy: Stationary Sources of NO_X," prepared for NO_X/VOC Task Force and presented at the *Workshop on Flexible Mechanisms*, Montreal, Canada, June 6-7, 1990.

"Emissions Trading: An Overview of Concepts and Experience," prepared for NO_X/VOC Task Force and presented at the *Workshop on Flexible Mechanisms*, Montreal, Canada, June 6-7, 1990.

"Market-Based Approaches for Environmental Improvement," presented to the Board of Directors, The Conference Board of Canada, Edmonton, Canada, May 30, 1990.

"Market-Based Approaches for Environmental Protection: Lessons from the U.S. Experience," presented to the Advisory Board, Research Program on Business and the Environment, The Conference Board of Canada, Toronto, Canada, April 24, 1990.

"Ozone and Economics," presented to the Air and Waste Management Association, Los Angeles, California, March 20, 1990.

"Clear Thinking on Clear Air: Agenda for the 1990's," paper and panel discussion presented at the American Enterprise Institute's Thirteenth Annual Policy Conference, Washington, DC, December 4, 1989.

"The Acid Rain Allowance Program," presented to the Energy Research Group, Washington, DC, November 3, 1989.

C. Water Quality

"Benefit-Cost Analysis in Section 316(b) BTA Determinations: The Road Ahead," presented at the American Fisheries Society Symposium, Seattle, Washington, September 6, 2011.

"Cost-Benefit Analysis for Fish Impingement and Entrainment Reduction at Pickering Nuclear Generating Station," presented to Canadian Nuclear Safety Commission, Ottawa, Canada, October 29, 2009.

"Cost-Benefit Analysis for Fish Impingement and Entrainment Reduction at Pickering Nuclear Generating Station," presented at Ontario Power Generation Inc. Stakeholder Workshop, Ontario, Canada, September 29, 2009

Uncertainty in §316(b) Compliance Demonstration: Case Study Including Monte Carlo Analysis," presented at the UWAG/EPRI Conference on Technologies and Techniques for §316(b) Compliance, Atlanta, Georgia, September 7, 2006.

"Electricity System Impacts of Nuclear Shutdown Alternatives," presented to New York City Council, New York, NY, May 7, 2002.

"Electricity System Impacts of Nuclear Shutdown Alternatives," presented to Westchester County Board of Legislators Committee on Environment and Health, Westchester, New York, April 29, 2002.

"An Economic Approach to 316(b) BTA Determination," presented to the UWAG 316(b) Technical Workshop for the Environmental Protection Agency, Annapolis, Maryland, January 25, 2001.

"Methodology for Cost-Benefit Assessment of Fish Protection Alternatives for the Mercer Facility," presentation to the Mercer 316(b) Permit Team, Newark, New Jersey, August 8, 2000.

"Roadmap for Costs & Benefits of Fish Protection Alternatives for the Salem Facility," presented to the Monitoring Advisory Committee, Mt. Laurel, New Jersey, December 9, 1999.

"Natural Resource Damage Assessments: Economic Techniques," presented to PSE&G, Newark, New Jersey, December 9, 1997.

"Use of Economic Analysis in Environmental Impact Statements and Other Regulatory Proceedings," presented to Hudson River Utilities, New York, New York, November 19, 1997.

"Combining Science and Economics: The Case of Superfund," presented to ENVIRON, Princeton, New Jersey, May 16, 1995.

"Social Costing: Policy Overview," presented to the British Columbia Utilities Commission Social Costing Workshop, Vancouver, British Columbia, March 29, 1995.

D. Economic Impact

"Financial Implications of a US Cap-and-Trade Program for Sectors and Companies," presented at 2nd Annual Carbon Trading Summit, New York City, January 13, 2010.

"Evaluating the Impact of Future E.U. Chemical Policy on the French Economy," presented to REMI Northeast Policy Analysis and Users' Conference, Boston, MA, January 31, 2006.

"Background on NERA Study 'Socioeconomic Effects of the Niagara Power Project and Local NYPA Presence'," presented to Niagara Power Project Relicensing Stakeholder Meeting, Niagara Falls, NY, November 13, 2003.

"Economic Benefits to the Chicago Region from the Whitecap Energy System," presented to the Illinois Department of Natural Resources, Springfield, Illinois, January 30, 2001.

"Fueling Electricity Growth for a Growing Economy," presented to Edison Electric Institute, Palm Springs, California, January 13, 2000.

"Economic Impact Analyses with REMI: Two Case Studies," presented to the REMI Seminar, Miami, Florida, October 6, 1997.

"Impacts on the Hawaii Economy of Alternative Resource Plans for Oahu," presented to the Hawaiian Electric Company IRP Advisory Group, Honolulu, Hawaii, July 24, 1997.

"Economic and Environmental Effects in Maine of the Maritimes & Northeast Pipeline Project," presented to the Maine Economic Development Council, Rockland, Maine, February 12, 1997.

"Economic and Environmental Effects of the Maritimes & Northeast Pipeline Project," presented to a media conference and Editorial Boards of the *Bangor Daily News*, the *Portland Press Herald,* and the *Kennebec Journal,* Bangor and Augusta, Maine, November 21, 1996.

"Assessing the Economic Impacts of Alternative HECO Resource Plans," presented to the PSP&ED Advisory Group of the Hawaiian Electric Company, Honolulu, Hawaii, July 3, 1996.

"The Lake Calumet Airport and Chicago's Economic Future," presented to the Lake Calumet Airport Advisory Committee, Chicago, Illinois, July 2, 1991.

"Socioeconomic Impacts of Proposed Rule 431.2," prepared for Southern California Edison and presented to the South Coast Air Quality Management District, Los Angeles, California, May 4, 1990.

"An Economist Looks at the Federal Regulation of Biotechnology," presented to the Conference on Emerging Issues in Biotechnology, sponsored by Boston University Law School, Boston, Massachusetts, March 2, 1990.

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Noah Kaufman
Consultant

Noah Kaufman is a Consultant in the NERA Environment Practice. He has published papers on the topics of energy efficiency programs and cost-benefit analyses related to climate change, and he wrote his doctoral dissertation on the economics of climate change.

Dr. Kaufman holds a Ph.D. in Economics with a concentration in Environment and Public Economics from the University of Texas at Austin. He earned a B.S. in Economics from Duke University. After graduating college he worked as an analyst in the corporate finance department of an investment bank and in the securities and finance practice of an economic consulting firm.

Education

THE UNIVERSITY OF TEXAS AT AUSTIN, Austin, Texas
Ph.D. in Economics, 2011

THE UNIVERSITY OF TEXAS AT AUSTIN, Austin, Texas
M.S. in Economics, 2009

DUKE UNIVERSITY, Durham, North Carolina
B.S., Economics, *cum laude*, 2004

Professional Experience

NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC.
2011 - *Consultant*
2006 - 2007 *Analyst*

RESOURCES FOR THE FUTURE
2008, 2009 *Research Analyst*

KEEFE BRUYETTE & WOODS, INC.
2004-2006 *Analyst*

Publications

I. Journal Articles

"The bias of integrated assessment models that ignore climate catastrophes," *Climatic Change*, Volume 110, Numbers 3-4 (2012), 575-595.

"Energy efficiency program evaluations: opportunities for learning and inputs to incentive mechanisms," *Energy Efficiency*, Volume 5, Number 2 (2012), 243-268.

II. Published Reports

Preliminary Economic Analysis of Cooling Water Intake Alternatives at Merrimack Station, prepared for Public Service of New Hampshire, February 2012.

Environmental and Economic Impacts of the First Amendment Supplemental Filing to the 2009 Integrated Resource Plan, prepared for Nevada Power Company, October 2011.

Environmental Costs and Economic Impacts of the Second Amendment to the 2009 Integrated Resource Plan, prepared for Nevada Power Company, August 2011.

Comments on Economic Issues Related to EPA's Proposed Regulations for Cooling Water Intake Structures at Existing Facilities, prepared for Utility Water Act Group, August 2011.

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EUGENE PENNELL ERICKSEN

Dr. Ericksen received an M.A. degree in Mathematical Statistics and Ph.D. degree in Sociology at the University of Michigan.

Dr. Ericksen is an Emeritus Professor of Sociology and Statistics at Temple University. In addition to statistical sampling, his fields of expertise include survey research and demographic methods. At Temple University, Dr. Ericksen has concentrated his teaching efforts in three areas: 1) statistics, research design and survey research methodology; 2) stratification and race and ethnic relations; and 3) demography and human ecology. He has taught extensively at both the graduate and undergraduate levels.

At NERA, Dr. Ericksen serves as a special consultant on matters of sampling, surveys and demography. In addition to the selection of samples, his survey expertise concerns the development of survey questionnaires and the analysis of questionnaire data. As a demographic consultant, he specializes in matters concerning census data and the calculation of post-censal estimates for local areas. He has developed methods of computing estimates for local areas when census data are unavailable and has done research on methods of measuring and adjusting for the undercount in the United States census. He has testified before federal and state congressional committees, federal and state courts and the Nuclear Regulatory Commission. He was the Co-Chair of the Special Advisory Committee on the 1990 Census, appointed by the Secretary of Commerce to advise him on the possibility of adjusting the 1990 Census for differential undercount.

Dr. Ericksen has designed samples and directed surveys for many clients in the public and private sectors, frequently for purposes of litigation. Dr. Ericksen's industry experience includes pharmaceuticals, automobiles, health and hospitals, insurance, movies, radio and television, and retail stores. Dr. Ericksen has published articles in the *Journal of the American Statistical Association, Demography, American Sociological Review, Public Opinion Quarterly* and several other journals. He is a Fellow of the American Statistical Association.

Education

University Of Michigan
Ph.D., Sociology, 1971
M.A., Mathematical Statistics, 1965

University of Chicago
B.S., Mathematics 1963

Professional Experience

Temple University
Philadelphia, Pennsylvania

1992-2010 Department of Statistics

1974-2010 Department of Sociology

1988-2010 Professor

1978-1988 Associate Professor

1974-1978 Assistant Professor

At Temple University Dr. Ericksen has concentrated his teaching efforts in three areas: 1) statistics, research design and survey research methodology; 2) stratification and race and ethnic relations; and 3) demography and human ecology. He has taught extensively at both the graduate and undergraduate levels. In the 1980 Spring Semester, as part of the Experimental Student Intern Program at the U. S. Bureau of the Census, he taught a special course training undergraduates to become enumerators in the 1980 Census. In the summer of 1984, Dr. Ericksen taught a course in survey sampling as part of the 37th Annual Symposium on Survey Research Techniques, Institute for Survey Research, University of Michigan.

NERA Economic Consulting
Philadelphia, PA
1986-Present Special Consultant

At NERA, Dr. Ericksen serves as a special consultant on matters of sampling, surveys and demography. In addition to the selection of samples, his survey expertise concerns the development of survey questionnaires and the analysis of questionnaire data. As a demographic consultant, he specializes in matters concerning census data and the calculation of post-censal estimates for local areas.

Mathematica Policy Research, Inc.
Plainsboro, New Jersey
1981-1984 Senior Sampling Statistician

At Mathematica Policy Research, Dr. Ericksen was responsible for supervising the sample design of all surveys conducted by the company, covering populations as diverse as households in the United States, social security recipients, hospital emergency room episodes, hospital admissions, companies in the United States, physicians, and working women. He also directed a survey on the costs of providing services to undocumented aliens in New York City hospitals and another concerning issues of working women. While at MPR, Dr. Ericksen conducted statistical evaluation projects including several which were the basis for expert testimony in litigation. Furthermore, he was the chief technical advisor for plaintiffs in a number of lawsuits concerning the adjustment of the 1980 Census.

Temple University
Philadelphia, Pennsylvania
1970-1981 Institute for Survey Research
1974-1981 Study Director
1970-1981 Sampling Statistician

At the Institute for Survey Research at Temple University, Dr. Ericksen was responsible for the sample design on all surveys conducted by the Institute. His duties included constructing sampling frames (especially of a national universe of households), adapting these frames to sampling from lists, drawing the samples, evaluating their quality and calculating statistical estimates with variances and confidence intervals.

University Of Michigan
Ann Arbor, Michigan
Population Studies Center
1969-1970 Student Fellow
1967-1968 Student Associate, Sampling Section, Institute for Social Research

At the Population Studies Center of the University of Michigan, Dr. Ericksen wrote his dissertation under a joint contract with the Census Bureau. The objective of this project was to develop a method for combining sample survey data with symptomatic information for computing local estimates.

Balham and Tooting College of Commerce
London, United Kingdom
1966-1967 Lecturer in Statistics

Honors and Professional Activities

Fellow, American Statistical Association, 1991.

Co-Chair, Special Advisory Panel on the 1990 Census. This panel was appointed by the Secretary of Commerce to advise him on the possible correction for undercount of the 1990 Census.

Associate Editor, *Journal of the American Statistical Association*, 1989-91.

Section K Representative to the American Association for the Advancement of Science, 1987-90.

Member, Executive Committee and Program Chair for the 1985 Meetings of the American Statistical Association Section on Survey Research Methods (elected position) 1984-85.

Reviewer of submitted articles, *Journal of the American Statistical Association, The American Statistician, Demography, American Sociological Review, Mathematical Sociology, Social Forces,* and *Sociological Forum*.

Proposal Reviewer, National Science Foundation (1975 to present), especially for the Center for Measurement Methods and Data Resources. Dr. Ericksen has also consulted with the Center on the development of standard practices for evaluating surveys.

Member, panel appointed by the National Academy of Sciences to evaluate Census Bureau methods for estimating post-censal population size and per capita income of local areas.

Chair, Subcommittee to Review Proposed Internal Surveys of the American Statistical Association, 1978-83.

Publications Liaison, Section on Survey Research Methods, 1978.

Member, panel appointed by the National Academy of Sciences to evaluate the use of microsimulation models for the evaluation of welfare and other federal entitlement programs.

Member, Board of Review, ASA Project on the Assessment of Survey Research Practices. The Board evaluated the report entitled, "Development of Survey Methods to Assess Survey Practices," by Barbara A. Bailar and C. Michael Lanphier, (ASA, 1978), 1976-77.

Founding member of the Executive Committee, Subsection on Survey Research Methods, 1975-77.

Written Testimony Before Legislative Bodies

Testimony on the 2000 Census, given on March 28, 2001 before the U. S. Senate Committee on Commerce, Science and Transportation, John McCain (R-Arizona), Chair.

Testimony on the 2000 Census, given on September 17, 1998 before the U. S. House of Representatives Committee on Government Reform and Oversight Subcommittee on the Census, Dan Miller (R-Florida), Chair.

Testimony on the 1990 Census, given on June 27, 1991 before the U. S. House of Representatives Committee on Post Office and Civil Service Subcommittee on Census and Population, Thomas C. Sawyer (D-Ohio), Chair.

Testimony on the 1990 Census, given on September 11, 1990 before the U. S. House of Representatives Committee on Post Office and Civil Service Subcommittee on Census and Population, Thomas C. Sawyer (D-Ohio), Chair.

Statement on the 1990 Census, given on January 30, 1990 before the U. S. House of Representatives Committee on Post Office and Civil Service Subcommittee on Census and Population, Thomas C. Sawyer (D-Ohio), Chair.

Testimony on the 1990 Census, given on September 4, 1986 before the Senate Committee on Governmental Affairs, Subcommittee on Energy, Nuclear Proliferation and Government Processes, Thad Cochran (R-Mississippi), Chair.

Testimony on the 1990 Census, given on July 24, 1986 before the House Committee on Post Office and Civil Service, Subcommittee on Census and Population, Robert Garcia (D-New York), Chair.

Evaluation of HUD Survey on Homelessness, given on December 4, 1985 before Subcommittee on Housing and Community Development of the Committee on Banking, Finance, and Urban Affairs of the U. S. House of Representatives, Henry Gonzalez (D-Texas), Chair.

Comment on the Design of the 1980 Census, given on April 13, 1984 before the Subcommittee on Census and Population, Committee on Post Office and Civil Service of the U. S. House of Representatives, Katie Hall (D-Indiana), Chair.

Summary of a report on voting patterns in state judicial primaries, given on November 30, 1983 before the Judiciary Committee of the Pennsylvania State Senate, Richard Snyder (R-Lancaster), Chair.

Publications

"Errors in the Census," (2011) in *Encyclopedia of the U.S. Census 2nd. Edition,* Margo J. Anderson, Constance Citro and Joseph Salvo (eds.) Congressional Quarterly, Washington, DC.

"Sexuality Research Methods" forthcoming 2010 in the Concise Encyclopedia of Sociology, George Ritzer and J. Michael Ryan, eds. (with Julia Ericksen). Revised and reprinted.

"Census Goals: Management Choices and Prospects for Accuracy," (2009) *Public Performance and Management Review,* 33:148-165.

"Using Non-Probability Samples for Confusion Surveys - Mall Intercepts and the Internet," (2009) *Survey Practice*.

"Sexuality Research Methods," (2006) The Blackwell Encyclopedia of Sociology, George Ritzer (ed.), Malden, MA: Blackwell Publishing Co. (with Julia Ericksen).

"Use of Surveys in Intellectual Property Disputes," (2005) *Economic Approaches to Intellectual Property Policy, Litigation and Management Issues,* Gregory K. Leonard and Lauren J. Stiroh (eds.) National Economic Research Associates, Inc.

"An Evaluation of the 2000 Census and Census Bureau Efforts to Measure the Gross and Net Rates of Undercount," (2001) *North Dakota Law Review,* Volume 77: 753-775.

"Errors in the Census," (2000) in *Encyclopedia of the U.S. Census,* Margo J. Anderson (ed.) Congressional Quarterly, Washington, DC. 206 – 209.

"Problems in Sampling the Native American and Alaska Native Populations," (April, 1997) *Population Research and Policy Review*, 16:43-59. Also in Changing Numbers, Changing Needs: American Indian Demography and Public Health, 1996, National Academy of Press, Washington, D.C. 113-129.

Book Reviews, "A Journalist's Guide to Public Opinion Polls" by Sheldon R. Gawiser and G. Evans Witt, and "Reference Guide on Survey Research" by Shari Seidman Diamond, *Public Opinion Quarterly* (Spring 1996). 159-165.

"Comment on Papers by Breiman, Freedman and Wachter, and Rolph and Belin," *Statistical Science*, (November, 1994) 9:511-515. (with Stephen Fienberg and Joseph B. Kadane).

"Beyond the Net Undercount: How to Measure Census Error," *Chance*, (Fall, 1993) 6:38-43, 14 (with Teresa K. DeFonso).

Comment on "Should We Have Adjusted the 1980 Census?" by David Freedman and W.S. Navidi, *Survey Methodology*, (June, 1992) 18:52-58 (with Joseph B. Kadane).

"A Validation Experiment With TRIM2," 1991 in *The Uses of Microsimulation Models to Evaluate*

Publications (Continued)

Social Welfare Programs, Constance Citro (ed.) National Academy Press, Washington, DC (with Michael L. Cohen, Lynne Billard, and David Betson).

Comment on Mulry, Mary S. and Spencer, Bruce D., "Total Error in PES Estimates of Population," (1991) *Journal of the American Statistical Association*, 86:855-7, December (with Joseph B. Kadane).

"1990 Census Adjustment-- Yes or No?" *Stats* 4:4-5, 22-25.

"Adjusting the 1980 Census of Population and Housing," *Journal of the American Statistical Association*, December 1989, 84:927-944 (with Joseph B. Kadane and John W. Tukey).

"Estimating the Concentratio n of Wealth in America," *Public Opinion Quarterly*, Summer 1988, 52:243-253.

Sensitivity Analysis of Local Undercount Estimates in the 1980 U.S. Census," 1987 in R. Platek, J.N.K. Rao, C.E. Sarndal, and M.P. Singh, *Small Area Statistics: An International Symposium*, New York: John Wiley, 22-45 (with Joseph B. Kadane, originally given as an invited paper at the symposium in Ottawa, Canada on May 24, 1985).

"Using Administrative Lists to Estimate Census Omissions," *Journal of Official Statistics*, December 1986, 2:397-414 (with Joseph B. Kadane).

"Comment on Paper by Freedman and Navidi," *Statistical Science*, February 1986, 1:18-21.

"Estimating the Populatio n in a Census Year," *Journal of the American Statistical Association*, March 1985, 80:98-132 including comments and rejoinder (with Joseph B. Kadane).

"The Structure of Pluralism: We're All Italian Around Here, Aren't We Mrs. O'Brien," *Ethnic and Racial Studies*, January 1985, 8:94-116 (with William L. Yancey and George Leon).

"The Cultivation of the Soil as a Moral Directive," *Rural Sociology*, Spring 1980, 45:49-68 (with Julia Ericksen and John Hostetler).

"Fertility Patterns and Trends Among the Old Order Amish," *Population Studies*, July 1979, 33:255-276 (with Julia Ericksen, John Hostetler, and Gertrude Huntington).

"The Division of Family Roles," *Journal of Marriage and the Family*, May 1979, 41:301-313 (with Julia Ericksen and William L. Yancey).

"Antecedents of Community: Economic and Institutional Structur e of Urban Neighborhoods," *American Sociological Review*, April 1979, 44:253-242 (with William L. Yancey).

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Publications (Continued)

Work and Residence in Industrial Philadelphia," *Journal of Urban History*, March 1979, 5:147-182 (with William L. Yancey).

"A Tale of Three Cities: Blacks and Immigrants in Philadelphia, 1850-1880, 1930, and 1970," *The Annals*, January 1979, 441:55-81 (with Theodore Hershberg, Alan Burstein, Stephanie Greenberg, and William L. Yancey).

"Sampling Report for Field Survey," in Howard Kunreuther et.al., *Disaster Insurance Protection: Public Policy Lessons*, New York: John Wiley, 271-283.

"On Transplanted Culture," *American Journal of Sociology*, November 1977, 83:737-741 (with William L. Yancey).

"Reply to Levine and Bergesen," *American Sociological Review*, October 1977, 42:825-827 (with William L. Yancey and Richard Juliani).
"Sampling a Rare Population: A Case Study," *Journal of the American Statistical Association*, December, 1976, 71:816-822.

"Emergent Ethnicity: A Review and Reformulation," *American Sociological Review*, June, 1976, 41:391-403 (With William L. Yancey and Richard Juliani).

"A Regression Method for Estimating Population Changes of Local Areas," *Journal of the American Statistical Association*, December, 1974, 69:867-875.

"A Method for Combining Sample Survey Data and Symptomatic Indicators to Obtain Population Estimates for Local Areas," *Demography*, May, 1973, 10:137-160.

Reports and Monographs

"Complex Sampling for Litigation," NERA Economic Consulting White Paper, July 14, 2009.

Report on the 1990 Decennial Census and the Post-Enumeration Survey, Prepared for the Secretary of the United States Department of Commerce, 1991 (with Leobardo F. Estrada, John W. Tukey and Kirk M. Wolter).

The Use of Microsimulation Models to Evaluate Social Welfare Programs (as a member of the National Academy of Sciences Panel on Microsimulation Models), National Academy Press, Washington, DC, 1991.

The State of Puerto Rican Philadelphia, published in February, 1985 by the Institute for Public Policy Studies, Temple University, (edited entire book, wrote chapters 1 and 10).

Reports and Monographs (Continued)

"Projection of the Jewish Population to Year 2000," Chapter 3 of William L. Yancey and Ira Goldstein, The Jewish Population of the Greater Philadelphia Area, published in November, 1984 by the Philadelphia Federation of Jewish Agencies.

"Women Who Work: A National Survey," published in June, 1984 by Newsweek, New York City (with Julia Ericksen).

Estimating Population and Income of Small Areas (as member of a National Academy of Sciences Panel on Small Area Estimates of Population and Income), National Academy Press, Washington, D.C., 1980.

Report of Conference on Economic and Demographic Methods for Projecting Population: Summary and Recommendations, published in April, 1978 by the American Statistical Association, Washington, D.C. (with Richard Engels).

"The Effects of 1980 Census Undercount on Apportionment and Allocations," given May 31, 1985 at the annual meetings of the American Association for the Advancement of Science, Los Angeles, California.

"Can Regression be Used to Estimate Local Undercount Adjustments?" given at a special Census Bureau conference on the possibility of adjusting the 1980 Census for differential undercount in February, 1980, published in Proceedings of the 1980 Conference on Census Undercount, July, 1980, Washington, D.C.: Government Printing Office, pp. 55-61.

"Defining Criteria for Evaluating Local Estimates: Discussion of Papers by Gonzalez and Fay," given in 1978 at NIDA Conference on Local Estimation Methods, Princeton, New Jersey and published in Synthetic Estimates for Small Areas: Statistical Workshop Papers and Discussions, National Institute on Drug Abuse Research Monograph, February, 1979, No. 24, pp. 185-191.

"Immigrants and Their Opportunities: Philadelphia, 1859-1936," given in January, 1979 at the annual meetings of the American Association for the Advancement of Science, Houston, Texas (with William L. Yancey).

"Recent Developments in Estimation for Local Areas," given in December, 1973 at the annual meetings of the American Statistical Association and published in Proceedings of the Social Statistics Section, pp.37-41.

"Using Administrative Lists to Estimate Census Omissions: An Example," given in 1983 and published in the Proceedings of the Section on Survey Research Methods, pp. 361-366 (with Joseph B. Kadane).

"Using the 1980 Census as a Population Standard," given in 1983 and published in the Proceedings of the Social Statistics Section, pp. 474-479 (with Joseph B. Kadane).

Reports and Monographs (Continued)

"Some Lessons Learned from Conducting Federally Sponsored Surveys," given in 1977 and published in the Proceedings of the Social Statistics Section, pp. 183-185.

"Outliers in Regression Analysis When Measurement Error is Large," given in 1975 and published in the Proceedings of the Social Statistics Section, pp. 412-417.

"Adjusting the 1980 Census of Housing and Population," submitted at the August 17, 1987 hearing of the House Committee on Post Office and Civil Service, subcommittee on Census and Population, Mervyn Dymally (D-California), Chair (with Joseph B. Kadane and John W. Tukey).

"Design of Sample and Estimator for Evaluating Local Rental and Rental Equivalent Price Relatives for the CPI," report submitted by Mathematica Policy Research (MPR) in August 1984 to U.S. Department of Labor, Bureau of Labor Statistics (with Harold Watts and Charles E. Metcalf).

"A New Survey to Study Duration on AFDC," report submitted by the Urban Institute in June 1984 to the Department of Health and Human Services (with Lee Bawden and Diana Davis).

"Voting Patterns in Pennsylvania Judicial Primaries: 1983," report submitted to the Judiciary Committee of the Pennsylvania State Senate, November 1983 (with Christena E. Nippert).

"A Survey of Undocumented Aliens in HHC Facilities," report submitted to New York City Health and Hospitals Corporation, June 1983 (with Andrea Vayda and William Borden) and later submitted to Federal District Court (Eastern District of New York) in May 1985 on behalf of plaintiffs in City of New York v. Heckler, 79 Civ. 1740.

"A DAWN Survey Design," report submitted to National Institute on Drug Abuse in August 1982 (with Richard Bucher and John Hall).

"An Evaluation of 1970 Estimates of Spanish Origin Population for Counties," submitted in January 1977 to the Congressional Research Service, Library of Congress.

"Population Estimation in the 1970's: The Stakes are Higher," report submitted in May 1975 to the U.S. Bureau of the Census.

"Test of a Statistical Procedure for Computing Estimates for Local Areas," report submitted in January 1973 to the U.S. Bureau of the Census.

JUNE, 2012

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Melissa Pittaoulis
Consultant

Dr. Pittaoulis is a Consultant based in NERA's Philadelphia office. Dr. Pittaoulis specializes in survey research, statistical sampling, and demography. Her survey research experience includes designing questionnaires, supervising data collection, and analyzing data. In addition to designing surveys, Dr. Pittaoulis also reviews and evaluates third-party surveys.

Dr. Pittaoulis has extensive experience working on surveys used in intellectual property disputes concerning false advertising and trademark and trade dress infringement. In the area of trademark and trade dress infringement, Dr. Pittaoulis' project experience includes participating in the design of surveys used to establish likelihood of confusion, secondary meaning, and genericness. She has conducted false advertising and trademark surveys using different modes of data collection, including telephone, mall-intercept, and the Internet.

Dr. Pittaoulis' sampling expertise includes designing sampling plans, selecting samples, and calculating sample estimates and confidence intervals. Her demography work has concentrated on producing population estimates used in determining class certification.

Dr. Pittaoulis has worked on survey and sampling projects in a wide variety of industries, including: automobiles, beverages, beauty products, clothing apparel, computers, financial products, insurance, mobile phones, personal care products, pharmaceuticals, snack foods, and video games. In addition, Dr. Pittaoulis has considerable experience with radio and television audience measurement. She has also conducted studies on cost-sharing in the Medicare Part D program.

Dr. Pittaoulis earned her B.A. in Sociology and Criminal Justice from La Salle University and her M.A. in Sociology from Temple University. She defended her dissertation in September 2011 and received her Ph.D. in Sociology from Temple University in January 2012.

Education

Temple University
Ph.D., Sociology 2012
M.A., Sociology, 2004

La Salle University
B.A., Sociology and Criminal Justice, 2000

Professional Experience

NERA Economic Consulting

2011-Present Consultant

2006-2011 Senior Analyst

2003-2006 Research Associate

Temple University

2003-2005 Teaching Assistant
- Course: Statistical Methods in Sociology (Fall 2003, Spring 2004, Fall 2004)
- Course: Multivariate Statistics (Spring 2005)

2005 Instructor
- Course: Statistical Methods in Sociology (Summer 2005)

2004 Instructor
- Course: Social Statistics (Summer 2004)

2001-2003 **Defense Supply Center, Philadelphia**
Commodity Business Specialist

2000-2001 **Villanova University**
Research Associate

Honors and Professional Activities

University Fellowship, Temple University, 2002-2006

University Scholarship, La Salle University, 1996-2000

Member, American Association of Public Opinion Research

Member, American Sociological Association

Member, Eastern Sociological Association

Presentations

Presenter
"College Students' Motivations for Choosing Academic Majors," at Eastern Sociological Society in 2010.

"The Sale of Tiffany Jewelry on eBay," NERA Senior Presentation Series in 2007.

"The Impact of Work-Family Conflict on Job Satisfaction," at Eastern Sociological Society in 2005.

"Nursing Home Activities: An Exploration of Activity Theory," at American Sociological Association in 2004.

Presider
Eastern Sociological Society, Philadelphia, Pennsylvania March 2010

Working Papers

"How Much Does that Medication Cost? A Study of Medicare Beneficiaries' Knowledge of Out-of-Pocket Costs for Prescription Drugs on the Specialty Tier," with Eugene P. Ericksen, NERA Economic Consulting, August 2011.

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BERNARD REDDY
Vice President

Overview

Dr. Reddy earned a B.A. in Mathematics from Northwestern University and a Ph.D. in Economics from the Massachusetts Institute of Technology under a National Science Foundation fellowship.

In litigation involving antitrust, breach of contract, and patent infringement, Dr. Reddy has performed a variety of theoretical and empirical analyses of liability, damages, or both. This work has involved estimation of damages in cases involving patent infringement, breach of contract, and antitrust, as well as the assessment of liability in antitrust cases. Industries have included credit cards, computer software and hardware, semiconductors, rail, air travel, telecommunications, tobacco, pharmaceuticals, medical equipment, and gas distribution. Dr. Reddy has also performed analyses of class certification in class action litigation.

Dr. Reddy has also performed theoretical and econometric analyses in litigation over the costs of environmental damage in Superfund and other cases. Dr. Reddy has modified and used regional forecasting models to analyze the impacts of airport operations, electric utility actions, and other events on local economies. He has also applied advanced econometric techniques in constructing models for many industries including telecommunications, electric, gas, nonferrous metals, and alloying metals for the steel industry.

In his work, Dr. Reddy has frequently designed surveys to collect information on consumer preferences, choices, and attitudes.

Bernard Reddy

Education

1983	**MASSACHUSETTS INSTITUTE OF TECHNOLOGY** Ph.D., Economics Major Fields: Econometrics, Advanced Economic Theory
1972	**NORTHWESTERN UNIVERSITY** B.A., Mathematics

Honors and Professional Activities

National Science Foundation Fellowship, 1972-1975

Member, American Economic Association

Member, Econometric Society

Materials Availability Activity, Materials System and Design Division, American Society for Metals, 1979

National Academy of Sciences/National Materials Advisory Board Panel on Manganese Supply and Its Industrial Implications, 1979-1980

National Academy of Sciences/National Materials Advisory Board, Technical Adviser to Committee on Technological Alternatives for Cobalt Conservation, 1982

Professional Experience

Date	**Company**
1992-	NERA Economic Consulting, Vice President, Cambridge and Boston, MA
1986-1992	NERA Economic Consulting, Senior Consultant, Cambridge, MA
1976-1986	Charles River Associates, Senior Associate, Cambridge and Boston, MA
1975-1976	Charles River Associates, Research Associate, Cambridge, MA

Publications

"Government Preferences for Promoting Open-Source Software: A Solution in Search of a Problem" (with David S. Evans), *Michigan Telecommunications and Technology Law Review,* vol. 9 (2003), pp. 313-394.

"A Monopolist Would Still Charge More for Windows: A Comment on Werden" (with David S. Evans, Albert L. Nichols, and Richard L. Schmalense e), *Review of Industrial Organization*, vol. 18 (2001), pp. 263-268.

"A Monopolist Would Still Charge More for Windows: A Comment on Werden's Reply" (with David S. Evans, Albert L. Nichols, and Richard L. Schmalensee), *Review of Industrial Organization*, vol. 18 (2001), pp. 273-274.

"Some Economic Aspects of Standards in Network Industries and Their Relevance to Antitrust and Intellectual Property Law" (with David S. Evans), prepared for *Intellectual Property Antitrust 1996*, May 4, 1996.

Consulting Reports

Cost-Effectiveness Analyses of Alternative California Air Resources Board Tier 3 Non-Handheld Exhaust Emission Proposals (with David Harrison, Tom Darlington, Warren Herold, Jeremy Heiken, Dennis Kahlbaum, and David Biegel), September 2003.

Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: a Comprehensive Study (with David Harrison, Daniel Radov, Philip Heirigs, James Lyons, Thomas Austin, and Michael Lovenheim), January 2001.

"The Economics of Competition in Servers" (with Jorge Atilano Padilla), November 2000.

"The Rise and Fall of Leaders in Personal Computer Software," (with David S. Evans and Albert L. Nichols), January 7, 1999.

"Why Does Microsoft Charge So Little for Windows?" (with David S. Evans and Albert L. Nichols), January 7, 1999.

"Economic Battles in the Antitrust Wars: Network Industries and Their Relevance to Antitrust in the Computer Industry" (with David S. Evans), prepared for Washington State Bar Association, Antitrust, Consumer Protection and Unfair Business Practices Conference, November 8, 1996.

Contributions of American Airlines to the Metro-Dade Economy (with David Harrison, Andre C. Meade, and David M. Rowland), October, 1996.

"Some Economic Aspects of Network Industries and Their Relevance to Antitrust in the Computer Industry" (with David S. Evans), prepared for American Bar Association Section of Antitrust Law, Conference on Cutting Edge Issues in Network Industries, May 24, 1996.

Report on Damages Allegedly Due to Senova Corp. and/or Arizona Instrument Corp. by Arizona State Research Institute and Arizona Board of Regents (with Richard T. Rapp), April 17, 1996.

Economic Evaluation of Alternative Regulations of Exhaust Emissions from Small Utility Engines (with J. Farr, B. Ligon, A. Meade, A. Nichols, and D, Harrison), prepared for Briggs & Stratton Corporation, February 1996.

Comments on Economic Costs and Benefits of OSHA's Proposed Rules on Smoking in the Workplace (with A. Nichols, M. Dreyfus, and M. Berkman), submitted to the Occupational Safety and Health Administration, August 1994.

Comments on EPA's Analysis of "The Costs and Benefits of Smoking Restrictions" (with A. Nichols and M. Dreyfus), submitted to the U.S. Environmental Protection Agency, August 1994.

The Benefits of Reducing Emissions of Nitrogen Oxides Under Title IV of the 1990 Clean Air Act Amendments (with A. Nichols, D. Harrison, and S. Bittenbender-Aggarwal), prepared for the U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, Air Policy Branch, March 1994.

The Environmental and Economic Benefits of Electricity: Positive Externalities and Other Impacts (with A. Nichols, D. Harrison, and M. Dreyfus), prepared for the Electric Power Research Institute, Integrated Systems Division, December 1993.

Diffusion of Innovation and the Demand for Energy-Saving Technologies (with A. Nichols), draft prepared for the U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, Energy Policy Branch, March 1993.

Economic Issues Raised by Antidumping Petition Concerning Crushed Limestone from Mexico (with Frederick C. Dunbar and Richard T. Rapp), 1992.

Does Advertising Affect Cigarette Consumption? A Critical Review of the Literature, 1992.

Passthrough of Commodity Taxes on Color Televisions in Taiwan: Economic Theory and Empirical Analysis (with Richard Schmalensee and J. Douglas Zona), 1991.

Evaluation Plans for Conservation and Load Management Programs (with Timothy Tardiff), report prepared for New England Electric System, 1987.

Marketing Strategies for New Alternative Rates for Small Commercial Customers, 1984.

Technical Documentation of the Snohomish County Public Utility 1985 Load Forecast, in part, 1984.

Revisions to 1985 Load Forecasts, 1984.

Processing Capacity for Critical Materials, in part, 1984.

Foreign Nonfuel Minerals Stockpiles, in part, 1984.

Cobalt Market Study, 1984.

Refining and Marketing Alternatives for Cobalt and Nickel Products, in part, 1984.

Cobalt, March 1984.

Cobalt, September 1983.

Cobalt, June 1983.

Review and Documentation of Snohomish County Public Utility District Load Forecast, in part, 1983.

Modeling the Short-Run Behavior of the New England Groundfish Industry, 1983.

Continuing Cobalt World Market Study, in part, 1982.

Alaska's Role in the Strategic Mineral Markets, 1981.

Testimony in Regulatory, Judicial, and Arbitration Proceedings

Testified before the House International Relations Committee on interim legislation to permit U.S. companies to begin mining the deep ocean seabed. Discussed commodity-related issues, such as the feasibility of cartel formation in the metal markets involved, the benefits from a U.S. reduction in metal imports, and the effects on current producers of the metals.

New York Public Service Commission Cases 92-T-0114 and 92-T-0252. Rebuttal testimony on behalf of Sithe Energies, Inc., evaluating two regional economic models and their predicted impacts of a hypothetical rate increase by Consolidated Edison. November 18, 1992. Filed testimony and cross-examination sealed under protective order.

Interstate Commerce Commission Dockets No. 40131 (Sub-No.1) and 40810. Verified statement (with Frederick C. Dunbar). Rebuttal testimony addressing the competitive time path of rates for a hypothetical phosphate slurry pipeline. September 12, 1994.

In the 2003 NPM Adjustment Proceedings before an Arbitration Panel Pursuant to Section XI(c) of the Master Settlement Agreement for the State of Illinois Hearing, May 31, 2012. Testimony at arbitration hearing on behalf of the State of Illinois.

In the 2003 NPM Adjustment Proceedings before an Arbitration Panel Pursuant to Section XI(c) of the Master Settlement Agreement for the State of New York Hearing, June 26, 2012. Testimony at arbitration hearing on behalf of the State of New York.

Project Descriptions

Antitrust

Analyzed issues related to market definition, monopoly power, and damages in an antitrust case involving television ratings.

Analyzed issues related to market definition, monopoly power, and damages in an antitrust case involving a pharmaceutical product. Also estimated damages in companion litigation for patent and trademark infringement.

Analyzed issues related to damages in a class action antitrust case against manufacturers of oriented strand board (OSB), on behalf of multiple defendants.

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Analyzed issues related to damages in an antitrust case brought by a specialty hospital in the Kansas City area against large local hospitals and insurers, working on behalf of defendants.

Analyzed class certification issues on behalf of defendants (BASF Corporation, Lyondell Chemical, Huntsman International, and Dow Chemical) in an antitrust case involving polyurethane chemicals (the "polyether polyols" cases).

Analyzed damages issues for Visa, MasterCard, and major U.S. issuers of Visa and MasterCard credit cards in class action antitrust case involving currency conversion.

Analyzed class certification issues in biotechnology antitrust case related to enforcement of patents.

Analyzed damages issues in biotechnology antitrust case brought by competing vendor of enzymes, related to enforcement of patents.

Analyzed liability issues in class action cases against pharmaceutical manufacturer concerning enforcement of patents. Also analyzed damages issues in related case brought by competing manufacturer.

Analyzed liability issues in antitrust case involving digital switching and transmission equipment for telecommunications.

Analyzed liability issues for Visa in private antitrust case involving credit cards.

Analyzed liability issues for Visa in federal antitrust case involving credit cards.

Analyzed liability issues for Visa in antitrust case involving national ATM networks.

Analyzed liability issues for Microsoft in combined federal and state antitrust case involving Windows.

Analyzed liability issues for Microsoft in private antitrust case involving MS-DOS.

Analyzed liability issues for Microsoft in class action antitrust cases involving Windows and Office.

Analyzed liability issues for Microsoft in private antitrust case involving media playing software.

Analyzed liability issues for Microsoft in private antitrust case involving media serving technology.

Analyzed liability issues for Microsoft in European antitrust case involving server operating systems and media playing software.

Analyzed pricing issues for Microsoft in European case involving pricing of products.

Analyzed liability issues for Microsoft in private antitrust case involving software porting tools.

Analyzed liability issues for Microsoft in private litigation involving the Java language and programming tools.

Analyzed damage issues for Microsoft in private antitrust case involving disk caching software.

Provided analytical support for Microsoft in federal antitrust investigations.

Provided analytical support for Microsoft in attempted acquisition of Intuit.

Critiqued damage model by witness for plaintiffs in price discrimination case involving books.

Analyzed damages and critiqued damage model by witness for plaintiffs in antitrust case involving boat engines.

Analyzed liability issues related to purported conspiracy among gas stations in New Zealand.

Investigated competitive issues in planned merger between publishing firms.

Analyzed claims of alleged buyer market power over tinplate supplies in a merger of two producers of tinplate food and aerosol cans. Examined the potential for exports of tin-plated steel from the United States to Europe as a result of the merger.

Analyzed conspiracy claims arising from different prices charged by pharmaceutical firms to large buyers (such as hospitals) and retail pharmacies.

Analyzed liability issues for an antitrust case involving two railroads.

Analyzed competitive issues in proposed merger between Union Pacific and Southern Pacific railroads.

Analyzed competitive issues in merger between the Illinois Central and Chicago, Central & Pacific railroads.

Analyzed competitive issues in merger between the Burlington Northern and Santa Fe railroads.

Analyzed claims for liability and damages in an antitrust case involving golf clubs.

Reviewed data analyses and damage claims by plaintiffs in antitrust suits against United Air Lines for screen bias in its computerized reservations system.

Reviewed prior testimony concerning the railroad industry by a proposed witness in an antitrust case brought by a coal slurry pipeline against numerous railroads.

Intellectual Property

Analyzed issues related to reasonable royalty and lost profits damages in a patent infringement action regarding DVD recording technology.

Estimated damages for arbitration of a commercial dispute over the development of an antibiotic.

In connection with an arbitration proceeding, analyzed issues related to fair, reasonable, and non-discriminatory royalties for some technologies used in the Blu-ray standard.

Analyzed irreparable harm and commercial success for a patented pharmaceutical product.

Estimated damages for plaintiff VNUS Medical Technologies in a patent case over treatment methods for varicose veins.

Analyzed issues related to post-trial royalties for defendant Toyota Motor in a patent case involving technology used in hybrid vehicles. In related work involving the same patents, analyzed public interest issues for an ITC case in which plaintiff had requested an exclusion order to prevent the sale of relevant Toyota hybrid vehicles in the United States. For an overlapping case involving some additional patents and some additional Toyota vehicles (e.g., new models or models from later model years), analyzed damages issues.

For Microsoft in defending a patent case, co-designed survey of Web browser users.

Developed preliminary estimates of damages (for use in settlement negotiations) in a case in which two separate parties both claimed to have purchased exclusive licensing rights to a technology owned by a third party.

Analyzed damage issues in a patent infringement suit involving linear guides.

Calculated damages in a patent infringement suit involving medical equipment for use in laparoscopic surgery.

Analyzed damage issues in a patent infringement suit involving cooling systems for auto engines.

Analyzed damage issues in a patent infringement suit involving intermittent windshield wipers.

Performed analyses to determine a reasonable royalty rate in a patent infringement suit involving video games.

Performed analyses to determine a reasonable royalty rate in a patent infringement suit involving a particular form of packaging for DRAM.

Natural Gas

Reviewed demand forecasting methodological issues for a gas distribution company in the Midwest.

Reviewed demand forecasting methodology for a gas distribution company in New England.

Evaluated competitive issues for gas transmission in Australia.

Evaluated competitive issues for antitrust case involving U.S. gas pipelines.

Critiqued the supply planning process, including the assessment of capacity requirements, for a gas distribution company in Massachusetts.

Evaluated the supply planning process for a small gas distribution company, with particular attention to the analysis of likely and possible weather conditions.

On behalf of a gas distribution company, prepared comments to be submitted to state regulators on the proper rate treatment for interruptible transportation.

For an overseas gas company in the process of being deregulated, analyzed issues related to the security of gas supplies. Concentrated on theoretical issues related to outage probabilities and interruptible customers.

Investigated the statistical properties of extreme weather conditions for a Massachusetts local gas distribution company to incorporate into its capacity planning process. Performed for hearings before the Siting Council.

For a local gas distribution company in Massachusetts, criticized the least-cost planning process that the firm planned to implement.

Constructed econometric model to analyze how changes in the financial structure of a local gas distribution company would affect the firm's bond ratings and bond yields.

Electric Industry

Constructed econometric model to analyze how changes in the financial structure of an electric utility would affect the firm's bond ratings and bond yields.

Developed approach to use in forecasting hourly and daily electricity prices as electricity markets in California become open to competition.

Modified and used an existing regional economic model to analyze how various supply alternatives for an electric utility would affect the regional economy in Hawaii.

Used an existing regional economic model to analyze how various supply alternatives for an electric utility would affect the regional economy.

Prepared report for an electric utility on the proper tax treatment of utility expenditures on conservation.

For an electric utility in Massachusetts, prepared comments in response to a Notice of Inquiry from the Massachusetts D.P.U. Comments addressed the regulatory treatment of expenditures made by electric utilities to comply with the Clean Air Act Amendments.

For the U.S. Environmental Protection Agency, critically reviewed literature on the diffusion of innovations to see how that literature might apply to the diffusion of energy-saving innovations.

Analyzed positive and negative externalities that might arise from electricity consumption and production in a project for the Electric Power Research Institute. Critically reviewed studies of how electricity prices might affect U.S. productivity growth.

Bernard Reddy

On behalf of a group of electric utilities, reviewed and critiqued pre-approval regulations issued by the Massachusetts D.P.U.

For a siting hearing in New York, evaluated two regional economic models and their predictions for impacts of a hypothetical rate increase by Consolidated Edison.

For an electric utility, developed an RFP to solicit bids for conservation projects as part of an all-source bidding process.

Prepared draft comments for an electric utility responding to a regulatory commission report analyzing regulatory incentives for conservation. The utility filed a modified version of these comments.

Prepared a paper on least-cost planning by electric utilities. Reviewed concepts and demonstrated that no simple rule of thumb (e.g., minimize the utility's revenue requirement) emerges that will lead to efficient decisions.

Developed evaluation plans for conservation and load management programs being implemented by New England Electric System.

Directed an analysis of household appliance choices for the Electric Power Research Institute. Studied the applicability of discrete choice models (such as logit or probit and their extensions) to fuel and efficiency choices for household appliances. Performed a survey of the discrete choice literature and examined available datasets.

Carried out a major study of the likely acceptance of new electric rate schedules by small commercial customers for a large West Coast utility. Developed survey instruments, selected a sample of customers, supervised a subcontractor that carried out the survey, and analyzed the survey responses. Developed a nested logit model of customer preferences over current rate schedules, time-of-use rate schedules, and direct control rate schedules. Also developed a plan for marketing the new rate schedules to the utility's customers.

Served as an internal consultant for a project for the California Energy Commission in which a detailed econometric analysis of the effects of weather on residential and commercial electricity consumption by end use was performed using conditional demand analysis. Suggested how to specify the equations and how to solve econometric problems that arose.

Evaluated the econometric methods currently in use, estimated new residential demand equations, suggested further improvements that might be made in the future, and produced Box-Jenkins (ARIMA) forecasts for Snohomish County (Washington) Public Utility District. Analyzed the effects (on the models and forecasts) of problems in the definition and collection of data by the District.

Reviewed and suggested changes in the forecasting methods used by a small electric utility in the Midwest. Examined current forecasting methods, analyzed the effects of weather and price on electricity sales by sector, and estimated equations for sales by sector and for seasonal peak demands.

Oil

On behalf of the State of Alaska, analyzed public policy and other issues related to interstate and intrastate tariffs for shipping crude oil on the Alaskan oil pipeline.

Estimated hedonic price equations for crude oil to investigate the extent to which crude oil prices on the U.S. West Coast and the U.S. Gulf Coast depend on the characteristics of the oil.

Performed a theoretical analysis of the effects of the opening of the Alaskan pipeline on oil export policy for the U.S. Department of Energy. Examined the incentives to producers to export oil versus transporting it to the Gulf Coast. Outlined the fundamental issues involved, created the framework required to calculate the costs to the United States of an export ban, and analyzed the effects of an export ban on incentives to reduce the costs for transporting oil to the Gulf Coast.

Other Regional Modeling

Used a model of regional economic activity to analyze issues related to airport operations in the Miami metropolitan area.

Used a model of regional economic activity to analyze the impacts on the Virginia economy of possible wholesale overcharges for beer and wine.

Modified and used a model of regional economic activity to analyze issues related to airport operations in the Chicago metropolitan area.

Environmental Studies

Participated in project to evaluate regional and national economic impacts of proposed regulations that would shut down a substantial fraction of U.S. coal-fired electric generating capacity.

Participated in project to evaluate economic and environmental impacts of the development of a port for coal exports.

Developed simulation models to use in assessing how California limitation on emissions of greenhouse gases by new vehicles would affect vehicle sales and the age distribution of the vehicle fleet in California. Critiqued model of the "rebound effect"–the extent to which mandated improvements in fuel efficiency would increase vehicle miles driven.

Developed simulation model to use in assessing how California mandates for sale of zero-emission vehicles would affect the demand for and pricing of automobiles in California.

Estimated models to summarize hydrocarbon emissions that might be expected from different sizes and types of engines for off-road equipment.

Estimated demand models for lawnmowers.

Estimated models to summarize hydrocarbon emissions that might be expected from different sizes and types of lawnmower engines.

Estimated models to summarize hydrocarbon emissions that might be expected for different sizes of outboard motors. Also estimated demand models for outboard motors, to assess extent to which emission regulations that raise the prices of outboard motors would suppress demand.

For the U.S. Environmental Protection Agency, evaluated feasibility of testing hypothesis that U.S. environmental regulations can improve global competitiveness of U.S. industry.

Reviewed and assessed available literature on the effects of ozone on agricultural crops and forests. Embedded the results into an assessment for the U.S. Environmental Protection Agency of the benefits of NO_x regulations.

Critically reviewed sections of report on environmental adders prepared on behalf of New York regulators. Concentrated on impacts on crops, forests, and recreation.

Evaluated likely future claims for damages to a wide variety of natural resources in a Superfund case.

Evaluated possible future claims for natural resource damages due to releases of PCBs into the Great Lakes.

Analyzed issues related to fishing benefits of changing cooling systems at New Jersey power plants.

Reviewed work by a consultant to the state of New Jersey estimating the economic damage to commercial and sport fishing allegedly caused by the cooling system of a nuclear plant.

Reviewed work by consultants to the state of Michigan estimating the economic damage to sport fishing allegedly caused by the operation of a pumped storage electrical generating plant.

Reviewed work by a government witness claiming that releases of PCBs into nearby waters had lowered property values in and around New Bedford, Massachusetts. Reviewed the relevant economic theory, the application of that theory to the data used, the quality of the data, and the econometric technique employed. Collected a similar data set and performed alternative analyses. Used this analysis to evaluate government claims for damages to natural resources.

Reviewed work by government witnesses claiming that releases from a mine had affected property values in Eagle County, Colorado. Reviewed econometric models estimated by the government witnesses, and estimated correctly specified models. Also reviewed a contingent valuation study done by government witnesses.

Calculated a compliance penalty for an electric utility with a generating unit that allegedly violated emissions standards.

Antidumping

Analyzed product and geographic markets potentially affected by imports of crushed limestone from Mexico.

Critically reviewed econometric model alleged to demonstrate that changes in Japanese import policies had adversely affected Kodak's sales of film in Japan.

Analyzed market structure, demand conditions, and production costs for color television market in Taiwan.

Other Litigation

Analyzed class certification issues on behalf of plaintiffs in a case involving products that contain bisphenol A.

Analyzed issues related to liability and damages in a suit claiming a fraudulent conveyance arising from a leveraged buyout.

Estimated choice models to study demand for railroad cranes in breach of contract suit.

Directed research to analyze damage claims in a class-action suit brought against AT&T by purchases of phone systems designed for small businesses.

Analyzed damage claims for breach of contract in a dispute between a manufacturer and a distributor of personal computers.

Directed a study of fishing industry subsidies in the Northwest Atlantic, for use by the U.S. State Department in arguments before the World Court on the U.S.-Canadian maritime boundary dispute. Information was collected and reviewed on direct and indirect subsidies for offshore fishing in New England and Canada's Maritime Provinces. Impacts of the various subsidy programs were assessed.

Other

Analyzed issues related to diligent enforcement of the Illinois' Escrow Statue regarding escrow deposits required of cigarette manufacturers that did not sign the MSA on behalf of Illinois *In the 2003 NPM Adjustment Proceedings before an Arbitration Panel Pursuant to Section XI(c) of the Master Settlement Agreement for the State of Illinois Hearing*.

Analyzed issues related to diligent enforcement of the New York Escrow Statue regarding escrow deposits required of cigarette manufacturers that did not sign the MSA on behalf of New York *In the 2003 NPM Adjustment Proceedings before an Arbitration Panel Pursuant to Section XI(c) of the Master Settlement Agreement for the State of New York Hearing*.

Analyzed distribution of historical inflation measures and applied to a Monte Carlo analysis of escalation clauses in a possible contract for operating a private toll road.

Bernard Reddy

Analyzed the demand for one-cent coins over a ten-year period, testing whether demand at various times in the period had been abnormally high in a suit filed against the U.S. Department of the Treasury.

Developed a short-run forecasting model of the New England commercial groundfish industry (for the New England Regional Fishery Management Council). Used a database consisting of approximately 20,000 observations on individual fishing trips for each year from 1965 to 1979. Binomial probit and conditional logit techniques were used to analyze the data.

Served as an internal consultant on statistical and econometric issues for the demand for transportation services. Assisted in specifying, estimating, and interpreting models for travel demand.

Extensive experience in analyzing, modeling, and forecasting the markets for nonferrous and alloying metals, particularly cobalt, chromium, manganese, nickel, zinc, and aluminum. The analyses of alloying metals required analyses of the steelmaking industry and its demand for and use of these metals. Work in this area has included policy analyses and the development and use of complex econometric/engineering models.

6/29/12

James E. Johndrow

Contact Information

Graduate Student
Department of Statistical Science
Duke University
Durham, NC 27701 USA

Mobile: +1-617-680-1422
E-mail: jj@stat.duke.edu
www: www.jamesjohndrow.com

Expertise

Statistics, Econometrics, and Economics: Enviornmental and energy economics, applied statistics and statistical methodology, mathematical statistics, welfare economics, demand estimation, antitrust economics, methods for time series and categorical data, discrete choice, nancial mathematics.

Research Interests

Bayesian Statistical Methods for Categorical Data: Bayesian discrete choice models, multinomial regression, nonparametric models for multinomial data, spatial methods for categorical outcomes, variable selection in multinomial regression, sparse models for high-dimensional categorical data.

Education

Duke University, Durham, NC

Ph.D., Statistical Science, Expected 2015

Adviser: Professor David B. Dunson
Area of Study: Bayesian Statistics

Amherst College, Amherst, MA

B.A., Chemistry, May 2003

Summa cum Laude
Thesis in Chemistry: Better Inhibitors of Protein Tyrosine Phosphatases Through Engineering the Protein-Small Molecule Interface

Research and Professional Positions

NERA Economic Consulting, Boston, MA

Consultant, Environment and Climate Change Practice, 2006-Present

Supervisor: David Harrison, PhD
Specialization: Econometric methods and mathematical modeling for environmental and energy economics.

University of California, San Francisco, San Francisco, CA

Research Technician II, UCSF Tetrad Program, 2005-2006

PI: Professor Je Cox
Area of Research: Mycobacterium tuberculosis host-pathogen interactions.

Fred Hutchinson Cancer Research Center, Seattle, WA

Research Technician II, Division of Basic Sciences, 2003-2005

PI: Susan Parkhurst, PhD
Area of Research: Drosophila melanogaster Developmental cell biology.

Journal Publications

[1] Liu R, Woolner S, Johndrow JE, Metzger D, Flores A, Parkhurst SM. Sisyphus, the Drosophila myosin XV homolog, tracs within lopodia trans sensory and adhesion cargos. Development. 135(1):53{63. 2008.

[2] Stanley SA, Johndrow JE, Manzanillo P, Cox JS. The Type I IFN response to infection with Mycobacterium tuberculosis requires ESX-1-mediated secretion and contributes to pathogenesis. Journal of Immunology, 178(5):3143{52. 2007.

[3] Verdier V, Johndrow JE, Betson M, Chen GC, Hughes DA, Parkhurst SM, Settleman J. Drosophila Rho-kinase (DRok) is required for tissue morphogenesis in diverse compartments of the egg chamber during oogenesis. Developmental Biology, 297(2):417{32. 2006.

[4] Johndrow JE, Rosales-Nieves AE, Keller LC, Magie CR, Pinto-Santini DM, Parkhurst SM. Coordination of microtubule and microlament dynamics by Drosophila Rho1, Spire and Cappuccino. Nature Cell Biology, 8(4):367{76, 2006.

[5] Machado FS, Johndrow JE, Esper L, Dias A, Baca A, Serhan CN, Aliberti J. Anti-inammatory actions of lipoxin A4 and aspirin-triggered lipoxin are SOCS-2 dependent. Nature Medicine, 12(3):330{4, 2006.

[6] Homan HE, Blair ER, Johndrow JE, Bishop AC. Allele-specic inhibitors tein tyrosine phosphatases. Journal of the American Chemical Society, 127(9):2824{ 5, 2005.

[7] Johndrow JE, Magie CR, Parkhurst SM. Rho GTPase function in ies: insights from a developmental and organismal perspective. Biochemistry and Cell Biology, 82(6):643{57, 2005.

Conference Presentations

[8] Platform Talk, 45th Annual International Drosophila Research Conference (Genetics Society of America), Washington, D.C., Cooridnated regulation of microtubules and microlaments by the formin homology protein cappuccino during Drosophila oogenesis, March, 2004.

[9] Poster Presentation, FASEB Summer Research Conference Biology of Small GTPases. Regulation of adhesion and cytoskeletal remodeling by Rho1 and its eectors during Drosophila Development. July, 2004.

Fellowships, Awards and Honors

University Scholars Graduate Fellow, Duke University (2010)

James B. Duke Graduate Fellow, Duke University (2010)

Rhodes Scholarship Finalist (2003)

Marshall Scholarship Finalist (2003)

White Prize for Excellence in Chemistry, Amherst College (2002)

Howard Waters Doughty Prize for best thesis in Chemistry, Amherst College (2003)

Phi Beta Kappa, Amherst College (2003)

Teaching Experience

Amherst College, Amherst, MA

Grader/TA 2000-2003

Grader for Math 13: Multivariate Calculus
Grader for Math 28: Real Analysis
TA for Chem 21/22: Organic Chemistry
Help session instructor for Mathematics department.

NERA
Economic Consulting

Andrew Foss
Consultant

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Andrew Foss
Consultant

Andrew Foss is a Consultant in the NERA Environment Practice. He has participated in several cost-benefit analyses of fish-protection alternatives at electric generating stations. He has particular experience in estimating the benefits to recreational and commercial fisheries from reducing fish losses. He has participated in cost-benefit and cost-effectiveness analyses related to various other environmental issues as well, including air emissions and chemicals.

Mr. Foss has also participated in various projects on emissions mitigation through cap-and-trade programs and other policy instruments. He also has been involved in several projects evaluating the market and industry impacts of greenhouse gas programs and proposals, including projects related to electricity generation, refining, pulp and paper, iron and steel, chemicals, and aluminum. He has extensive experience in modeling U.S. climate change policies with the NEMS model.

Mr. Foss holds a Master in Public Policy with a concentration in Environment and Natural Resources from the Harvard Kennedy School of Government. He earned a B.A., *magna cum laude*, in Physics from Amherst College. After graduating from college he studied resource management in Norway on a Fulbright Scholarship.

Education

HARVARD KENNEDY SCHOOL OF GOVERNMENT, Cambridge, Massachusetts
Master in Public Policy, 2009

NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY, Trondheim, Norway
Independent research on a Fulbright Scholarship, 2003-2004

AMHERST COLLEGE, Amherst, Massachusetts
B.A., Physics, *magna cum laude*, 2003

Professional Experience

NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC.

2009 - *Consultant*

2005 - 2007 *Research Associate - Analyst*

Consulting Project Experience

I. Water Quality

Preliminary Economic Analysis of Cooling Water Intake Alternatives at Merrimack Station, prepared for Public Service of New Hampshire, February 2012.

Comments on Economic Issues Related to EPA's Proposed Regulations for Cooling Water Intake Structures at Existing Facilities, prepared for Utility Water Act Group, August 2011.

Cost-Benefit Comparisons of Fish-Protection Alternatives for AES Cayuga, prepared for AES Corporation, January 2011.

Comments on EPA's Proposed Survey to Estimate the Potential Benefits of Alternative Cooling Water Intake Policies, prepared for American Chemistry Council, American Forest & Paper Association, American Petroleum Institute, and Utility Water Act Group, September 2010.

Cost-benefit Analysis for Fish Impingement and Entrainment Reduction at Pickering Nuclear Generating Station, prepared for Ontario Power Generation, Inc., December 2009.

Preliminary Costs and Benefits of Cooling Water Intake Alternatives for Mandalay and Ormond Beach Generating Stations, prepared for RRI Energy, Inc., September 2009.

Preliminary Costs and Benefits of California Draft Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, prepared for California Council for Environmental and Economic Balance, September 2009.

Assessment of Alternative Intake Technologies: Costs and Benefits of Fish Protection Alternatives at the Salem Facility, prepared for Public Service Electric & Gas Incorporated, January 2006.

II. Other

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for major U.S. trade associations, 2009.

Environmental Costs and Economic Benefits of Electric Utility Resource Selection, prepared for Nevada Power Company and Sierra Pacific Power Company, 2006 and 2009.

Evaluation of the Financial Impacts of Alternative Climate Change Cap-and-Trade Programs using the NERA Carbon Financial Impacts Model, prepared for a major U.S. energy company, 2006.

Financial Impacts of Potential Mandatory CO_2 Cap-and-Trade Programs on the Pulp and Paper Sector: A Scoping Study, prepared for the American Pulp & Paper Association, 2006.

Effectiveness of the California Light Duty Vehicle Regulations As Compared to Federal Regulations, in collaboration with Sierra Research, Inc. and Air Improvement Resource, Inc., prepared for the Alliance of Automobile Manufacturers, 2006.

An Evaluation of Alternative Approaches to Reducing Pennsylvania Mercury Emissions, prepared for PPL Corporation, 2006.

NERA
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Marta Luczynska
Analyst

National Economic Research Associates, Inc.
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Boston, Massachusetts 02116
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Marta Łuczyńska
Analyst

Marta Łuczyńska, Analyst, has substantial experience in cost-benefit analyses of cooling water intake alternatives, with a particular focus on converting biological information into monetized benefits. She has been involved in other aspects of resource and environmental planning and policy as well, including developing a framework and practitioners' guide for willingness-to-pay estimation. She also has experience at NERA in economic and financial investment modeling and optimization in the UK for private companies both in the water and energy sectors.

Ms. Łuczyńska holds a Master of Public Administration in Public and Economic Policy (with distinction) from the London School of Economics, a Master of Engineering in Computer Science and Engineering from MIT, and a B.S. in Computer Science and Engineering from MIT.

Education

London School of Economics and Political Science, London, United Kingdom
Master in Public Administration, Public and Economic Policy, *with distinction*
2010

Massachusetts Institute of Technology, Cambridge, Massachusetts
Master of Engineering, Computer Science and Engineering, 2007

Massachusetts Institute of Technology, Cambridge, Massachusetts
B.S., Computer Science and Engineering, 2006

Professional Experience

NERA Economic Research Associates, Inc.

2012 -	Analyst
2010 - 2012	Research Officer

Honors and Professional Activities

2006 Google Anita Borg Scholarship
2006 MIT Microsoft iCampus Grant

Consulting Project Experience

I. Water Quality

Preliminary Economic Analysis of Cooling Water Intake Alternatives at Merrimack Station, prepared for Public Service of New Hampshire, February 2012.

II. Resource and Environment Planning and Policy

Modeling Peer Review, currently ongoing project for Water Resources South East (WRSE), providing peer review on the economic aspects of the WRSE regional modeling work, which is centered around developing a shared resource strategy for the 7 water companies in the southeast of England, 2011-Present.

Carrying Out Willingness to Pay Surveys, developed a common valuation framework and an accompanying practitioners guide for United Kingdom Water Industry Research (UKWIR) to guide UK water companies in carrying out willingness-to-pay surveys, 2011.

Environmental Scarcity Charging and Stochastic Optimization, Extended a UK water company's model for balancing water supply and demand to incorporate various alterations to the optimization methodology, including incorporating environmental scarcity charges and enabling stochastic optimization, 2011.

III. Investment and Related Modeling

Investment Modeling, developed a model for RWE npower to schedule a series of onshore and offshore wind farm investments in the UK subject to regional capacity constraints, a requirement to meet power demand, and a requirement to meet the UK government's targets for electricity generated from renewable sources, 2011.

Supply Margin Modeling, modeled the supply margins in the UK retail energy industry for Energy UK, including examining different categories of costs and revenue line items to best reflect the economic position of the big six suppliers in Great Britain, 2011.

IV. Competition, Regulatory Design, and Financial Valuation

Inset Competition and Access Pricing, advised a UK Water Company on appropriate wholesale charges to ensure compliance with competition law, 2011.

Assessment of Access Pricing Methodologies, identified and appraised possible access pricing approaches and associated regulatory regimes for a UK Water Company, including with respect to the amount of entry generated, affordability, cost recovery, and competition law compliance, 2011.

Regulatory and Structural Reform Assessment, provided an assessment of the possible implications of proposed regulatory and structural reforms for a UK Water Company's valuation, 2011.

Karan Bains

2712 Hawkesbury Blvd. Hudson, OH 44236 330-328-1634 karanbains91@gmail.com

Education

Amherst College, Amherst, MA
- Bachelor of Arts, expected May 2014
- 3.98 GPA
- Hamilton Prize Winner as the highest ranking first-year economics student at Amherst
- Majors: economics, neuroscience

Western Reserve Academy
- High School Diploma, 2010
- #2 student in Class of 2010 in GPA
- Test scores: 2360 composite SAT, 36 composite ACT
- Joel B. Hayden Award as the best all-around student in the Class of 2010 (2008-2009 school year)
- Harvard University Book Prize (awarded by Harvard Club of Northeast Ohio)
- Exchange program with the Caterham School near London, England (Summer 2009)

Experience

Arun's Tennis Academy – Hunting Valley, OH **Summer 2011**
Instructor
- Coached players of ages 7-18 on the fundamentals, techniques, and strategies of tennis
- Worked with beginners and advanced high school athletes
- Designed drills and planned lessons to help students improve their mental and physical mastery of the game

Say Yes to Tennis, Inc. – Akron, OH **Summer 2011**
Volunteer Instructor
- Coached young players for this non-profit program which helps inner-city youth and provides an opportunity for anyone to learn the game, regardless of financial standing
- Worked alongside the program director during the Advanced Summer Program

Burton D. Morgan Foundation – Hudson, OH **2009-2010**
Morgan Leader
- One of five students selected from over 400 at Western Reserve Academy for "proven leadership in word and deed, exemplary service to others, entrepreneurial potential" to become a Morgan Leader
- Traveled to Washington D.C. to interview prominent alumni about leadership habits, developed communication/networking skills through preparation and execution of interviews with 13 professionals
- Published a leadership booklet with experiences from the trip, marketing the Morgan program in and out of the school community

The Cleveland Clinic – Cleveland, OH **Summer 2007, 2008**
Junior Ambassador
- Volunteered in patient rooms, patient services, transportation, marketing
- Learned communication skills in this selective program, member of a large professional environment
- Earned a Two-Year Service Award which stated the following: "The successful completion of this program required dedication, a caring spirit and a level of maturity that would enable one to interact successfully with Cleveland Clinic patients, family members and employees."

Activities

- Varsity tennis player at Amherst College
- Sports section editor and sports columnist of Amherst College's student newspaper, *The Amherst Student*
- Member of Amherst College Investment Club and Amherst College South Asian Student Association (SASA)
- Dancer for Amherst Dance and for Amherst College SASA Performances
- Two year varsity tennis captain and two-time MVP at Western Reserve Academy
- Three year varsity cross country runner, two year varsity basketball player at Western Reserve Academy
- Editor-in-Chief of the *Reserve Record*, Western Reserve Academy's school newspaper

William H. Desvousges, Ph.D.
President

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Employment Chronology

2005 to date	**President** W.H. Desvousges & Associates, Inc.
1994 to 2005	**President** Triangle Economic Research Durham, NC
1996 to 1999	**Research Professor** Duke University Durham, NC
1989 to 1994	**Program Director/Senior Program Director** Center for Economics Research Research Triangle Institute Research Triangle Park, NC
1980 to 1989	**Senior Economist** Center for Economics Research Research Triangle Institute Research Triangle Park, NC
1975 to 1980	**Assistant/Associate Professor** Department of Economics University of Missouri at Rolla Rolla, MO
1986	**Visiting Lecturer** Meredith College Raleigh, NC
1984 to 1985	**Visiting Lecturer** University of North Carolina at Chapel Hill Chapel Hill, NC
1980 to 1984	**Visiting Lecturer** North Carolina State University Raleigh, NC

Education

Ph.D., 1977, Economics, Florida State University, Tallahassee, Florida

M.S., 1974, Economics, Florida State University, Tallahassee, Florida

B.A., 1972, Economics, Stetson University, Deland, Florida

Key Projects

- Use of habitat equivalency analysis in Grand River Ditch damage assessment (Water Supply and Storage Company)
- Use and critique of habitat equivalency analysis for petroleum refinery sites (confidential client)
- Services-based critiques of various groundwater damage assessments in New Jersey (ExxonMobil, Dow Chemical, and others)
- Critique of Trustee contingent valuation study of alleged aesthetic and ecological injuries in the Illinois River Watershed (Tyson Foods, Inc.)
- Assessment of potential recreation use losses in Illinois River Watershed (Tyson Foods, Inc.)
- Critique of the use of habitat equivalency analysis for historical mining site (Confidential Client)
- Prepared alternative natural resource damage estimates for key mining and smelting sites (ASARCO, Inc.)
- Conducting human use service assessment for cooperative damage assessment for Ottawa River (GenCorp, Inc.)
- Groundwater damages at the South Valley Superfund Site in New Mexico (General Electric Company)
- Evaluation of the use of survey methods by appraisers to value a commercial property (ChevronTexaco)
- Evaluation of the use of contingent valuation surveys to measure diminished property values in Mississippi (confidential client)
- Evaluation of market and survey-based methods for measuring damages from underground storage tanks (USTs) to both residential and commercial properties (confidential client)

- The role of individual factors in using market and survey-based methods for measuring potential damages to classes of residential properties in Colorado Springs, Colorado (Davis Graham Stubbs)
- The role of individual factors in using market and survey-based methods for measuring both residential and commercial properties in Oklahoma (confidential client)
- The reliability of survey and market-based methods for measuring damages from increased eutrophication in lakes (confidential clients)
- Comments on the benefit estimates of EPA's proposed Phase II 316(b) Rule (The Utility Water Act Group)
- Benefit-cost analysis of various regulatory alternatives for 316(b) compliance in Connecticut" (confidential client)
- Benefit-cost analysis of 316(b) regulatory alternatives in California (confidential client)
- Creel/angler survey on the Lower Passaic River (Tierra Solution)
- Human use compensatory restoration strategy for Onondaga Lake (Honeywell International)
- Review of New Jersey's groundwater damage assessment formula (New Jersey Site Remediation Industry Network)
- Environmental costs for particulate matter and mercury: an assessment of the recent literature (Xcel Energy)
- NRDA for a major waterway in the Northeast (confidential client)
- Alternative Santa Clara River HEA (confidential client)
- Saginaw Bay and River natural resource damage assessment (General Motors)
- Evaluating the reliability of contingent valuation (U.S. Environmental Protection Agency)
- Measuring environmental costs for resource planning (Northern States Power Company)
- Natural resource damage assessment for Lavaca Bay, Texas (Alcoa)
- Natural resource damage assessment for the Clark Fork Basin in Montana (ARCO)
- Using conjoint analysis to value health (Health Canada et al.)
- Wisconsin Energy Research Project (consortium of Wisconsin utilities)

- Estimating the market potential for 'green' products (Niagara Mohawk)
- Fox River natural resource damage assessment (Fox River Group)
- Kalamazoo River natural resource damage assessment (Kalamazoo River Study Group)
- St. Lawrence River-Massena natural resource damage assessment (Reynolds, Alcoa, General Motors)
- Wisconsin externalities costing: principles & practices (Task Force on Externality Costing, Wisconsin utilities)
- Measuring benefits of the effluent guidelines: an evaluation of the benefits transfer technique (Office of Science and Technology, U.S. Environmental Protection Agency)
- Information, risk perception, and mitigation: behavioral responses to environmental risk (National Science Foundation)
- Natural resource damage assessments for the Martinez, California; Gasconade River, Missouri; and Arthur Kill, New Jersey Oil Spills (various clients)
- Communicating risk effectively (Office of Policy Planning and Evaluation, U.S. Environmental Protection Agency)
- Valuing reductions in hazardous waste risks (Office of Policy Analysis, U.S. Environmental Protection Agency)
- Evaluating risks of a high-level nuclear waste repository (State of Nevada)
- A comparison of benefit estimation approaches (Office of Policy Analysis, U.S. Environmental Protection Agency)

Expert Reports

- Reply Affidavit of William H. Desvousges, Ph.D. in the *Matter of Thomas H. Ivory, Thomas P. Ivory, Shawn (Ivory) Stevens, Tami Lynn (Ivory) Azouri, Emmanuel Odom, Grace Odom, and James Odom v. International Business Machines Corporation.* Supreme Court of the State of New York, Country of Broome. June 20, 2012.
- Expert Rebuttal Report in the Matter of *Commissioner of the Department of Planning and Natural Resources, Alicia V. Barnes, et al. v. Virgin Islands Alumina Co., et al*. May 30, 2012
- Affidavit of William H. Desvousges, Ph.D. in the *Matter of Thomas H. Ivory, Thomas P. Ivory, Shawn (Ivory) Stevens, Tami Lynn (Ivory) Azouri, Emmanuel Odom, Grace Odom, and James Odom v. International Business*

Machines Corporation. Supreme Court of the State of New York, Country of Broome. May 1, 2012.

- Expert Report of William H. Desvousges, Ph.D. In the *Matter of Betty Jean Cole, et al. v. Asarco Incorporated, et al.* July 29, 2011.

- Critique of Dr. Barnthouse's Report: Estimation of Natural Resource Losses Related to Oil Field Development in the Concession in the Case of *Maria Aguinda y Otros v. Chevron Corporation*. September 28, 2010.

- Expert Report of William H. Desvousges, Ph.D. In the Matter of *New Jersey Department of Environmental Protection, et al. v. Union Carbide Corporation, et al.* August 13, 2010.

- Expert Report in the Matter of *The Quapaw Tribe of Oklahoma, et al. v. Blue Tee Corp, et al.* June 25, 2010.

- Expert Report in the Matter of *New Jersey Department of Environmental Protection, et al. v. Essex Chemical Corporation.* Superior Court of New Jersey Law Division - Middlesex County Docket No: MID-L-5685-07. January 8, 2010.

- Expert report in the Matter of *DeLeo, et al. v. Bouchard Transportation Co., et al.* December 15, 2009.

- Expert report in the Matter of *Abrams, et al. v. Ciba Specialty Chemicals Corp, et al.* The United States District Court Southern District Of Alabama. CASE NO. 08-68-WS-B. May 15, 2009.

- Rebuttal expert report in the Matter of *Robert C. Brandriff, et al. v. Dataw Island Owners' Association, Inc., et al.* Civil Action No. 9:07-3361-CWH. April 27, 2009.

- Expert report in the Matter of *STATE OF OKLAHOMA, ex. rel. W.A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT, J.D. Strong, in his capacity as the TRUSTEE FOR NATURAL RESOURCSE FOR THE STATE OF OKLAHOMA, Plaintiffs v. TYSON FOODS, INC., TYSON POULTRY, INC., TYSON CHICKEN, INC., COBB-VANTRESS, INC., AVIAGEN, INC.,CAL-MAINE FOODS, INC., CAL-MAINE , FARMS, INC., CARGILL, INC., CARGILL TURKEY PRODUCTION, LLC, GEORGE'S INC., GEORGE'S FARMS, INC., PETERSON FARMS, INC., SIMMONS FOODS INC., and WILLOW BROOK FOODS, INC., Defendants.* Case No. 05-CV-329-GKF-PJC. March 31, 2009.

- Report prepared in Response to Request for Comments on Regulatory Review Alternatives: The Value of Cost-Benefit Analysis. Utility Water Act Group. March 31, 2009.

- Expert report in the Matter of *Robert C. Brandriff, et al. v. Dataw Island Owners' Association, Inc., et al.* Civil Action No. 9:07-3361-CWH. December 1, 2008.

- Affidavit of William H. Desvousges, Ph.D. in the Matter of *Jeff Alban, et al. v. ExxonMobil Corporation, et al.* Submitted to the In Circuit Court for Baltimore County. Case No.:03-C-06-010932

- Affidavit of William H. Desvousges, Ph.D. in Support of Defendants' Opposition to Motion for Class Certification in the Matter of *Murray Gintis, Victoria Gintis and Claudia Martin on behalf of themselves and all others similarly situated v. Bouchard Transportation Company, Inc., Tug Evening Tide Corporation and B. NO. 120 Corporation*. Submitted to the United States District Court for the District of Massachusetts. Civil Action No. 06-10747-JLT. July 29.

- Expert Report of William H. Desvousges, Ph.D. Submitted in Support of Defendants' Opposition to Plaintiffs' Motion for Partial Summary Judgment in the Matter of *Murray Gintis, Victoria Gintis and Claudia Martin on behalf of themselves and all others similarly situated v. Bouchard Transportation Company, Inc., Tug Evening Tide Corporation and B. NO. 120 Corporation*. July 10.

- Rebuttal Expert Report of William H. Desvousges, Ph.D. in the Matter of *USA v. Water Supply & Storage*. October 24, 2007.

- Expert Report of William H. Desvousges, Ph.D. in the Matter of *USA v. Water Supply & Storage*. September 27, 2007.

- Expert Reports in the Matter of *Official Committee of Unsecured Creditors v. ASARCO LLC (In re ASARCO LLC), Case No. 05-21207.*

  - Estimate of Environmental Liabilities. California Gulch Superfund Site. Leadville, Colorado. Prepared by ENVIRON International Corporation, Chicago, Illinois and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. May 4, 2007.

  - Estimate of Environmental Liabilities. Bunker Hill Superfund Facility/Coeur d'Alene Basin. Idaho/Washington. Prepared by ENVIRON International Corporation Chicago, Illinois and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. June 15, 2007.

  - Estimate of Environmental Liabilities. Tacoma Smelter Site. Tacoma, Washington. Prepared by ENVIRON International Corporation Chicago, Illinois and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. June 15, 2007.

  - Estimate of Environmental Liabilities. Everett Smelter Site. Everett, Washington. Prepared by ENVIRON International Corporation Chicago, Illinois and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. June 15, 2007.

  - Rebuttal Expert Report. California Gulch Superfund Site. Leadville, Colorado. Prepared for Milbank, Tweed, Hadley & McCloy LLP. On

behalf of ASARCO Incorporated. Prepared by ENVIRON International Corporation Chicago, Illinois and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. June 22, 2007.

- Estimate of Environmental Liabilities. Nueces Bay/Corpus Christi Bay. Corpus Christi, Nueces County, Texas. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Big River Mine Tailings and Federal Mine Tailings Sites. St. Francois County, Missouri. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Catherine Mine Site/Madison County Mines Site. Madison County, Missouri. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Glover Lead Facility. Glover, Missouri. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Sweetwater Mine Site. Reynolds County, Missouri. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. West Fork Mine Site. Reynolds County, Missouri. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Tar Creek Site. Ottawa County, Oklahoma. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Cherokee County Superfund Site. Cherokee County, Kansas. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Newton County Mine Tailings Site. Newton County, Missouri. Prepared by ENVIRON International

Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Estimate of Environmental Liabilities. Jasper County Superfund Site. Jasper County, Missouri. Prepared by ENVIRON International Corporation St. Peters, Missouri and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. On behalf of ASARCO Incorporated. July 27, 2007.

- Rebuttal Expert Report. Bunker Hill Superfund Facility/Coeur d'Alene Basin. Idaho/Washington. Prepared for Milbank, Tweed, Hadley & McCloy LLP. On behalf of ASARCO Incorporated. Prepared by W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. August 10, 2007.

- Rebuttal Expert Report. Tacoma Smelter Site. Tacoma, Washington. Prepared for Milbank, Tweed, Hadley & McCloy LLP. On behalf of ASARCO Incorporated. Prepared by ENVIRON International Corporation Chicago, Illinois and W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. August 14, 2007.

- Rebuttal Expert Report. Nueces Bay/Corpus Christi Bay Corpus Christi, Nueces County, Texas. Prepared for Milbank, Tweed, Hadley & McCloy LLP. On behalf of ASARCO Incorporated. Prepared by W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. September 17, 2007.

- Rebuttal Expert Report. Tri-State Sites. Prepared for Milbank, Tweed, Hadley & McCloy LLP. On behalf of ASARCO Incorporated. Prepared by W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. September 17, 2007.

- Rebuttal Expert Report. East Helena Superfund Site, East Helena, Montana. Prepared for Milbank, Tweed, Hadley & McCloy LLP. On behalf of ASARCO Incorporated. Prepared by W.H. Desvousges & Associates, Inc. Raleigh, North Carolina. November 2, 2007.

- Expert Report in the Matter of *New Jersey Department of Environmental Protection and Acting Administrator, New Jersey Spill Compensation Fund v. Higgins Disposal, et al.* March 16, 2006.

- Expert Report in the Matter of *New Jersey Department of Environmental Protection and Acting Administrator, New Jersey Spill Compensation Fund v. Exxon Mobil Corporation, et al.* March 3, 2006.

- Expert Affidavit of William H. Desvousges In Support Of Defendant's Opposition To Plaintiffs' Motion For Partial Summary Judgment in the Matter of *New Jersey Department of Environmental Protection and Administrator New Jersey Spill Compensation fund v. Exxon Mobil Corporation*. February 17, 2006.

- Expert Report in the Matter of *Fisher, et al. v. Ciba Corporation.* February 15, 2006.
- Expert Report in the Matter of *Perrine, et al. v. E.I. DuPont De Nemours and Company, et al*. February 3, 2006.
- Expert Report in the Matter of *Estate of David Hill, et al. v. Koppers Industries, Inc., et al.* January 26, 2006.
- Second Expert Report in the Matter of *Allgood, et al. v. General Motors Corporation.* September 29, 2005.
- Expert Report in the Matter of *Jackson, et al. v. Johnson Electric Automotive, Inc., et al.* August 15, 2005.
- Expert Report in the Matter of *Beck, et al. v. Koppers Industries, Inc., et al.* August 1, 2005.
- Declaration of William H. Desvousges, Ph.D. Pursuant to 28 U.S.C. § 1746. April 15, 2005.
- Supplemental Report in the Matter of *Palmisano, et al. v. Olin Corporation*. February 7, 2005.
- Expert Report in the Matter of *Allgood, et al. v. General Motors Corporation.* January 17, 2005.
- Expert Report in the Matter of *LaBauve, et al. v. Olin Corporation.* December 10, 2004.
- Expert Report in the Matter of *Cole, et al. v. ASARCO, et al*. August 23, 2004.
- Expert Report in the Matter of *Daniels, et al. v. Olin Corporation*. August 16, 2004.
- Expert Report in the Matter of *Kellum, et al. v. Kuhlman Corporation, et al*. July 2003.
- Expert Report in the Matter of *Susann Stalcup, et al. v. Schlage Lock Company, et al*. April 1, 2003.
- Expert Report in the Matter of *Muise/Tzannetakis, et al. v. GPU Energy*. December 2, 2002.
- Expert Report in the Matter of *State of New Mexico v. General Electric Company, et al.* February 1, 2002.
- Expert Report in the Matter of *Major Andrews, et al. v. Kerr-McGee Corporation, Inc., et al*. June 29, 2001.
- Expert Report: *Volume I: Critique of the State of Montana's Contingent Valuation Study*. 1995. Submitted to United States District Court, District of

Montana, Helena Division in the Matter of *State of Montana v. Atlantic Richfield Company*. Case No. CV-83-317-HLN-PGH.

- Expert Report: *Volume II: Critique of the State of Montana's Recreation Study*. 1995. Submitted to United States District Court, District of Montana, Helena Division in the Matter of *State of Montana v. Atlantic Richfield Company*. Case No. CV-83-317-HLN-PGH.

- Expert Report of William H. Desvousges and Steven M. Waters: *Volume III: Report on Potential Economic Losses Associated with Recreation Services in the Upper Clark Fork River Basin*. 1995. Submitted to United States District Court, District of Montana, Helena Division in the Matter of *State of Montana v. Atlantic Richfield Company*. Case No. CV-83-317-HLN-PGH.

- Expert Report: *Volume IV: Critique of the State of Montana's Groundwater Valuation*. 1995. Submitted to United States District Court, District of Montana, Helena Division in the Matter of *State of Montana v. Atlantic Richfield Company*. Case No. CV-83-317-HLN-PGH.

- Expert Report: *Volume V: Report on Potential Economic Losses Associated with Groundwater*. 1995. Submitted to United States District Court, District of Montana, Helena Division in the Matter of *State of Montana v. Atlantic Richfield Company*. Case No. CV-83-317-HLN-PGH.

- Expert Report of William H. Desvousges and Steven M. Waters: *Volume VI: Additional Economic Critique of the State of Montana's Damage Estimates*. 1995. Submitted to United States District Court, District of Montana, Helena Division in the Matter of *State of Montana v. Atlantic Richfield Company*. Case No. CV-83-317-HLN-PGH.

Testimony

Provided expert witness deposition telephonic deposition in the *Matter of Betty Jean Cole, et al. v. Asarco Incorporated, et al.* September 8, 2011.

Provided expert witness testimony In the *Matter of New Jersey Department of Environmental Protection, et al. v. Union Carbide Corporation, et al.* October 2010.

Provided expert witness deposition testimony In the *Matter of New Jersey Department of Environmental Protection, et al. v. Union Carbide Corporation, et al.* September 9, 2010.

Provided expert witness deposition testimony in the Matter of *The Quapaw Tribe of Oklahoma, et al. v. Blue Tee Corp, et al.* The United States District Court For The Northern District Of Oklahoma. Case No. 03-CV-0846-CVE-PJC. June 29, 2010.

Provided expert witness testimony in the Matter of *DeLeo, et al. v. Bouchard Transportation Co., et al.* March 30, 2010.

Provided expert witness testimony in the Matter of *New Jersey Department of Environmental Protection, et al. v. Essex Chemical Corporation*. Superior Court of New Jersey Law Division - Middlesex County Docket No: MID-L-5685-07. March 25, 2010.

Provided expert witness telephonic deposition testimony in the Matter of *Abrams, et al. v. Ciba Specialty Chemicals Corp, et al.* The United States District Court Southern District Of Alabama. CASE NO. 08-68-WS-B. St. Augustine, FL. June 15, 2009.

Provided expert witness testimony in the *Matter of Robert C. Brandriff, et al. v. Dataw Island Owners' Association, Inc., et al.* Civil Action No. 9:07-3361-CWH. April 2009.

Provided expert witness testimony in the *Matter of USA v. Water Supply & Storage*. November 28, 2007.

Provided expert witness testimony in the *Matter of Official Committee of Unsecured Creditors v. ASARCO LLC (In re ASARCO LLC), Case No. 05-21207.* Bunker Hill Superfund Facility/Coeur d'Alene Basin. Idaho/Washington. Settlement Hearing. October 9-12, 2007.

Provided expert witness testimony in the *Matter of Official Committee of Unsecured Creditors v. ASARCO LLC (In re ASARCO LLC), Case No. 05-21207.* Bunker Hill Superfund Facility/Coeur d'Alene Basin. Idaho/Washington. Deposition. September 26, 2007.

Provided expert witness testimony in the *Matter of Official Committee of Unsecured Creditors v. ASARCO LLC (In re ASARCO LLC), Case No. 05-21207.* California Gulch Superfund Site Settlement Hearing. July 27, 2007.

Provided expert witness testimony in the *Matter of Official Committee of Unsecured Creditors v. ASARCO LLC (In re ASARCO LLC), Case No. 05-21207.* California Gulch Superfund Site Deposition. July 24, 2007.

Provided expert witness testimony in the Matter of *New Jersey Department of Environmental Protection and Acting Administrator, New Jersey Spill Compensation Fund v. Exxon Mobil Corporation, et al.* March 28, 2006.

Provided expert witness testimony in the Matter of *Fisher, et al. v. Ciba Corporation.* March 2, 2006.

Provided expert witness testimony in the Matter of *Allgood, et al. v. General Motors Corporation.* February 15, 2006.

Provided expert witness testimony in the Matter of *Palmisano, et al. v. Olin Corporation.* February 23, 2005.

Provided expert witness testimony in the Matter of *LaBauve, et al. v. Olin Corporation.* Civil No. 03-567 in the U.S. District Court, Southern District of Alabama. February 14, 2005.

Provided expert witness testimony in the Matter of *Betty Jean Cole, et al. v. ASARCO Incorporated, et al.* Case No. 03-CV-327(H) M in the U.S. District Court, Northern District of Oklahoma. October 8, 2004.

Provided expert witness testimony in the Matter of *Daniels, et al. and Palmisano, et al. v. Olin Corporation, et al*. Case No. C 03-01211 RMW in the U.S. District Court, Northern District of California, San Jose Division. September 21 and 22, 2004 and February 23, 2005.

Provided expert witness testimony and participated in Daubert hearing in the Matter of *State of New Mexico v. General Electric Company, et al.* Case No. CIV 99-1254, Case No. CIV 99-1118. Consolidated by Order dated June 14, 2000. January 2004.

Provided testimony to the Public Service Commission of Wisconsin in the Matter of "Application of Wisconsin Electric Power Company; Wisconsin Energy Corporation; and W.E. Power, LLC for a Certificate of Public Convenience and Necessity for Construction of Three Large Electric Generation Facilities, the Elm Road Generating Station, and Associated High Voltage Transmission Interconnection Facilities to be Located in Milwaukee and Racine Counties. Docket No. 05-CE-130. September 8, 2003.

Provided expert witness testimony in the Matter of *Kellum, et al. v. Kuhlman Corporation, et al*. Civil Action No. 2001-0313 through 2001-324 in the Circuit Court of Copiah County, Mississippi. August 19 and August 20, 2003.

Provided expert witness testimony in the Matter of *Susann Stalcup, Craig Lewis and Sharon Lewis v. Schlage Lock Company, Ingersoll-Rand Company and Eagle-Picher Industries, Inc.* Case No. 02-RB01188(OES). June 12, 2003.

Provided expert witness testimony in the Matter of *Mary Louise Fairey, et al. v. the Exxon Corporation, Standard Oil Company, et al.* Case No. 94-CP-38-118. March 13 and June 3, 2003.

Provided expert witness testimony in the Matter of *Muise/Tzannetakis, et al. v. GPU Energy*. January 22, 2003.

Provided expert witness testimony in the Matter of *Andrews, et al. v. Kerr-McGee Corporation, et al.* Civil Action No. 1:00-CV-00158-B-A in the U.S. District Court, Northern District of Mississippi, Eastern Division. October 16, 2001.

Provided expert witness testimony in the Matter of *State of New Mexico v. General Electric Company, et al.* Case No. CIV 99-1254, Case No. CIV 99-1118. Consolidated by Order dated June 14, 2000.

Provided expert witness testimony in the Matter of *State of Montana v. Atlantic Richfield Company* in the U.S. District Court, District of Montana, Helena Division. Case No. CV-83-317-HLN-PGH. July 13, 1995. Rebuttal Testimony provided February 1, 1996.

Provided testimony on the Matter of "The Role of Contingent Valuation in Natural Resource Damage Assessment" before the U.S. House of Representatives Subcommittee on Commerce, Trade, and Hazardous Materials. June 20, 1995.

Provided testimony before the Public Utilities Commission of the State of Minnesota in the Matter of "The Quantification of Environmental Costs." Docket No. E-999/CI-93-583. Testimony in November 1994. Rebuttal in March 1995, and Sur-rebuttal in April 1995.

Testified before the National Oceanic and Atmospheric Administration (NOAA) Contingent Valuation Panel in the Matter of "Using CV to Measure Nonuse Damages: An Assessment of Validity and Reliability." August 12, 1992.

Provided testimony to Wisconsin Public Service Commission in the Matter of "Accounting for Environmental Externalities in Electric Utility Planning." November 26, 1991.

Areas of Specialization

Property Valuation

Prepared expert report that critiqued reports provided by the plaintiff's economic experts in a lawsuit alleging groundwater contamination at a Superfund site in the western U.S. Created a sophisticated hedonic property value model demonstrating that the Superfund site had no effect on residential property values.

Performed statistical analyses of changes in property values as a result of mandatory membership in a golf club.

In several states, directed projects evaluating the use of surveys to measure diminished property values, commercial and residential property values, potential damages to residential and commercial properties, and potential damages from various contaminants.

Critiqued the contingent valuation survey of a plaintiff's expert in a series of lawsuits alleging property damages caused by a wood-treating facility in Mississippi. Demonstrated that the survey is unreliable for use in litigation.

Natural Resource Damage Assessment

Assisted in NRD assessment for a process-water release (Mosaic).

Performed and critiqued habitat equivalency analysis studies.

Prepared assessment of proposed changes to DOI NRDA rules.

Developed comprehensive assessment plans for complex assessments for a wide range of sites.

Performed preliminary assessments for both oil-spill and hazardous-waste sites.

Designed state-of-the-art studies to measure potential losses for recreation and groundwater services. Studies included data-collection protocols and implementation.

Performed critical analyses of studies that used contingent valuation to measure nonuse values.

Designed and directed studies to measure potential recreation losses and to evaluate potential restoration gains.

Critiqued the transfer study used by the plaintiff's expert in a Louisiana lawsuit seeking restoration funds to convert floatant freshwater marsh habitat to uplands. Provided an alternative estimate of the value of the wetlands.

Benefit/Cost Analysis

Prepared comments on EPA's Proposed Survey to Estimate the Potential Benefits of Alternative Cooling Water Intake Policies for the Utility Water Act Group. Prepared in conjunction with NERA Consulting Group. September 2010.

Prepared comments to Office of Management and Budget on potential revisions to benefit cost analyses of governmental regulations for the Utility Water Act Group.

Prepared comments on economic issues in EPA's proposed 316(b) regulations for The Utility Water Act Group.

Directed a benefit analysis of technology-based effluent guidelines for municipal and industrial dischargers.

Directing projects to measure benefits of 316(b) regulatory alternatives for several utility clients

Served on peer review committee associated with benefits transfer data needs for Environment Canada.

Served as peer reviewer on benefits transfer for Ontario Ministry of the Environment.

Directed a feasibility study of using benefit-cost techniques to assist in the planning of estuaries cleanup. The study used case studies of two estuaries: the Albemarle and Pamlico Sounds.

Prepared a handbook on benefit-cost assessment for water programs that included chapters on measuring benefits and costs, selecting a discount rate, and assembling a benefit-cost assessment.

Compared alternative approaches for estimating the recreation and related benefits of the Monongahela River in Pennsylvania. Developed a survey questionnaire to measure recreation, user, option, and existence benefits for different levels of water quality. The survey design enabled a comparison of bidding games, direct-question, and contingent-ranking techniques for measuring benefits. Used clustered sampling techniques to sample 393 households, and compared the direct survey results with benefits estimates derived from an indirect estimation technique.

Survey Design and Management

During the past 25 years, designed and managed large-scale surveys. Experienced in using bidding games, direct-question, contingent-ranking, and discrete-choice techniques for measuring benefits of natural resource and environmental policies. Directed focus groups to determine appropriate terminology, to evaluate the effectiveness of alternative visual aids used in the surveys, and to assess the various survey issues. Developed surveys to evaluate the following:

- Health benefits from reduced cardiac and respiratory morbidity using conjoint analysis
- Market penetration for “green” products using conjoint analysis
- Customer willingness to pay for “greener” electricity using conjoint analysis
- The role of quality-of-life measures in the benefits of improved life extension
- Natural resource damages
- Risk-communication effectiveness
- Radon risk perceptions and willingness to pay to reduce perceived risks
- Benefits of hazardous waste management regulations
- Risk perceptions related to the proposed siting of a nuclear waste repository and willingness to pay to reduce those perceived risks
- Recreation benefits demand
- Recreation, user, and option benefits for different levels of water quality

Environmental Costing

Provided analysis and testimony for the eastern Wisconsin utilities in hearings on environmental costing before the Wisconsin Public Service Commission.

Estimated the environmental externality costs of resource planning options for the eastern Wisconsin utilities and for Northern States Power.

Participated in environmental costing workshop and served on peer review committee for Ontario Hydro.

Health Economics

Conducted focus groups and used verbal protocols to develop stated-preference conjoint survey questionnaires.

Conducted large-scale stated-preference conjoint survey to measure benefits of reduced cardiac and respiratory morbidity.

Designed/conducted pilot study of quality of life and enhanced longevity using conjoint stated-preference methods.

Designed and distributed radon information materials that were sent to 2,000 homeowners in the state of New York who had their homes tested for radon. Supervised interviews with homeowners, sequenced over a nine-month to two-year period, to elicit their perceptions of radon risks and tracked any expenditure decisions to reduce these risks. The expenditures were used to estimate a willingness-to-pay measure of the value of reductions in radon risks. The research design also evaluated the effectiveness of an information policy for reducing radon risks.

Developed and evaluated alternative approaches for encouraging Maryland homeowners to test for radon. Developed and pretested risk communication materials that ranged from radio public service announcements to public display posters and brochures. Used a three-community experimental design with 1,500 baseline and follow-up interviews in each community to measure effectiveness.

Professional Associations

- American Economic Association
- Association of Environmental and Resource Economists (AERE)
- Associate Member, Appraisal Institute
- Member of Nominating Committee for AERE, 1983 and 1986

Honors and Awards

- Recipient, Research Triangle Institute Professional Development Award, 1985
- Nominated for Outstanding Young Man of Rolla, Missouri, 1979
- Outstanding Teacher Award, University of Missouri at Rolla, 1977 to 1979
- Scholar-Diplomat, U.S. State Department, 1978
- Graduated *cum laude*, Stetson University, 1972

Professional Leadership

- Vice President, Association of Environmental and Resource Economists, 1992 to 1994
- Associate Editor, *International Journal of Energy Studies*, 1989 to 1993
- Associate Editor, *Journal of Environmental Economics and Management*, 1992 to 1994
- Associate Editor, *Water Resources Research*, 1984 to 1987

Journals and Book Reviews

- *American Economic Review*
- *Review of Economics and Statistics*
- *Land Economics*
- *Journal of Environmental Economics and Management*
- *Growth and Change*
- *American Journal of Agricultural Economics*
- *Southern Economics Journal*
- *Mansfield's Principles of Microeconomics*
- *Marine Resource Economics*
- *National Science Foundation*
- *Journal of the American Statistical Association*

Publications

MacNair, D.J. and W.H. Desvousges. 2007. "The Economics of Fish Consumption Advisories: Insights from Revealed and Stated Preference Data." *Land Economics* 83(4): 600-616.

Mathews, K.E., M.L. Freeman, and W.H. Desvousges. 2006. "How and How Much? The Role of Information in CE Questionnaires." In *Valuing Environmental Amenities Using Stated Choice Studies*, Barbara Kanninen, ed. Boston: Kluwer Academic Publishers.

Kinnell, J.C., M.F. Bingham, A.F. Mohamed, W.H. Desvousges, T.B. Kiler, E.K. Hastings, and K.T. Kuhns. 2006. "Estimating Site-Choice Decisions for Urban Recreators." *Land Economics* 82(2):257–272.

Dunford, R.W., T.C. Ginn, and W.H. Desvousges. 2004. "The Use of Habitat Equivalency Analysis in Natural Resource Damage Assessments." *Ecological Economics* 48(1):49–70.

Mathews, K.E., and W.H. Desvousges. 2003. "Stigma Claims and Survey Reliability: Lessons Learned from Natural Resource Damages Litigation." *Journal of Forensic Economics* 16(1):23–36.

Iannuzzi, T.J., D.F. Ludwig, J.C. Kinnell, J.M. Wallin, W.H. Desvousges, and R.W. Dunford. 2002. *A Common Tragedy: History of an Urban River*. Amherst, MA: Amherst Scientific Publishers.

Mathews, K.E., K.J. Gribben, and W.H. Desvousges. 2002. "Integration of Risk Assessment and Natural Resource Damage Assessment: A Case Study of Lavaca Bay." In *Human and Ecological Risk Assessment: Theory & Practice,* Dennis J. Paustenbach, ed. New York: John Wiley and Sons.

Johnson, F.R., R.W. Dunford, W.H. Desvousges, and H.S. Banzhaf. 2001. "The Role of Knowledge in Assessing Nonuse Damages: A Case Study of the Lower Passaic River." *Growth and Change* 32(Winter):43–68.

Smith, V. Kerry, Donald H. Taylor, Jr., Frank A. Sloan, F. Reed Johnson, and William H. Desvousges. 2001. "Do Smokers Respond to Health Shocks?" *The Review of Economics and Statistics* 83(4):675–687.

Desvousges, W.H., and J.C. Lutz. 2000. "Compensatory Restoration: Economic Principles and Practice." *Arizona Law Review* 42(2):411–432.

Johnson, F.R., M.R. Banzhaf, and W.H. Desvousges. 2000. "Willingness to Pay for Improved Respiratory and Cardiovascular Health: A Multiple-Format Stated-Preference Approach." *Health Economics* 9:295–317.

Payne, J.W., D.A. Schkade, W.H. Desvousges, and C. Aultman. 2000. "Valuation of Multiple Environmental Programs." *Journal of Risk and Uncertainty* 21(1):95–115.

Desvousges, W.H., F.R. Johnson, and H.S. Banzhaf. 1998. *Environmental Policy Analysis With Limited Information: Principles and Applications to the Transfer Method.* Cheltenham, UK: Edward Elgar.

Johnson, F.R., W.H. Desvousges, M.C. Ruby, D. Stieb, and P. De Civita. 1998. "Eliciting Stated Health Preferences: An Application to Willingness to Pay for Longevity." *Medical Decision Making* 18(2):57–67.

Johnson, F.R., and W.H. Desvousges. 1997. "Estimating Stated Preferences With Rated-Pair Data: Environmental, Health, and Employment Effects of Energy Programs." *Journal of Environmental Economics and Management* 34(1):79–99.

Banzhaf, H.S., W.H. Desvousges, and F.R. Johnson. 1996. "Assessing the Externalities of Electricity Generation in the Midwest." *Resource and Energy Economics* 18:395–421.

Boyle, K.J., F.R. Johnson, D.W. McCollum, W.H. Desvousges, R.W. Dunford, and S.P. Hudson. 1996. "Valuing Public Goods: Discrete Versus Continuous Contingent-Valuation Responses." *Land Economics* 72(3):381–96.

Desvousges, W.H., S.P. Hudson, and M.C. Ruby. 1996. "Evaluating CV Performance: Separating the Light From the Heat." In *The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs*, D.J. Bjornstad and J.R. Kahn, eds. Brookfield, VT: Edward Elgar Publishing Limited.

Smith, V.K., W.H. Desvousges, and J.W. Payne. 1995. "Do Risk Information Programs Promote Mitigating Behavior?" *Journal of Risk and Uncertainty* 10:203–221.

Wood, L.L., A.E. Kenyon, W.H. Desvousges, and L.K. Morander. 1995. "How Much Are Customers Willing to Pay for Improvements in Health and Environmental Quality?" *The Electricity Journal* May: 70-77.

Boyle, K.J., W.H. Desvousges, F.R. Johnson, R.W. Dunford, and S.P. Hudson. 1994. "An Investigation of Part-Whole Biases in Contingent Valuation Studies." *Journal of Environmental Economics and Management* 27(1):64–83.

Desvousges, W.H., H. Kunreuther, P. Slovic, and E.A. Rosa. 1993. "Perceived Risk and Attitudes Toward Nuclear Wastes: National and Nevada Perspectives." In *Public Reactions to Nuclear Waste*, R. Dunlap, M. Kraft, and E.A. Rosa, eds. Durham, NC: Duke University Press.

Desvousges, W.H., F.R. Johnson, R.W. Dunford, K.J. Boyle, S.P. Hudson, and K.N. Wilson. 1993. "Measuring Natural Resource Damages With Contingent Valuation: Tests of Validity and Reliability." In *Contingent Valuation, A Critical Assessment*, J.A. Hausman, ed., pp. 91–164. Amsterdam: Elsevier.

Desvousges, W.H., A.R. Gable, R.W. Dunford, and S.P. Hudson. 1993. "Contingent Valuation: The Wrong Tool for Damage Assessment." *Choices* 8(2):9–11.

Desvousges, W.H., V.K. Smith, and H.H. Rink, III. 1992. "Communicating Radon Risks Effectively: The Maryland Experience." *Journal of Public Policy and Marketing* 11(1):68–78.

Desvousges, W.H., and R.W. Dunford. 1992. "Russian River Basin Formaldehyde Release." In *Natural Resource Damages: Law and Economics*, K.M. Ward and J.W. Duffield, eds. New York: John Wiley and Sons.

Desvousges, W.H., M. Naughton, and G. Parsons. 1992. "Benefits Transfer: Conceptual Problems in Estimating Water Quality Benefits Using Existing Studies." *Water Resources Research* 28(3):675–683.

Kunreuther, H., D. Easterling, W.H. Desvousges, and P. Slovic. 1990. "Public Attitudes Toward Siting a High-Level Nuclear Waste Repository in Nevada." *Risk Analysis* 10(4):469–484.

Smith, V.K., and W.H. Desvousges. 1990. "Risk Communication and the Value of Information: Radon as a Case Study." *Review of Economics and Statistics* 72(1):137–140 .

Smith, V.K., W.H., Desvousges, F.R. Johnson, and A. Fisher. 1990. "Can Public Information Programs Affect Risk Perceptions?" *Journal of Policy Analysis and Management* 9(1):41–59.

Desvousges, W.H., and J.H. Frey. 1989. "Integrating Focus Groups and Surveys: Examples from Environmental Risk Studies." *Journal of Official Statistics* 5(4):1–15.

Smith, V.K., and W.H. Desvousges. 1989. "Subjective Versus Technical Risk Estimates: Do Risk Communication Policies Increase Consistency?" *Economic Letters* 31:287–291.

Desvousges, W.H., and V.K. Smith. 1988. "Focus Groups and Risk Communication: The 'Science' of Listening to Data." *Risk Analysis* 8(4):479–484.

Smith, V.K., and W.H. Desvousges. 1988. "Risk Perception, Learning and Individual Behavior." *American Journal of Agricultural Economics* 70(5):1113–1117.

Kunreuther, H., W.H. Desvousges, and P. Slovic. 1988. "Nevada's Predicament: Public Perceptions of Risk From the Proposed Nuclear Waste Repository." *Environment* 30(8):17–20, 30–33.

Smith, V.K., and W.H. Desvousges. 1988. "The Valuation of Environmental Risks and Hazardous Waste Policy." *Land Economics* 64(3):211–219.

Smith, V.K., W.H. Desvousges, A. Fisher, and F.R. Johnson. 1988. "Learning About Radon's Risk." *Journal of Risk and Uncertainty* 1:233–258.

Johnson, F.R., A. Fisher, V.K. Smith, and W.H. Desvousges. 1988. "Informed Choice or Regulated Risks? Lessons From a Social Experiment in Risk Communication." *Environment* 30(4):12–15, 30–35. Reprinted in *Readings in Risk.* 1990. Washington, DC: Resources for the Future.

Desvousges, W.H., V.K. Smith, A. Fisher, and F.R. Johnson. 1988. "Communicating Radon Risks Effectively." In *Managing Environmental Risks, Proceedings of Air Pollution Control Association, Specialty Conference on Risk Management and Risk Communication.* Pittsburgh, PA.

Smith, V.K., and W.H. Desvousges. 1987. "An Empirical Analysis of the Economic Value of Risk Changes." *Journal of Political Economy* 95(1):89–114.

Desvousges, W.H., V.K. Smith, and A. Fisher. 1987. "Option Price Estimates for Water Quality Improvements: A Contingent Valuation Study for the Monongahela River." *Journal of Environmental Economics and Management* 14:248–267.

Smith, V.K., and W.H. Desvousges. 1986. *Measuring Water Quality Benefits*. Boston: Kluwer Nijhoff.

Smith, V.K., and W.H. Desvousges. 1986. "Asymmetries in the Valuation for Risk Reductions." *American Economic Review* 76(2):291–294.

Smith, V.K., and W.H. Desvousges. 1986. "The Value of Avoiding a LULU: Hazardous Waste Landfill Sites." *Review of Economics and Statistics* 68(2):293–299.

Smith, V.K., and W.H. Desvousges. 1986. "Averting Behavior: Does It Exist?" *Economic Letters* 20:291–296.

Smith, V.K., W.H. Desvousges, and A. Fisher. 1986. "A Comparison of Direct and Indirect Methods for Estimating Environmental Benefits." *American Journal of Agricultural Economics* 68:280–289.

Smith, V.K., and W.H. Desvousges. 1985. "The Generalized Travel Cost Model and Water Quality Benefits: A Reconsideration." *Southern Economic Journal* 52(2):371–381.

Smith, V.K., and W.H. Desvousges. 1984. "Measuring the Benefits of Water Quality Improvements: Additional Considerations." *Southern Economic Journal* October.

Desvousges, W.H., and M.J. Piette. 1984. "Problems and Prospects: Outer Continental Shelf Petroleum Resources." *Growth and Change* 15(2):3–10.

Desvousges, W.H. 1984. "Benefit Cost Assessment of the Toulumne River: A Foreword." *Environmental Defense Fund*, Spring.

Desvousges, W.H., V.K. Smith, and A. Fisher. 1983. "Estimates of the Option Values for Water Quality Improvements." *Economic Letters* 13:81–86.

Smith, V.K., W.H. Desvousges, and M.P. McGivney. 1983. "Estimating Water Quality Benefits: An Econometric Analysis." *Southern Economic Journal* 50(2):422–437.

Smith, V.K., W.H. Desvousges, and M.P. McGivney. 1983. "The Opportunity Cost of Travel Time in Recreation Demand Models." *Land Economics* 59(3):259–278.

Piette, M.J., and W.H. Desvousges. 1981. "Behavior of the Firm: The U.S. Petroleum Pipeline Industry Under Regulatory Constraint." *Growth and Change* 12(2):17–22.

Garbacz, C., and W.H. Desvousges. 1980. "The Impact of Increased Energy Costs on Municipal Budgets in Missouri." *Missouri Municipal League Review*, July.

Desvousges, W.H., and M.J. Piette. 1979. "The Effect of 'Large' Mergers on Concentration Trends in Petroleum Production: 1955–1975." *Southern Economic Journal*, October.

Desvousges, W.H. 1978. *Tourism U.S.A. Volume 1: Appraising Tourism Potential.* United States Department of Commerce, United States Travel Service, Washington, D.C.

Desvousges, W.H. 1978. "Savannah, Georgia." *Profiles in Tourism U.S.A., 1978*. United States Department of Commerce, United States Travel Service, Washington, D.C.

Foreyt, J.P., C.E. Rockwood, J.C. Davis, W.H. Desvousges, and R. Hollingsworth. 1975. "Benefit-Cost Analysis of a Token Economy Program." *Professional Psychology* February.

Selected Reports and Working Papers

The Aluminum Association, BP Americ a, Inc., The Dow Chemical Company, Exxon Mobil Corporation, General Electric Company, and National Mining Association. 2008. "Comments on The United States Department of the Interior's Notice of Proposed Rulemaking on Revisions of Its Type B Procedures for Natural Resource Damage Assessments" (73 Fed.Reg. 11081, February 29, 2008). May 29. (Appendix B: Comments on Proposed Changes to DOI Rule.)

Desvousges, W.H. 2006. "Letter to Steve Glomb at the U.S. Department of Interior re: Proposed DOI Changes." December 15.

Desvousges, W.H. and H.J. Michael. 2006. "Response to the Department of the Interior's Questions to FACA Subcommittee #3." Prepared for Department of the Interior FACA Subcommittee #3. June 2. Raleigh, NC: W.H. Desvousges & Associates, Inc.

Desvousges, W.H., M.F. Bingham, J.C. Kinnell, A.F. Mohamed, and K.T. Kuhns. 2005. *Review and Response to the EPA's Response to Comments from the American Chemistry Council et al. and Accompanying Triangle Economic Research (TER) Report*. Prepared for the Utility Water Act Group, General Electric Company, American Chemistry Council, American Forest and Paper Association, American Iron and Steel Institute, American Public Power Association, and American Petroleum Institute. April 20. Durham, NC: Triangle Economic Research.

Desvousges, W.H., M.F. Bingham, J.C. Kinnell, and A.F. Mohamed. 2005. *Comments on Potential Nonuse Values for Proposed Phase III Cooling*

Water Intake Regulations: Final Report. Prepared for the Utility Water Act Group, American Chemistry Council, American Forest and Paper Association, American Iron and Steel Institute, American Petroleum Institute, and American Public Power Association. January 24. Durham, NC: Triangle Economic Research.

Mathews, K.E., and W.H. Desvousges. 2004. *Stigma Claims and Survey Reliability: Lessons Learned from Natural Resource Damages Litigation.* Working Paper No. T-0401. Durham, NC: Triangle Economic Research.

Bingham, M.F, W.H. Desvousges, and A.F. Mohamed. 2003. *Comments on Benefit Estimation of EPA's Proposed Phase II 316(b) Rule as Summarized in the Notice of Data Availability: Final Report*. Prepared for The Utility Water Act Group. Durham, NC: Triangle Economic Research. June 2.

Mathews, K.E., and W.H. Desvousges. 2002. "The Truth, the Partial Truth, or Anything But the Truth: Survey Reliability and Property Valuation." Paper presented at the Symposium on Environmental & Property Damages: Standards, Due Diligence, Valuation & Strategy, Toronto, Ontario. April 4–6.

Desvousges, W.H., D.M. Clark, M.F. Bingham, A.F. Mohammed, S.M. Small, and D.F. Ludwig. 2002. *Comments on the Benefit Estimates of EPA's Proposed Phase II 316(b) Rule: Final Report.* Prepared for the Utility Water Act Group.

Desvousges, W.H., J.C. Kinnell, K.S. Lievense, and E.A. Keohane. 2001. *Passaic River Study Area Creel/Angler Survey: Data Report.* T E R Working Paper No. G-0101. Durham, NC: Triangle Economic Research.

Desvousges, W.H., D.J. MacNair, F.R. Johnson, G.A. Smith, and S.D. Cox. 2000. *Comments on the Federal Trustees' Restoration Scaling and Compensable Value Determination for the Fox River/Green Bay*. Durham, NC: Triangle Economic Research.

Desvousges, W.H., D.J. MacNair, and G.A. Smith. 2000. *Lower Fox River and Green Bay: Assessment of Potential Recreational Fishing Losses and Restoration Offsets*. Durham, NC: Triangle Economic Research.

Desvousges, W.H., R.W. Dunford, K.E. Mathews, C.L. Taylor, and J.L. Teague. 1999. *A Preliminary Economic Evaluation of New Jersey's Proposed Groundwater Damage Assessment Process.* Report prepared for New Jersey Site Remediation Industry Network.

Johnson, F.R., Melissa C. Ruby, William H. Desvousges, and Jonathan R. King. 1998. *Using Stated Preferences and Health-State Classifications to Estimate the Value of Health Effects of Air Pollution.* Report prepared for Environment Canada, Health Canada, Ontario Hydro, and Ontario Ministry of Environment and Energy.

Desvousges, W.H., F. Reed Johnson, M.C. Ruby, and Alicia R. Gable. 1997. *Valuing Stated Preferences for Health Benefits of Improved Air Quality: Results of a Pilot Study.* TER Working Paper No. T-9702. Durham, NC: Triangle Economic Research.

Dunford, R.W., W.H. Desvousges, F.R. Johnson, E.E. Fries, H.J. Michael, and K.E. Mathews. 1997. *Comments on NOAA's Draft Compensatory Restoration Guidance Document.* Submitted to National Oceanic and Atmospheric Administration, Silver Spring, MD.

Dunford, R.W., A.R. Gable, S.P. Hudson, W.H. Desvousges, and F.R. Johnson. 1996. *A Review of the 1996 Contingent Valuation Study on the Value of Preventing Oil Spills Along California's Central Coast*. Prepared for Ad Hoc Industry Group. Durham, NC: Triangle Economic Research.

Desvousges, W.H., F.R. Johnson, S.P. Hudson, A.R. Gable, and Melissa C. Ruby. 1996. *Using Conjoint Analysis and Health-State Classifications to Estimate the Value of Health Effects of Air Pollution: Pilot Test Results and Implications.* Prepared for Environment Canada, Health Canada, Ontario Hydro, Ontario Ministry of Environment and Energy, and Quebec Ministry of Environment. Durham, NC: Triangle Economic Research.

Desvousges, W.H., S.M. Waters, and K.E. Train. 1996. *Supplemental Report on Potential Economic Losses Associated with Recreation Services in the Upper Clark Fork River Basin*. Durham, NC: Triangle Economic Research.

Dunford, R.W., K.E. Mathews, A.R. Gable, E.E. Fries, F.R. Johnson, and W.H. Desvousges. 1995. *Nonuse Values for Nonenvironmental Commodities: Preliminary Contingent Valuation Results for Avoiding Job Losses.* Prepared for the U.S. Department of Energy. Durham, NC: Triangle Economic Research.

Dunford, R.W., K.E. Mathews, A.R. Gable, E.E. Fries, F.R. Johnson, and W.H. Desvousges. 1995. *Nonuse Values for Nonenvironmental Commodities: Preliminary Conjoint Survey Results.* Prepared for the U.S. Department of Energy. Durham, NC: Triangle Economic Research.

Gable, A.R., W.H. Desvousges, and F.R. Johnson. 1995. *Calibrating Contingent Valuation Estimates: A Review of the Literature and Suggestions for Future Research.* Prepared for the U.S. Department of Energy. Durham, NC: Triangle Economic Research.

Mathews, K.E., F.R Johnson, R.W. Dunford, and W.H. Desvousges. 1995. *The Potential Role of Conjoint Analysis in Natural Resource Damage Assessments*. TER Working Paper No. G-9503. Durham, NC: Triangle Economic Research.

Desvousges, W.H. 1995. *The Role of Contingent Valuation in Natural Resource Damage Assessment.* TER Working Paper No. G-9502. Durham, NC: Triangle Economic Research.

Desvousges, W.H., K.E. Mathews, R.W. Dunford, R.R. Russell, and H.L. James. 1995. *Comments on NOAA's Proposed NRDA Rule Under the Oil Pollution Act.* Submitted to NOAA. Durham, NC: Triangle Economic Research.

Desvousges, W.H., K.E. Mathews, R.W. Dunford, R.R. Russell, and H.L. James. 1995. *Comments on NOAA's Proposed NRDA Rule Under the Oil Pollution Act: Executive Summary.* Durham, NC: Triangle Economic Research.

Desvousges, W.H., and R.A. Sandefur. 1995. "Modeling Natural Resource Damages for Spills and Releases of Oils and Chemicals." White Paper prepared for API by Arthur D. Little and Triangle Economic Research.

Desvousges, W.H., L.A. Sturtevant, S.E. Holden, and S.P. Hudson. 1995. *Review of DOI's Proposed NRDAM/CME and Associated Regulations.* Prepared by Arthur D. Little, Inc. and Triangle Economic Research.

Desvousges, W.H., S.P. Hudson, A.R. Gable, and S.K. Snow. 1995. *Review of DOI's Proposed NRDAM/GLE and Associated Regulations.* Prepared by Arthur D. Little, Inc., and Triangle Economic Research.

Desvousges, W.H., F.R. Johnson, H.S. Banzhaf, R.R. Russell, E.E. Fries, K.J. Dietz, S.C. Helms, D. Keen, J. Snyder, H. Balentine, V. Sadeghi, and S.A. Martin. 1995. *Assessing Environmental Externality Costs for Electricity Generation in Wisconsin.* Prepared for Wisconsin Task Force on Externality Costing. Seven volumes. Durham, NC: Triangle Economic Research.

Desvousges, W.H., F.R. Johnson, H.S. Banzhaf, R.R. Russell, E.E. Fries, K.J. Dietz, S.C. Helms, D. Keen, J. Snyder, H. Balentine, V. Sadeghi, and S.A. Martin. 1995. *Assessing Environmental Externality Costs for Electricity Generation.* Prepared for Northern States Power Company. Seven volumes. Durham, NC: Triangle Economic Research.

Johnson, F.R., W.H. Desvousges, E.E. Fries, and L.L. Wood. 1995. *Conjoint Analysis of Individual and Aggregate Environmental References*. TER Technical Working Paper No. T-9502. Durham, NC: Triangle Economic Research.

Desvousges, W.H., R.W. Dunford, R.R. Russell, and S.P. Hudson. 1994. *Review of Technical Memorandum: Quantification and Scaling of Resource Services.* Prepared for ASARCO Incorporated, Champion International Corporation, Kaiser Aluminum & Chemical Corporation, Occidental Chemical Corporation, and the City of Tacoma.

Desvousges, W.H., F.R. Johnson, and H. Spencer Banzhaf. 1994. *Assessing Environmental Costs For Electricity Generation.* TER General Working Paper No. G-9402. Durham, NC: Triangle Economic Research.

Desvousges, W.H., S.P. Hudson, S.K. Snow, R.W. Dunford, A.R. Gable, M.C. Ruby, and R.A. Sandefur. 1994. *Comments on the National Oceanic*

and Atmospheric Administration's Natural Resource Damage Assessment Proposed Rule. Prepared for NOAA. Durham, NC: Triangle Economic Research.

Desvousges, W.H., L.L. Wood, A.E. Kenyon, F.R. Johnson, R. Iachan, and E.E. Fries. 1994. *Willingness-to-Pay Results and Market Penetration Forecasts.* Prepared for the Electric Power Research Institute.

Desvousges, W.H., S.P. Hudson, and R.R. Russell. 1993. *Comments on the Department of the Interior's Natural Resource Damage Assessment Proposed Rule.* Prepared for the Office of Environmental Affairs, U.S. Department of the Interior.

Desvousges, W.H., and F.R. Johnson. 1992. *A Review of "Methods for Measuring Nonuse Values: A Contingent Valuation Study of Groundwater Cleanup,"* by McClelland, Schulze, et al. Prepared for the Environmental Advisory Committee, U.S. Environmental Protection Agency.

Desvousges, W.H., F.R. Johnson, R.W. Dunford, K.N. Wilson, H.S. Banzhaf, and K.J. Stettler. 1992. *Using Contingent Valuation to Measure Nonuse Damages: An Assessment of Validity and Reliability.* Prepared for the NOAA Contingent Valuation Panel.

Desvousges, W.H., F.R. Johnson, R.W. Dunford, K.J. Boyle, S.P. Hudson, and K.N. Wilson. 1992. *Measuring Nonuse Damages Using Contingent Valuation: An Experimental Evaluation of Accuracy*. Monograph 92-1, Prepared for Exxon Company, USA. Research Triangle Park, NC: Research Triangle Institute.

Desvousges, W.H., K.E. Mathews, N. Dean, J.S. Smith, and K.N. Wilson. 1992. *Measuring Benefits of the Effluent Guidelines: An Evaluation of Benefits-Transfer Technique.* Prepared for the Office of Science and Technology, U.S. Environmental Protection Agency.

Desvousges, W.H., F.R. Johnson, J.A. Mauskopf, S.A. Johnston, J.S. Smith, K.N. Wilson, and M. Benerofe. 1991. *Accounting for Externality Costs in Wisconsin Electric Utility Planning.* Prepared for the Wisconsin Public Service Commission.

Desvousges, W.H., and A.J. Milliken. 1991. *An Economic Assessment of Natural Resource Damages from the Arthur Kill Oil Spill.* Prepared for Exxon Company, USA.

Desvousges, W.H., and R.W. Dunford. 1991. *Comments on the Proposed Revision in the NRDA Rule Pursuant to the 1989 Ohio vs. Interior Ruling.* Submitted to the U.S. Department of the Interior.

Robilliard, G.A., W.H. Desvousges, R.W. Dunford, and J. Milliken. 1991. *Natural Resource Injury and Damage Assessment Guidance Manual.* Prepared for the Petroleum Environmental Research Forum.

Regan, M.J., and W.H. Desvousges. 1990. *Communicating Environmental Risks: A Guide to Practical Evaluations.* Prepared for the U.S. Environmental Protection Agency.

Mauskopf, J.A., A. Forrest, and W.H. Desvousges. 1990. *Hazardous Substances in Our Environment: A Citizen's Guide to Understanding Health Risks and Reducing Exposure.* Prepared for the Risk Communication Program, U.S. Environmental Protection Agency.

Regan, M.J., J.L. Creighton, and W.H. Desvousges. 1990. *Sites for Our Solid Wastes: A Guidebook for Effective Public Involvement.* Prepared for the Office of Solid Waste, U.S. Environmental Protection Agency.

Desvousges, W.H., R.W. Dunford, and J.L. Domanico. 1989. *Measuring Natural Resource Damages: An Economic Appraisal.* Prepared for the American Petroleum Institute.

Desvousges, W.H., V.K. Smith, and H.H. Rink, III. 1988. *Communicating Radon Risk Effectively: Radon Testing in Maryland*. Prepared for the Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency.

Desvousges, W.H., V.K. Smith, A. Fisher, and F.R. Johnson. 1987. *Communicating Radon Risks Effectively*. Cooperative Agreement report to the Office of Policy Analysis, U.S. Environmental Protection Agency.

Smith, V. Kerry, William H. Desvousges, Ann Fisher, and F. Reed Johnson. 1987. *Radon Risk Perceptions and Risk Communications: Preliminary Results.* Interim report prepared for the Office of Policy Analysis, U.S. Environmental Protection Agency.

Desvousges, W.H., R.W. Dunford, J. Frey, H. Kunreuther, R. Kasperson, and P. Slovic. 1987. *High-Level Nuclear Waste Repository Risks: Focus Group Findings and Implications for Surveys.* Prepared for Mountain West and the State of Nevada.

Desvousges, W.H., R.W. Dunford, and H.H. Rink, III. 1987. *The Social Cost of a Formaldehyde Release in the Russian River Basin.* Prepared for the U.S. Department of Justice.

Desvousges, W.H., R.W. Dunford, J. Frey, H. Kunreuther, R. Kasperson, and P. Slovic. 1986. *High Level Nuclear Waste Risk Surveys: Integrated Survey Plan.* Prepared for Mountain West and the State of Nevada.

Desvousges, W.H., and V.A. Skahen. 1986. *Techniques to Measure Damages to Natural Resources: Final Report.* Prepared for CERCLA 301 Task Force, U.S. Department of the Interior. Durham, NC: Research Triangle Institute.

Desvousges, W.H., and M.C. Naughton. 1985. *Water Quality Benefits of the BCT Regulations for the Pulp and Paper Industry.* Prepared for the Economic Analysis Division, U.S. Environmental Protection Agency.

Desvousges, W.H., and V.K. Smith. 1984. *The Travel Cost Approach for Valuing Improved Water Quality: Additional Considerations.* Prepared for the Economic Analysis Division, U.S. Environmental Protection Agency.

Desvousges, W.H., V.K. Smith, and M.P. McGivney. 1983. *A Comparison of Alternative Approaches for Estimating Recreation and Related Benefits of Water Quality Improvements.* Prepared for the Economic Analysis Division, U.S. Environmental Protection Agency.

Selected Presentations

Desvousges, W.H. 2010. "Estimation of Restoration and Compensable Value Damages." Panel Discussion. Fourth Annual Natural Resource Damages Claims Conference. Santa Fe, New Mexico. July 16.

Desvousges, W.H. 2009. "Groundwater Valuation and Restoration: One Economist's Perspective." Third Annual Advanced Conference on Natural Resource Damages Litigation. Santa Fe, New Mexico. July 9.

Desvousges, W.H. 2008. "Natural Resource Damage Assessments: Economic Valuation of Natural Resource Damages." National Advanced Conference on Natural Resource Damages Litigation. Santa Fe, New Mexico. July 18.

Desvousges, W.H. 2007. "Natural Resource Damage Assessments: Key Economic Issues in Defending a Damages Claim." National Advanced Conference on Natural Resource Damages Litigation. Santa Fe, New Mexico. July 16.

Desvousges, W.H. 2007. "HEA and Conjoint Analysis Not Ready for Prime Time." Presentation at the U.S. Department of the Interior 2007 NRDA Restoration Program National Workshop. Phoenix, Arizona. April 26.

Desvousges, W.H. 2006. Presentation at the Office of Policy, Economics and Innovation's National Center for Environmental Economics and the Office of Solid Waste and Emergency Response's Land Revitalization Office workshop on Risk Assessment and Benefit Estimation Methods. Washington, D.C. September 28.

Desvousges, W.H. 2006. "Response to the Department of the Interior's Questions to FACA Subcommittee #3." Presented to Department of the Interior FACA Subcommittee #3, Shepherdstown, West Virginia, June 5.

Desvousges, W.H. 2005. "Compensatory Restoration Principles and Practices." Presented at the Natural Resource Damages Seminar, Cook College, New Brunswick, NJ. May 24.

Desvousges, W.H., and M.F. Bingham. 2004. "Benefit-Cost Analysis and 316(b) Compliance." Presented at the UWAG/EPRI (316(b) Legal Advisory Session, Atlanta, GA. May 12.

Desvousges, W.H., and K.E. Mathews. 2004. "Evaluating Mass Tort-Class Action Claims for Property Stigma Damages from Environmental Contamination." American Bar Association Conference on Environmental Law, Keystone, Colorado. March 11.

Kinnell, J.C., M.F. Bingham, E.A. Keohane, and W.H. Desvousges. 2002. "Using Intercept and Count Data to Estimate the Population of Anglers in an Urban and Industrial River." Presented at the 2002 W-133 Conference, Monterey, CA. February.

Kinnell, J.C., D.J. MacNair, and W.H. Desvousges. 2001. "Using RP and SP Data For Valuing Recreational Access in a Compensatory Restoration Framework." Presented at the 2001 W-133 Conference, Miami, FL. February.

MacNair, D.J., and W.H. Desvousges. 2001. "Using RP and SP Data to Measure the Effect of Fish Consumption Advisories on Recreational Anglers." Presented at the 2001 W-133 Conference, Miami, FL. February.

Bingham, M.T., G. Smith, and W.H. Desvousges. 1999. "A Cognitive Approach to Modeling the WTP Decision Under Dichotomous Choice and Open-Ended Contingent-Valuation Survey Formats." Presented at the American Agricultural Economics Association Meeting, Nashville, Tennessee. August.

Kinnell, J.C., M.F. Bingham, and W.H. Desvousges. 1999. "Sequencing Effects in Valuing Multiple Environmental Programs." Presented at the American Agricultural Economics Association Meeting in Nashville, Tennessee. August.

Desvousges, W.H., and F.R. Johnson. 1998. "Measuring and Influencing Health-Related Attitudes, Perceptions, and Behavior." August.

Johnson, F.R., W.H. Desvousges, and M.J. Bingham. 1998. "Trade-off Preferences for Pharmaceuticals Development, Marketing, and Outcome Evaluation." Third international meeting of the International Society for Pharmacoeconomics and Outcomes Research, Philadelphia, PA. May.

MacNair, D.J., W.H. Desvousges, and J.C. Lutz. 1998. "An In-Kind Damage Assessment of Recreational Fishing Using Revealed and Stated Preference Data." The American Agricultural Economics Association Meeting, Salt Lake City, UT. August.

Desvousges, W.H. 1997. "Scaling and Selecting Compensatory-Restoration Projects: An Economic Perspective." Conference on Restoration of Lost Human Uses of the Environment, Washington, DC. May.

Desvousges, W.H. 1996. "NRDA From an Economist's Viewpoint." Blasland, Bouck and Lee, Inc. Sediment Management Seminar, Orlando, FL. February.

Fries, E.E., F.R. Johnson, K.E. Mathews, W.H. Desvousges, and R.W. Dunford. 1996. "The Consistency of Stated Preferences: An Analysis of Salmon-Preservation and Job-Loss Trade-offs." Camp Resources, Wilmington, N.C. August.

Johnson, F.R., M.C. Ruby, and W.H. Desvousges. 1996. "Valuing Stated Preferences for Health Benefits of Improved Air Quality: Results of a Pilot Study." Department of Economics at Stockholm School of Economics in Stockholm, Sweden. September.

Desvousges, W.H. 1995. "The Reliability of Contingent Valuation for NRDA." Panel Presentation at the Southern Economic Association Meetings in New Orleans, LA. November.

Johnson, F.R., W.H. Desvousges, and H.S. Banzhaf. 1995. "Assessing the Externalities of Electricity Generation in the Midwest." Southern Economic Association Meetings in New Orleans, Louisiana. November.

Desvousges, W.H., S.P. Hudson, and M.C. Ruby. 1994. "Evaluating CV Performance: Separating the Light from the Heat." DOE/EPA Workshop on Using Contingent Valuation to Measure Nonmarket Values, Herndon, VA. May.

Desvousges, W.H., and S.P. Hudson. 1994. "Contingent Valuation: Is it Accurate Enough for Damage Assessments?" American Bar Association Seminar on Natural Resource Damage Assessments, Chicago, IL. May.

Desvousges, W.H. 1993. "Using Contingent Valuation to Measure Nonuse Damages: A Lesson in Unreliability." Meeting of the Society for Environmental Toxicology and Chemistry, Houston, TX. November.

Robilliard, G.A., Fischel, W.H. Desvousges, R.W. Dunford, and K.E. Mathews. 1993. "Evaluation of Compensation Formulae to Measure Natural Resource Damages." International Oil Spill Conference, Tampa, FL. March.

Dunford, R.W., S.P. Hudson, and W.H. Desvousges. 1993. "Experimental Contingent Values for Reducing Environmental Damage from Oil Spills." International Oil Spill Conference, Tampa, FL. March.

Desvousges, W.H., R.W. Dunford, K.E. Mathews, and H.S. Banzhaf. 1993. "NRDA Case Study: The Arthur Kill Oil Spill." International Oil Spill Conference, Tampa, FL. March.

Desvousges, W.H., F.R. Johnson, R.W. Dunford, K.J. Boyle, and S.P. Hudson. 1993. "The Validity of Expressed Nonuse Values for Environmental Commodities." American Agricultural Economics Association meeting, Baltimore, MD. August.

Desvousges, W.H., F.R. Johnson, R.W. Dunford, K.J. Boyle, S.P. Hudson, and K.N. Wilson. 1992. "Measuring Natural Resource Damages with Contingent Valuation: Tests of Validity and Reliability." Cambridge Economics, Inc., symposium titled, "Contingent Valuation: A Critical Assessment." Washington, DC. April.

Dunford, R.W., and W.H. Desvousges. 1992. "Oil Spill Liability: Recent Legal and Economic Developments." American Economics Association meeting, New Orleans, LA. January.

Johnson, F.R., and W.H. Desvousges. 1991. "Nonuse Values in Natural Resource Damage Assessments." Southern Economic Association meeting, Nashville, TN. November.

Desvousges, W.H. 1991. "Valuing Ecological Risks." National Academy of Sciences Workshop on Ecological Risks, Warrenton, VA. February.

Dunford, R.W., S.P. Hudson, and W.H. Desvousges. 1991. "Linkages Between Oil Spill Removal Activities and Natural Resource Damages." Presented at the International Oil Spill Conference in San Diego, CA. March.

Desvousges, W.H. 1990. "Economics and the NRDA: One Economist's View." Workshop on Natural Resource Damages, American Bar Association, Washington, DC. May.

Desvousges, W.H. 1989. "Risk Perceptions and Nuclear Wastes." Engineering Foundation Conference on Risk Decision-Making, Santa Barbara, CA. October.

Desvousges, W.H., H. Kunreuther, and P. Slovic. 1989. "Perceived Risk and Nuclear Waste—A National and Nevada Perspective." American Association for the Advancement of Science Annual Meeting, San Francisco, CA. January.

Desvousges, W.H. 1987. "Hazardous Waste and Radon Risks: Good News and Bad News for Economists." Engineering Foundation Conference on Risk Management, Santa Barbara, CA. November.

Desvousges, W.H. 1987. "The Use of Focus Groups in Complex Environmental Surveys." American Association of Public Opinion Research Annual meeting, Hershey, PA.

Smith, V.K., and W.H. Desvousges. 1986. "Information and the Valuation of Risk Reductions," American Economics Association meeting, New Orleans, LA. December.

Desvousges, W.H. 1986. "Methods for Measuring Natural Resource Damages." Conference on Natural Resource Damages, Washington, DC. November.

Smith, V.K., and W.H. Desvousges. 1985. "Values for Risk Reductions: Some Considerations for Siting Decisions." American Economics Association meeting, New York, NY. December.

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Employment Chronology

2006 - Present	**Senior Economist** W.H. Desvousges & Associates, Inc. Raleigh, NC
2005	**Senior Economist** Triangle Economic Research Durham, NC
1997 to 1999	**Senior Economist** Triangle Economic Research Durham, NC
1995 to 1997	**Economist** Triangle Economic Research Durham, NC
1994 to 1995	**Research Assistant** Resource Economics & Policy University of Maine
1993	**Teaching Assistant** Resource Economics & Policy University of Maine
1988 to 1993	**High School Science Teacher** Massabesic High School Waterboro, ME

Education

M.S., 1995, Agricultural and Resource Economics, University of Maine, Orono, Maine. Thesis: "A Hedonic Property Value Study of Water Quality in Maine Lakes."

Course work related to teaching assignment, 1988–1992, University of Southern Maine

B.A., 1987, Biology, Colby College, Waterville, Maine

Areas of Specialization

Habitat Equivalency Analysis

Conducted multiple habitat equivalency analyses for various contamination sites and conditions. The sites included large mining regions in Idaho, Colorado, and Oklahoma, a large oil refinery area in New Jersey, and smelter site in Washington. In addition, conducted habitat equivalency analyses for several smaller sites with various degrees of injury and habitat types. Affected resources included marsh, wetland, upland, riverine, riparian, and various marine sediment types.

Natural Resource Damage Assessment

Conducted natural resource damage assessments for multiple mining sites including sites in Idaho, Colorado, and Oklahoma. Provided support for counsel in deposition preparation, settlement meetings and hearings.

Conducted natural resource damage assessments and critiques of Trustees' assessments for groundwater injury in several cases in New Jersey and Colorado.

Assisted in the preparation of expert reports for mining cases in Idaho, Colorado, and Oklahoma. In addition, contamination cases in Washington, New Jersey, and Oklahoma. Also, several groundwater cases in New Jersey and an oil spill case in Massachusetts.

Assisted in the preparation of critiques of Trustees' experts' reports on natural resource damages associated with multiple cases.

Co-authored the Assessment Plan for conducting an NRDA at the Lower Fox River/Green Bay. Critiqued the Trustees' assessment plan for the Lower Fox River/Green Bay.

Contributed comments submitted to the National Oceanic and Atmospheric Administration regarding proposed natural resource damage assessment regulations.

Conducted pre-assessments of potential recreation losses associated with PCB contamination at several sites.

Hedonic Property Value Models

Analyzed the effect on property values of increased golf-club membership requirements and community fees in golf resort communities using a hedonic property value model.

Designed and administrated a hedonic property-value study of water quality in Maine Lakes.

Survey Design and Administration

Used telephone and mail survey results as inputs in evaluation of service losses in natural resource damage assessments.

Designed, pre-tested, and planned the administration of a telephone and mail survey of Wisconsin residents to gather data to measure the potential losses associated with PCB releases as well as the benefits of compensatory restoration projects.

Supervised the administration of a beach-use survey to characterize beach use along a 30-mile stretch of coastline.

Designed a telephone survey to learn how lake-water clarity influenced the purchasing decisions of lake-front property owners in Maine. Pre-tested and administered the survey. Evaluated and analyzed the data.

Statistical Analysis

Used multiple regression analysis to analyze the effect of increased golf club membership and fee requirements on property values in golf communities.

Examined the effect of water quality on property values using a hedonic property value model. Estimated model using both OLS and Maximum Likelihood techniques and used the Box-Cox transformation to test for functional form.

Honors and Awards

- Dow and Griffee Award, 1995, University of Maine, Awarded to the top graduate research in the College of Agriculture.
- Nauman Scholarship, 1994, University of Maine, Awarded to the top returning graduate student in the College of Agriculture.

Publications

Selected Reports and Publications

Michael, H.J., K.J. Boyle, and R. Bouchard. 2000. "Does the Measurement of Environmental Quality Affect Implicit Prices Estimated From Hedonic Models?" *Land Economics* 76(2): 283-298.

Boyle, YL J., S. R. Lawson, H. J. Michael, and R Bouchard. 1998. "Lakefront Property Owners' Economic Demand for Water Clarity in Maine Lakes." Report No. 410, Maine Agricultural and Forest Experiment Station, University of Maine, Orono.

Dunford, R.W., W.H. Desvousges, F.R. Johnson, E.E. Fries, H.J. Michael, and K.E. Mathews. 1997. Comments on NOAA's Draft Compensatory Restoration Guidance Document. Comments submitted to National Oceanic and Atmospheric Administration, Silver Spring, MD.

Michael, H.J., K.J. Boyle, and R. Bouchard. 1996. Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes. Maine Agricultural and Forest Experiment Station. University of Maine Miscellaneous Report 398.

Michael, H.J., Mathews, K.E., and King, J.R. 1996. *NRDA Overview: A Guide Through the Acronym Maze.* Triangle Economic Research General Working Paper.

Desvousges, W.H., R.W. Dunford, K.E. Mathews, R.R. Russell, and H.L. James. 1995. *Comments on NOAA's Proposed NRDA Rule Under the Oil Pollution Act.* Durham, NC: Triangle Economic Research.

James (Michael), H.L., K.J. Boyle, and R. Bouchard. 1995. *Protecting Lake Water Quality Means Protecting Your Property Values.* Maine Agriculture and Forest Experiment Station Publication No. 1954.

James (Michael), H.L. 1995. "A Hedonic Property Value Study of Water Quality in Maine Lakes." Master's Thesis, University of Maine, Orono, Maine.

Presentations

James (Michael), H.L., K.J. Boyle, and R. Bouchard. 1995. "A Hedonic Property Value Study of Water Quality in Maine Lakes." Paper presented at the annual meeting of the Northeastern Agricultural and Resource Economics Association, Burlington, Vermont. June.

James (Michael), H.L., K.J. Boyle, and R. Bouchard. 1995. "Measuring the Benefits to Property Owners of Lake Water Quality Protection." Presented at the annual meeting of the Universities Council on Water Resources, Portland, Maine. August.

James (Michael), H.L., K.J. Boyle, and R. Bouchard. 1995. "Property Values and Lake Water Quality." Presented at *A National Conference: Enhancing the States' Lake Management Programs*. Sponsored by U.S. Environmental Protection Agency, Chicago, Illinois. April.

Volunteer Experiences

Classroom volunteer at Elk Grove Elementary 2008-present

Classroom volunteer at Stoneleigh Elementary 2002-2008

Stoneleigh PTA Biweekly Newsletter Editor 2004-present.

Director of Wiltondale Improvement Board 2002-2003.

President of Wiltondale Mothers Club 2001-2002.

LAWRENCE W. BARNTHOUSE, Ph. D.

President and Principal Scientist
LWB Environmental Services, Inc.

Adjunct Associate Professor of Zoology
Miami University

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Education

Ph.D., Biology, University of Chicago, Chicago, Illinois, 1976
A.B., Biology, Kenyon College, Gambier, Ohio, 1968

Work History

1976-1995: Research Staff Member, Environmental Sciences Division, Oak Ridge National Laboratory
1995-1998: Principal Scientist, McLaren-Hart, Inc.
1998: - President and Principal Scientist, LWB Environmental Services, Inc.

Experience Summary

Dr. Barnthouse is the President and Principal Scientist of LWB Environmental Services, Inc. His consulting activities include 316(b) demonstrations for nuclear and non-nuclear power plants, Superfund ecological risk assessments, Natural Resource Damage Assessments, risk-based environmental restoration planning, and a variety of other projects involving close interactions with regulatory and resource management agencies. He formerly spent 19 years as a research staff member and Group Leader at Oak Ridge National Laboratory, where he was involved in dozens of environmental research and assessment projects involving development of new methods for predicting and measuring environmental risks of energy technologies. After leaving Oak Ridge National Laboratory in 1995, he spent two and a half years with McLaren-Hart, Inc. prior to establishing LWB Environmental Services.

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Dr. Barnthouse has authored or co-authored more than 90 publications relating to ecological risk assessment. He is a Fellow of the American Association for the Advancement of Science, Hazard/Risk Assessment Editor of the journal *Environmental Toxicology and Chemistry*, and

Founding Editorial Board Member of the new journal *Integrated Environmental Assessment and Management.* He frequently serves on committees of the National Academy of Sciences and on peer review panels for major federal agency projects.

Current Activities

- **Technical expert on effects of cooling water withdrawals on Hudson River fish populations**. Performing analysis of impacts of cooling water withdrawals on Hudson River fish populations and communities in support of ongoing permitting proceedings for the Indian Point Generating Station. Testified as an expert witness at permit hearings for the Danskammer Generating Station, November-December 2005.

- **Analysis of use and non-use benefits of EPA's revised 316(b) Existing Facilities Rule**. Participating in Electric Power Research Institute (EPRI)-funded evaluation of economic benefits of reducing entrainment and impingement of fish by cooling water intake structures.

- **Review of peer-reviewed scientific literature on effects of cooling water withdrawals on fish populations.** Being performed for EPRI at the request of EPRI membership.

- **Development of fish life history parameters for use in implementing equivalent adult and production forgone models**. Being performed for EPRI to support evaluations of economic benefits of reducing entrainment and impingement of fish by cooling water intake structures.

- **Member, National Academy of Sciences Committee on Uranium Mining in Virginia.** This committee is evaluating the potential environmental impacts of mining commercially recoverable uranium ore deposits located in the Commonwealth of Virginia. The committee's report is due in September, 2011.

- **Technical expert on NRDA, Portland Harbor Superfund site.** Engaged to evaluate the contribution of the client's site to alleged natural resource injuries in the Willamette River, Oregon.

- **Senior ecologist, restoration of the southeastern Tennessee Copper Basin.** The project involves development and implementation of an adaptive management-based watershed restoration plan for the North Potato Creek Watershed, Tennessee, which was seriously degraded by historic mining and smelting activities. This project was recently cited by the National Academy of Sciences as an example that should be followed at other large, complex sites.

Significant Previous Projects

<u>LWB Environmental Services</u>

- **Technical expert on impacts of power plants on Long Island Sound fish populations**. Engaged as expert witness by owners of two New England nuclear power plants to testify concerning impacts of their plants on winter flounder and American shad populations.

- **Technical expert on impacts of power plants on Cape Cod Bay fish populations**. Engaged by owners of a Massachusetts nuclear power plant to perform technical analyses and testify concerning impacts of their plant on winter flounder and other susceptible fish populations.

- **Technical expert on ecological risk assessment and NRDA for General Electric Co. operations in New York and Massachusetts**. The project involved support of CERCLA risk assessment and Natural Resource Damage Assessment activities relating to historic discharges of PCBs to the Hudson and Housatonic Rivers.

- **Technical expert on NRDA, Tar Creek Superfund site.** Engaged to evaluate natural resource injuries related to mining activities in northeastern Oklahoma.

- **Technical expert on fisheries impacts at the proposed Calypso LNG terminal.** Engaged by company preparing Environmental Impact Statement to provide oversight on the fisheries impact component of the EIS.

- **Technical expert on ecological risk assessment and NRDA for pulp mill in eastern North Carolina**. Provided confidential comments to facility owner concerning validity of ecological risk assessments performed by consultants to the owner and by the U.S. Environmental Protection Agency; advised the owner concerning the types and magnitudes of potential natural resource damage liabilities due to contamination of sediment by dioxins and mercury.

- **Technical advisor, remediation of contaminated sediment at Langley AFB, Virginia**. Provided advice to remediation team concerning (1) establishment of cleanup goals in lead-contaminated sediment, and (2) development of a post-remediation monitoring program involving measurement of lead concentrations in fish and mussels. Assisted team in obtaining EPA approval of cleanup goal.

- **Development of biologically-based methods for compliance with EPA's 316(b) Phase II Rule.** Funded by the Electric Power Research Institute (1) to develop and demonstrate methods for quantifying biological benefits of reducing entrainment and impingement losses at existing facilities, and (2) to review biological issues affecting the feasibility of using habitat restoration as a compliance approach.

- **Technical expert on entrainment impact assessment for Gulf of Mexico LNG terminals**. Provided advice to two major corporations concerning the validity of data and methods used

to predict impacts of proposed offshore LNG terminals on Gulf of Mexico fishery resources, and on the design of baseline monitoring programs for these facilities.

- **Technical Team Leader, 316(b) assessment for the Salem Generating Station.** Responsible for developing methods for quantitative assessment of impacts of entrainment and impingement on estuarine fish species; directed the analysis of data relating to entrainment and impingement impacts to support the facility owner's 1999 and 2006 permit renewal applications.

- **Expert witness, NPDES Permit action in western Pennsylvania**. Engaged by corporate client to evaluate claims that discharges from the client's steel mills have caused ecological degradation of the Allegheny and Kiskiminetas Rivers. Led technical team performing quantitative ecological risk assessment. Testified at trial, February, 2001. Prepared supplemental report following successful appeal of initial decision by client; case was settled out-of-court in November, 2004.

- **Expert witness, NPDES Permit action in Ohio**. Engaged by corporate client to evaluate allegations by federal and state agencies that discharges from the client's metal plating plant caused fish kills in the Ohio River. Charges against the client were withdrawn prior to trial.

- **Technical expert on 316(a) and 316(b) issues at the Diablo Canyon Power Plant**. Reviewed historical predictive and retrospective thermal effects assessment studies; provided expert review of draft 316(b) Demonstration. Represented client at regional water board hearing, March 2001.

- **Peer Review Coordinator, Columbia Basin PATH Project**. Organized and chaired an external review committee for a multi-stakeholder project that developed and tested models of the impacts of hydropower operations, harvesting, hatcheries, habitat quality, and oceanic conditions on endangered Snake River Basin salmonid populations. Organized an expert briefing on salmon issues for senior executives of the Bonneville Power Administration.

McLaren-Hart, Inc.

- **Senior Technical Advisor for an assessment of ecological risks of chlorinated solvents, heavy metals, mercury, and PCBs at a chemical manufacturing facility in southwest Louisiana**. Responsible for selection of risk assessment methodologies used by team of risk assessors evaluating on-site and off-site risks to fish, wildlife, and sediment-dwelling biota. Developed a strategy for negotiating major elements of the project work plan with EPA Region VI. Responsible for defining strategy for integrating results of ecological risk assessment into corrective measures planning and potential NRDA defense activities.

Environmental Sciences Division, Oak Ridge National Laboratory

- **Co-principal investigator, 5-year EPA/DOE research program on ecological risk assessment methods.** This was the first federally funded research project explicitly identified as an "ecological risk assessment" project. Methods for uncertainty analysis of ecological models developed for this project were the forerunners of Monte Carlo food-chain exposure models that are widely used today. Much of the ecological risk assessment terminology now used by EPA and other agencies (e.g., "assessment endpoints" and "measurement endpoints") originated with this project. The final publication from this research was named the best scientific paper published at Oak Ridge National Laboratory in 1990.

- **Project manager for a basic research program on biological mechanisms underlying density-dependent population growth in fish**. The project pioneered the development and application of "individual-based population models" that are now widely used in biological research and in management of endangered species.

- **Technical advisor and expert witness for EPA Region II in NPDES permit hearings related to impacts of fossil and nuclear power plants on fish populations in the Hudson River.** Assisted EPA lawyers in preparation of case, performed independent data evaluations and model-based analyses, testified in administrative law hearings. Represented EPA on a technical team that assisted EPA, the State of New York, and the Consolidated Edison Co. in the negotiation of a widely publicized settlement agreement. Became senior editor for an American Fisheries Society monograph presenting scientific results from 10 years of monitoring and research on the Hudson. Assessment methods developed for the "Hudson River Power Case" are now used by utility companies and regulatory agencies throughout the United States.

- **Group leader for ecological risk assessment team performing CERCLA baseline ecological risk assessments for U.S. Department of Energy facilities in Oak Ridge, Tennessee, Portsmouth, Ohio, and Paducah, Kentucky (EPA Regions IV and V).** Major assessments included a five-year investigation and baseline risk assessment for the Clinch River, Tennessee; reservation-wide assessments for the Portsmouth Gaseous Diffusion Plant and the Oak Ridge National Laboratory; and operational-unit-level assessments for numerous burial grounds and waste ponds.

- **Expert advisor on ecological risk assessment for the DOE Office of Air, Water, and Radiation**. Surveyed ecological risk assessment capabilities at all major DOE facilities, initiated development of standard ecological screening benchmarks for all DOE sites, reviewed EPA draft Ecological Risk Assessment Guidance for Superfund for DOE; developed training course on Natural Resource Damage Assessment for DOE site managers, led NRDA case study project at the Savannah River Site, prepared white paper on the application of the EPA Data Quality Objectives Process at DOE sites.

Professional Society Activities

Member, Ecological Society of America, Society for Environmental Toxicology and Chemistry, Society for Risk Analysis

Hazard/Risk Assessment Editor, *Environmental Toxicology and Chemistry*, 1992 - 2010

Founding Editorial Board Member and Associate Editor, *Integrated Environmental Assessment and Management*, 2004-present

Chair, SETAC Global Internet Committee, 2007-present

Chair, SETAC/ESA Workshop on Sustainable Environmental Management, Pellston, Michigan, August 1993.

Chair, SETAC Workshop on Population-Level Ecological Risk Assessment, Roskilde, Denmark, August, 2003.

Short Course Instructor, Annual SETAC meeting

- Ecological Risk Assessment (1992, 1994)
- Product Life Cycle Assessment (1996, 1997)
- Applications of Population Biology in Ecological Risk Assessment (2008, 2010)

Chair, Applied Ecology Section, Ecological Society of America, 1995-1997

Ecological Risk Assessment Specialty Group Chair, Society for Risk Analysis, 1991-1993

Member, Advisory Panel, Society for Risk Analysis, 1996-1998

Other Professional Activities

Member, Kalamazoo River Ecological Risk Studies Peer Review Panel, 2008-

Member, Atlantic States Marine Fisheries Commission Power Plant Panel, 2001-2006

Member, External Laboratory Review Panel, EPA Midwest Ecology Division, Duluth, MN, February, 2002.

Peer reviewer, EPA Drake Chemical Site Incinerator Risk Assessment, 1998.

Member, Ecological Committee on FIFRA Risk Assessment Methodologies (ECOFRAM), 1997-2000

Reviewer and issue paper author, EPA Risk Assessment Forum Ecological Risk Assessment Guidelines Program, 1991-present

- Member of Peer Review Panel for EPA Framework for Ecological Risk Assessment
- Author of issue paper on Conceptual Model Development
- Member of Peer Review Panel for EPA Ecological Risk Assessment Guidelines
- Member of Peer Review Panel for EPA Generic Endpoints for Ecological Risk Assessment

Chair, National Research Council Workshop on Ecological Risk Assessment, Warrenton, Virginia, February 1991.

Member, National Research Council Committee on Environmental Remediation at Naval Facilities, 1997-1998.

Member, National Research Council Committee to Review the DOI's Biomonitoring of Environmental Status and Trends Program, 1994

Member, National Research Council Committee on Risk Assessment Methodology (Chair, Ecological Risk Assessment Topic Group), 1989-1993

Member, National Research Council Board on Environmental Studies and Toxicology, 1989-1992

Member, National Research Council Committee on Pesticides and Ecological Risk Assessment, 1986-1987

Member, National Academy of Sciences Committee on Superfund Site Assessment and Remediation of the Coeur d'Alene River Basin. 2003-2005.

International Activities:

21st SETAC Europe Congress, Milan, Italy, 2011

Workshop on Population-Level Ecological Risk Assessment, 12th SETAC Europe Congress, Vienna, Austria, 2002

Ninth SETAC Europe Congress, Leipzig, Germany, 1999

XIIIth International Plant Protection Congress, The Hague, The Netherlands, 1995

Fifth SETAC Europe Congress, Copenhagen, Denmark, 1995

IPPC Special Workshop on Article 2 of the U.N. Framework Convention on Climate Change, Fortaleza, Brazil, 1994

SGOMSEC Workshop on Methods to Assess the Effects of Chemicals on Ecosystems, Montpellier, France, 1994

IAEA Validation of Assessment Models Project, Vienna, Austria, 1992

International Biospheric Model Validation Project, Vienna, Austria, 1992

Seventh International Congress of Pesticide Chemistry, Hamburg, Germany, 1990

Workshop on Ecological Risk Assessment for Chemicals, Schmallenburg, West Germany, 1987

NATO Conference on Safety Assurance for Environmental Introductions of Genetically-Engineered Organisms, Rome, 1987

Awards and Honors

- Martin Marietta Energy Systems Technical Achievement Award, 1991
- Martin Marietta Energy Systems Author of the Year, 1991
- Martin Marietta Energy Systems Technical Achievement Award, 1994
- Fellow, American Association for the Advancement of Science, 1994

Publications

Books and Monographs

Barnthouse, L. W., W. R. Munns, and M. T. Sorensen (eds.). 2007. *Population-Level Ecological Risk Assessment*. Taylor & Francis, Boca Raton, Florida, U.S.A.

Barnthouse, L. W., G. R. Biddinger, W. E. Cooper, J. A. Fava, J. H. Gillett, M. M. Holland, and T. F. Yosie (eds.) 1998. *Sustainable Environmental Management*. SETAC Press, Pensacola, Florida, U.S.A.

Barnthouse, L. W., J. Fava, K. Humphres, R. Hunt, L. Laibson, S. Noeson, J. Owens, J. Todd, B. Vigon, K. Weitz, and J. Young. 1997. *Life-Cycle Impact Assessment: The State-of-the-Art*. SETAC Press, Pensacola, Florida, U.S.A.

Barnthouse, L. W., R. J. Klauda, D. S. Vaughan, and R. L. Kendall (eds.) 1988. *Science, Law, and Hudson River Power Plants: a Case Study in Environmental Impact Assessment*. American Fisheries Society Monograph 4. American Fisheries Society, Bethesda, Maryland, U.S.A.

Journal articles and book chapters

Barnthouse, L. W., D. Glaser, and L. DeSantis. 2009. Polychlorinated biphenyls and Hudson River whiter perch: Implications for population-level risk assessment and risk management. *Integrated Environmental Assessment and Management* 5:435-444.

Barnthouse, L. W. 2008. The strengths of the ecological risk assessment process: Linking science to decision making. *Integrated Environmental Assessment and Management* **4**:299-305.

Gustavson, K. E., **L. W. Barnthouse**, C. L. Brierly, E. H. Clark, II, and C. H. Ward. 2007. Superfund and mining megasites. *Environmental Science and Technology* **41:**2667-2672.

Barnthouse, L. W. 2007. Population modeling. Ch. 27 in G. W. Suter II (Ed.) *Ecological Risk Assessment*, 2nd Edition. Taylor & Francis, Boca Raton, Florida, USA.

Barnthouse, L. W. 2004. Quantifying population recovery rates for ecological risk assessment. *Environmental Toxicology and Chemistry* **23**:500-508.

Suter, G. W. II, S. B. Norton, and **L. W. Barnthouse**. 2003. The evolution of frameworks for ecological risk assessment from the Red Book ancestor. *Human and Ecological Risk Assessment* **9**:1349-1360.

Barnthouse, L. W., D. Glaser, and J. Young. 2003. Effects of historic PCB exposures on the reproductive success of the Hudson River striped bass population. *Environmental Science and Technology* **37**:223-228

Barnthouse, L, W., D. G. Heimbuch, V. C. Anthony, R. W. Hilborn, and R. A. Myers. 2002. Indicators of AEI applied to the Delaware Estuary. *The Scientific World* **2** (S1): 169-190.

Barnthouse, L. W., and R. G. Stahl, Jr. 2002. Quantifying natural resource injuries and ecological service reductions: challenges and opportunities. *Environmental Management* **30**:1-12.

Suter, G. W. II, and **L. W. Barnthouse**. 2001. Modeling toxic effects on populations: Experience from aquatic studies. In: Albers, P. H., G. Heinz, and H. M. Ohlendorf (eds.), *Environmental Contaminants and Terrestrial Vertebrates: Effects on Populations, Communities, and Ecosystems*, pp. 177-188. SETAC Special Publication Series, Society of Environmental Toxicology and Chemistry, Pensacola, FL, USA.

Barnthouse, L. W., D. R. Marmorek, and C. N. Peters 2000. Assessment of multiple stresses at regional scales. IN: Ferenc, S. (ed.) *Multiple Stressors in Ecological Risk and Impact Assessment: Approaches to Risk Estimation*. SETAC Press, Pensacola, Florida

Barnthouse, L. W. 2000. Impacts of power-plant cooling systems on estuarine fish populations: The Hudson River after 25 years. *Environmental Science & Policy* **3**:S341-S348.

K. A. Rose, L. W. Brewer, **L. W. Barnthouse**, G. A. Fox, N, W. Gard, M. Mendonca, K. R. Munkittrick, and L. J. Vitt. 1999. Ecological responses of oviparous vertebrates to contaminant effects on reproduction and development. Ch. 4. IN: Di Giulio, R. T., and D. E. Tillitt (eds.).

Reproductive and Developmental Effects of Contaminants in Oviparious Vertebrates. SETAC Press, Pensacola, Florida.

Suter, G. W. II., **L. W. Barnthouse**, R. A. Efroymson, and H. Jager. 1999. Ecological risk assessment in a large river-reservoir: 2. Fish community. *Environmental Toxicology and Chemistry* **18**:589-598.

Jones, D. S., **L. W. Barnthouse**, G. W. Suter II, R. A. Efroymson, J. M. Field, and J. J. Beauchamp. Ecological risk assessment in a large river-reservoir: 3. Benthic invertebrates. *Environmental Toxicology and Chemistry* **18**:599-609.

Barnthouse, L. W. 1998. Modeling ecological risks of pesticides: a review of available approaches. Pp. 769-798 in Chapter 24 in H. Schüürmann and B. Markert (eds.) *Ecotoxicology*. Spektrum Academic Publishers, Heidelberg.

Jaworska, J. S., K. A. Rose, and **L. W. Barnthouse**. 1997. General response patterns of fish populations to stress: an evaluation using an individual-based simulation model. *Journal of Aquatic Ecosystem Stress and Recovery* 6:15-31.

Barnthouse, L. W. 1995. A framework for ecological risk assessment. pp. 367-360 in R. A. Linthurst, P. Bourdeau, and R. G. Tardiff (eds.) *Methods to Assess the Effects of Chemicals in Ecosystems*. John Wiley & Sons, Chichester, England.

Barnthouse, L.W. 1994. Ecological Risk Assessment: the CRAM perspective. *Risk Analysis* 14:251-256.

Barnthouse, L.W. 1993. Population-level effects, pp. 247-274 in GW Suter I (ed). *Ecological Risk Assessment*. Lewis Publishers, Chelsea, Michigan.

Suter, G.W. II, and **L.W. Barnthouse**. 1993. Assessment Concepts, pp 21-48 in G.W. Suter (ed.) *Ecological Risk Assessment*. Lewis Publishers, Chelsea, Michigan.

Barnthouse, L.W. 1992. Models in ecological risk assessment: a 1990s perspective. *Environmental Toxicology and Chemistry*, 11:1751-1760.

Barnthouse, L.W. 1992. Case studies in ecological risk assessment. *Environmental Science and Technology* 26:230-231.

Jones, T.D., B.A. Owen, J.R. Trabalka, **L.W. Barnthouse**, C.E. Easterly, and P.J. Walsh. 1991. Chemical pollutants: a caricaturized logos for future planning. *Environmental Auditor* 2:71-88.

Barnthouse, L.W., G.W. Suter II, S.M. Bartell, and C.T. Hunsaker. 1991. Prospective advances in ecological risk assessment for pesticides. pp. 445-454 in H. Frehse (ed.), *Pesticide Chemistry: Advances in International Research, Development, and Legislation*. VCH, Weinheim, Germany.

DeAngelis, D.L., **L.W. Barnthouse**, W. Van Winkle, and R.G. Otto. 1990. A critical appraisal of population approaches in assessing fish community health. *Journal of Great Lakes Research* 16(4):576-590.

Hunsaker, C.T., R.L. Graham, G.W. Suter II, R.V. O'Neill, **L.W. Barnthouse**, and R.H. Gardner. 1990. Assessing ecological risk on a regional scale. *Environmental Management* 14:324-332.

Barnthouse, L.W., G.W. Suter II, and A.E. Rosen. 1990. Risks of toxic contaminants to exploited fish populations: influence of life history, data uncertainty, and exploitation intensity. *Environmental Toxicology and Chemistry* 9:297-312.

Barnthouse, L.W. 1990. Ecotechnology (book review). *Ecology* 71:411-412.

Barnthouse, L.W. 1989. Ecological simulation primer (book review). *Transactions of the American Fisheries Society* 118:103.

Barnthouse, L.W. G.W. Suter II, and A.E. Rosen, 1989. Inferring population-level significance from individual-level effects: an extrapolation from fisheries science to ecotoxicology, pp. 289-300 IN G.W. Suter II and M.A. Lewis (eds) *Aquatic toxicology and environmental fate: 11th volume*. ASTM STP 1007, American Society for Testing and Materials, Philadelphia, Pennsylvania.

Barnthouse, L.W. G.S. Sayler, and G.W. Suter II, 1988. A biological approach to assessing ecological risks of bioengineered organisms, pp. 89-98 IN J. Fiksel and V.T. Covello (eds), *Risk Analysis Approaches for Environmental Releases of Genetically Engineered Organisms*. NATA Advanced Science Institutes Series, Volume F. Springer-Verlag, Berlin.

Barnthouse, L.W. G.W. Suter II, and S.M. Bartell. 1988. Quantifying risks of toxic chemicals to aquatic populations and ecosystems. *Chemosphere* 17:1487-1492.

Barnthouse, L.W., R.J. Klauda, and D.S. Vaughan. 1988. What we didn't learn about the Hudson River, why, and what it means for environmental assessment. *American Fisheries Society Monograph* 4:329-336.

Klauda, R.J., **L.W. Barnthouse**, and D.S. Vaughan. 1988. What we learned about the Hudson River: journey toward an elusive destination. *American Fisheries Society Monograph* 4:316-328.

Barnthouse, L.W., J. Boreman, T.S. Englert, W.L. Kirk, and E.G. Horn. 1988. Hudson River settlement agreement: technical rationale and cost considerations. *American Fisheries Society Monograph* 4:267-273.

Barnthouse, L.W., and W. Van Winkle. 1988. Analysis of impingement impacts on Hudson River fish populations. *American Fisheries Society Monograph* 4:182-190.

Barnthouse, L.W., R.J. Klauda, and D.S. Vaughan. 1988. Introduction to the monograph. *American Fisheries Society Monograph* 4:1-8.

Jones, T.D., P.J. Walsh, A.P. Watson, B.A. Owen, **L.W. Barnthouse**, and D.A. Sanders. 1988. Chemical scoring by a rapid screening hazard (RASH) method. *Risk Analysis* 8:99-118.

Barnthouse, L.W. 1987. The Hudson River Ecosystem (book review). *Environmental Management* 11:421-422.

Suter, G.W. II, **L.W. Barnthouse**, and R.V. O'Neill. 1987. Treatment of risk in environmental impact assessment. *Environmental Management* 11:295-303.

Barnthouse, L.W., G.W. Suter II, A.E. Rosen, J.J. Beauchamp. 1987. Estimating responses of fish populations to toxic contaminants. *Environmental Toxicology and Chemistry* 6:811-824.

Hildebrand, S.G., **L.W. Barnthouse**, and G.W. Suter II. 1987. The role of basic ecological knowledge in environmental assessment. pp. 51-70 IN: Draggen, S., J.J. Cohrsen, and R.E. Morrison (eds), *Preserving Ecological Systems*, Pareger, New York.

Smith, E.D., **L.W. Barnthouse**, G.W. Suter II, J.E. Breck, T.D. Jones, and D. Sanders. 1986. Improving the risk relevance of systems for assessing the relative hazard of contaminated sites. IN: Proceedings of the Third National Conference and Exhibition on Hazardous Wastes and Hazardous Materials, Atlanta Georgia, March 4-6, 1986.

Barnthouse, L.W., and A.V. Palumbo. 1986. Assessing the transport of fate and bioengineered microorganisms in the environment. pp 109-128 IN: Covello, V.T., and J.R. Fiksell. *Biotechnology Risk Assessment: Issues and Methods for Environmental Introductions*, Pergamon, New York.

Barnthouse, L.W., R.V. O'Neill, S.M. Bartell, and G.W. Suter II. 1986. Population and ecosystem theory in ecological risk assessment. pp. 82-96 IN: T.M. Poston and R. Purdy (eds), *Aquatic Toxicology and Environmental Fate: Ninth Volume*, ASTM STP 921, American Society for Testing and Materials, Philadelphia, Pennsylvania.

Barnthouse, L.W. 1986. Theory and practice of environmental impact assessment (book review). *Bioscience* 36:389-390.

Suter, G.W. II, **L.W. Barnthouse**, J.E. Breck, R.H. Gardner, and R.V. O'Neill. 1985. Extrapolating from the laboratory to the field: how uncertain are you? pp. 400-413 IN: *Aquatic Toxicology and Hazard Assessment, Seventh Symposium*. ASTM STP 854, American Society for Testing and Materials, Philadelphia, Pennsylvania.

Barnthouse, L.W. and G.W. Suter II. 1984. Risk assessment: ecology. *Mechanical Engineering* 106:36-39.

Barnthouse, L.W., J.Boreman, S.W. Christensen, C.P. Goodyear, W. Van Winkle, and D.S. Vaughan. 1984. Population biology in the courtroom: the Hudson River controversy. *Bioscience* 34:14-19.

Barnthouse, L.W., G.W. Suter II, and R.V. O'Neill. 1983. Quantifying uncertainties in ecological risk analysis. pp. 487-489 IN Proceedings, International Conference on Renewable Resources Inventories for Monitoring Changes and Trends, Corvallis, Oregon, August 15-19, 1983. School of Forestry, Oregon State University, Corvallis, Oregon.

Barnthouse, L.W., W. Van Winkle, and D.S. Vaughan. 1983. The magnitude and biological significance or impingement of white perch at Hudson River power plants. *Environmental Management* 7:355-364.

O'Neill, R.V., R.H. Gardner, **L.W. Barnthouse**, G.W. Suter, S.G. Hildebrand, and C.W. Gehrs. 1982. Ecosystem risk analysis: a new methodology. *Environmental Toxicology and Chemistry* 1:167-177.

Christensen, S. W., W. Van Winkle, **L. W. Barnthouse**, and D. S. Vaughan. 1981. Science and the law: Conflict and confluence on the Hudson River. *Environmental Impact Assessment Review* 2:63-88.

Van Winkle, D. S. Vaughan, **L.W. Barnthouse**, and B. L. Kirk. 1981. Analysis of the minimum detectable reduction in year-class strength of the Hudson River white perch population. *Canadian Journal of Fisheries and Aquatic Sciences* 38:627-632.

Barnthouse, L.W. 1981. Mathematical models useful in chemical hazard assessment. pp. 155-168. IN: A.S. Hammons (ed) *Methods for Ecological Toxicology: A Critical Review of Laboratory Multispecies Tests*. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan.

Barnthouse, L.W., and W. Van Winkle. 1981. The impact of impingement on the Hudson River white perch population. pp. 199-205 IN: L.D. Jensen (ed), Issues Associated with Impact Assessment: Proceedings of the Fifth National Workshop on Entrainment and Impingement, San Francisco, California, May 5-7, 1980. Ecological Analysts, Inc., Sparks, Maryland.

Roop, R.D., F.S. Sanders, and **L.W. Barnthouse**. 1978. Coal conversion and aquatic environments: overview of impacts and strategies for monitoring. pp. 118-123. IN: D.G. Nichols, E.J. Rolinski, R.A. Servias, L. Theodore, and A.J. Buonicore (eds), Energy and the Environment: Proceedings of the Fifth National Conference. American Institute of Chemical Engineers, Dayton, Ohio.

Allan, J.D., **L.W. Barnthouse**, R.A. Prestbye, and D.R. Strong. 1973. On foliage arthropod communities of Puerto-Rican second growth vegetation. *Ecology* 54:628-632.

Technical Reports

Barnthouse, L. W. 2005. Parameter development for equivalent adult and production foregone models. EPRI Report 1008832. Electric Power Research Institute, Palo Alto, California.

Barnthouse, L. W. 2004. Extrapolating impingement and entrainment losses to equivalent adults and production foregone. EPRI Report 1008471. Electric Power Research Institute, Palo Alto, California.

Barnthouse, L. W., and G. W. Suter II. 1996. Guide for developing data quality objectives for ecological risk assessment at DOE Oak Ridge Operations Facilities. ES/ER/TM-185/R1, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Barnthouse, L. W.. J. J. Bascietto, S. A. Deppen, R. W. Dunford, D. E. Gray, and F. E. Sharples. 1995. Natural resource damage assessment implementation project: Savannah River Site. DOE/EH-0510, U.S. Department of Energy, Washington, D.C.

Barnthouse, L. W. 1995. Effects of ionizing radiation on terrestrial plants and animals: a workshop report. ORNL/TM-13141, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Floit, S.B., and **L.W. Barnthouse**. 1991. Demographic analyses of a San Joaquin kit fox population. ORNL/TM-11679, Oak Ridge National Laboratory, Oak Ridge Tennessee.

Hunsaker, C.T., R.L. Graham, G.W. Suter II, R.V. O'Neill, B.L. Jackson, and **L.W. Barnthouse**. 1989. Regional ecological risk assessment: theory and demonstration. ORNL/TM-11128, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., J.E. Breck, T.D. Jones, G.W. Suter II, C. Easterly, L.R. Glass, B.A. Owen, and A.P. Watson. 1988. Relative toxicity estimates and bioaccumulation factors for the Defense Priority Model. ORNL-6416. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Smith, E.D., and **L.W. Barnthouse**. 1987. User's manual for the Defense Priority Model. ORNL-6411. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., J.E. Breck, T.D. Jones, S.R. Kramer, E.D. Smith, and G.W. Suter II. 1986. Development and demonstration of a hazard assessment rating methodology for Phase II of the Installation Restoration Program. ORNL/TM-9857. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., and G.W. Suter II (eds). 1986. User's manual for ecological risk assessment. ORNL-6251. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Suter, G.W. II, **L.W. Barnthouse**, S.R. Kraemer, M.E. Grismer, D.S. Durnford, D.B. McWhorter, F.R. O'Donnell, C.F. Baes III, and A.E. Rosen. 1985. Environmental risk analysis for oil from shale. ORNL/TM-9808. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., G.W. Suter II, C.F. Baes III, S.M. Bartell, R.H. Gardner, R.E. Millemann, R.V. O'Neill, C.D. Powers, A.E. Rosen, L.L. Sigal, and D.S. Vaughan. 1985. Unit release risk analysis for environmental contaminants of potential concern in synthetic fuels technologies. ORNL/TM-9070. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., G.W. Suter II, C.F. Baes III, S.M. Bartell, M.G. Cavendish, R.H. Gardner, R.V. O'Neill, and A.E. Rosen. 1985. Environmental risk analysis for indirect coal liquefaction. ORNL/TM-9120. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Suter, G.W. II, **L.W. Barnthouse**, C.F. Baes III, S.M. Bartell, M.G. Cavendish, R.H. Gardner, R.V. O'Neill, and A.E. Rosen, 1984. Environmental risk analysis for direct coal liquefaction. ORNL/TM-9074. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Travis, C.C., C.F. Baes, **L.W. Barnthouse**, E.L. Etnier, G.A. Holton, B.D. Murphy, G.P. Thompson, G.W. Suter II, and A.P. Watson. 1983. Exposure assessment methodology and reference environments for synfuels risk analysis. ORNL/TM-8672. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., D.L. DeAngelis, R.H. Gardner, R.V. O'Neill, C.D. Powers, G.W. Sutter II, and D.S. Vaughan. 1982. Methodology for environmental risk analysis. ORNL/TM-8167. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Christensen, S.W., D.S. Vaughan, W. Van Winkle, **L.W. Barnthouse**, D.L. DeAngelis, K.D. Kumar, and R.M. Yoshiyama. 1982. Methods to assess impacts on Hudson River striped bass: final report. ORNL/TM-8309. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Boreman, J., **L.W. Barnthouse**, D.S. Vaughan, C.P. Goodyear, S.W. Christensen, K.D. Kuman, B.L. Kirk, and W. Van Winkle. 1982. Entrainment impact estimates for six fish populations inhabiting the Hudson River estuary. ORNL/NUREG/TM-385/V1. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., W. Van Winkle, J. Golumbek, G.F. Cada, C.P. Goodyear, S.W. Christensen, J.B. Cannon, and D.W. Lee. 1982. Impingement impact analysis evaluations of alternative screening devices, and critiques of utility testimony relating to density-dependent growth, the age composition of the striped bass spawning stock, and the LMS real-time life-cycle model. ORNL/NUREG/TM-385/V2. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., W. Van Winkle, B.L. Kirk, and D.S. Vaughan. 1982. The impact of impingement on the Hudson River white perch population: final report. ORNL/TM-7975. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Hammons, A.S., J.M. Giddings, G.W. Suter II, and **L.W. Barnthouse**. 1981. Ecotoxicological test systems: proceedings of a series of workshops. ORNL-5709. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Hammons, A.S., J.M. Giddings, G.W. Suter II, and **L.W. Barnthouse**. 1981. Methods for ecological toxicology: a critical review of laboratory multispecies tests. ORNL-5708. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W. 1981. Modeling power plant impacts on multipopulation systems: application of loop analysis to the Hudson River white perch population. ORNL/TM-7900. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Van Winkle, W., **L.W. Barnthouse**, B.L. Kirk, and D.S. Vaughan. 1980. Evaluation of impingement losses of white perch at the Indian Point Nuclear Station and other Hudson River power plants. ORNL/NUREG/TM-361, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sanders, F.S., S.M. Adams, **L.W. Barnthouse**, J.M. Giddings, E.E. Huber, K.D. Kumar, D.W. Lee, B.D. Murphy, G.W. Suter, and W. Van Winkle. 1980. Strategies for ecological effects assessment at DOE energy activity sites. ORNL/TM-6783, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., S.W. Christensen, B.L, Kirk, K.D. Kumar, W. Van Winkle, and D.S. Vaughan. 1980. Methods to assess impacts on Hudson River striped bass: report for the period October 1, 1977, to September 30, 1979. ORNL/NUREG/TM-374, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., B.L. Kirk, K.D. Dumar, W. Van Winkle, and D.S. Vaughan. 1980. Methods to assess impacts on Hudson River white perch: report for the period October 1, 1978 to September 30, 1979. ORNL/NUREG/TM-373, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., D.L. DeAngelis, and S.W. Christensen. 1979. An empirical model of impingement impact. ORNL/NUREG/TM-290, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Braunstein, H.M., J.N. Baird, **L.W. Barnthouse**, H.F. Hartman, R.J. Haynes, R.D. Roop, M.S. Salk, and F.S. Sanders. 1978. Environmental and health aspects of disposal of solid wastes from coal conversion: an information assessment. ORNL-5361, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Stinton, L.H., J.N. Baird, **L.W. Barnthouse**, L.G. Berry, H.M. Braunstein, S.G. DeCicco, R.J. Haynes, D.L. Kasterman, D.W. Lee, B.D. Murphy, K.M. Oakes, R.G.S. Rao, R.J. Raridon, R.D. Roop, M.S. Salk, and W.P. Staub. 1978. Environmental analysis for pipeline gas demonstration plants. ORNL/TM-6325, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Barnthouse, L.W., J.B. Cannon, S.W. Christensen, A.H. Eraslen, J.L. Harris, K.H. Kim, M.E. LaVerne, H.A. McLain, B.D. Murphy, R.J. Raridon, T.H. Row, R.D. Sharp, and W. Van Winkle. 1977. A selective analysis of power plant operation on the Hudson River with emphasis on the Bowline Point Generating Station. ORNL/TM-5877 (Vols 1 and 2), Oak Ridge National Laboratory, Oak Ridge, Tennessee.

To: CN=Travis Loop/OU=DC/O=USEPA/C=US@EPA[]
Cc: kopocis.ken@epa.gov;CN=Sonia Altieri/OU=DC/O=USEPA/C=US@EPA[]; N=Sonia Altieri/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US
Sent: Wed 7/18/2012 4:48:39 PM
Subject: Re: 316b

Yes! Ken announced it.

From: Travis Loop/DC/USEPA/US
To: kopocis.ken@epa.gov, Elizabeth Southerland/DC/USEPA/US@EPA
Cc: Sonia Altieri/DC/USEPA/US@EPA
Date: 07/18/2012 12:31 PM
Subject: 316b

Were industry stakeholders told this morning that 316b is extended?

Travis Loop
Communications Director
Office of Water
U.S. Environmental Protection Agency
phone: 202-870-6922

To: kopocis.ken@epa.gov;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA;CN=Cara Lalley/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA;CN=Cara Lalley/OU=DC/O=USEPA/C=US@EPA[]; N=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA;CN=Cara Lalley/OU=DC/O=USEPA/C=US@EPA[]; N=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA;CN=Cara Lalley/OU=DC/O=USEPA/C=US@EPA[]; N=Robert Wood/OU=DC/O=USEPA/C=US@EPA;CN=Cara Lalley/OU=DC/O=USEPA/C=US@EPA[]; N=Cara Lalley/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Travis Loop/OU=DC/O=USEPA/C=US
Sent: Mon 7/23/2012 8:15:04 PM
Subject: desk statement for 316b

EPA has secured an additional year to finalize standards for cooling water intake structures under section 316(b) of the Clean Water Act, under a modified settlement agreement. The Agency is working to finalize the standards by June 27, 2013.

Travis Loop
Communications Director
Office of Water
U.S. Environmental Protection Agency
phone: 202-870-6922

To: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Travis Loop/OU=DC/O=USEPA/C=US@EPA;CN=John Senn/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Travis Loop/OU=DC/O=USEPA/C=US@EPA;CN=John Senn/OU=DC/O=USEPA/C=US@EPA[]; N=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Travis Loop/OU=DC/O=USEPA/C=US@EPA;CN=John Senn/OU=DC/O=USEPA/C=US@EPA[]; N=Travis Loop/OU=DC/O=USEPA/C=US@EPA;CN=John Senn/OU=DC/O=USEPA/C=US@EPA[]; N=John Senn/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;CN=Paul Shriner/OU=DC/O=USEPA/C=US@EPA;CN=Erik Helm/OU=DC/O=USEPA/C=US@EPA;CN=Lisa Biddle/OU=DC/O=USEPA/C=US@EPA[]; N=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;CN=Paul Shriner/OU=DC/O=USEPA/C=US@EPA;CN=Erik Helm/OU=DC/O=USEPA/C=US@EPA;CN=Lisa Biddle/OU=DC/O=USEPA/C=US@EPA[]; N=Paul Shriner/OU=DC/O=USEPA/C=US@EPA;CN=Erik Helm/OU=DC/O=USEPA/C=US@EPA;CN=Lisa Biddle/OU=DC/O=USEPA/C=US@EPA[]; N=Erik Helm/OU=DC/O=USEPA/C=US@EPA;CN=Lisa Biddle/OU=DC/O=USEPA/C=US@EPA[]; N=Lisa Biddle/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Robert Wood/OU=DC/O=USEPA/C=US
Sent: Tue 7/24/2012 12:57:30 PM
Subject: 316(b) Webpage Is Updated

The 316(b) webpage has been updated to reflect the revised date for final action on the existing facilities rule. There is a hot link on the page to the amended settlement agreement. OCIR and OGC have been notified. Here's the link to the webpage: http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/index.cfm.

Robert Wood, Acting Director
Engineering and Analysis Division
Office of Water
U.S. EPA
1200 Pennsylvania Ave, NW (4303T)
Washington, DC 20460

EPA West Room 6233B
202-566-1822
202-329-8053 (C)
http://www.epa.gov/waterscience

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]; N=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Diane Jones-Coleman/OU=DC/O=USEPA/C=US
Sent: Thur 8/16/2012 7:33:52 PM
Subject: AL-12-001-3650 (Ben Nelson, et al)
AL12-001-3650.pdf
MOS Feedback

Control Subject: EPA'S PROPOSED RULE GOVERNING COOLING WATER INTAKE STRUCTURES
From: Nelson, Benjamin; Pryor, Mark; Isakson, Johnny; McCaskill, Claire; Chambliss, Saxby; Alexander, Lamar; Crapo, Michael D; Blunt, Roy; Landrieu, Mary L; Boozman, John; Wicker, Roger; Warner, Mark; Cochran, Thad; Toomey, Patrick; Rubio, Marco; JOHANNS, MIKE

Assigned to OST to prepare response for the AAA-OW signature. DUE TO OW-IO: 08-28-12

Diane
Diane C. Coleman
OW Awards Coordinator
OW FOIA Coordinator
OW Correspondence Team Leader
(202) 564-0379
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In an effort to evaluate customer satisfaction, MOS would appreciate your taking a few moments to provide feedback to the MOS Feedback email box. Your time and effort are greatly appreciated.

United States Senate

WASHINGTON, DC 20510

August 6, 2012

The Honorable Lisa P. Jackson, Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460-0001

Dear Administrator Jackson:

As you are aware, the U.S. Environmental Protection Agency (EPA) recently published two Notices of Data Availability (NODAs) related to the EPA's proposed rule governing cooling water intake structures under Section 316(b) of the Clean Water Act. We agree these NODAs raise critically important issues regarding cost-effective approaches to regulating affected facilities while protecting fishery resources; however, we believe the proposed rule has the potential to impose enormous costs on consumers without providing human health benefits or significant improvements to fish populations.

As a result, we believe the EPA needs to make a number of substantial improvements to the proposed rule before issuing it in final form. In addition, we are concerned by the "willingness-to-pay" public opinion survey, which we believe is misleading and will artificially inflate the rule's purported benefits. This rule will affect more than one thousand coal, nuclear and natural gas power plants and manufacturing facilities. Therefore, we urge you to ensure that the final rule provides ample compliance flexibility to accommodate the diversity of these facilities. Specifically, we request the EPA to address the following critical issues:

Flexibility. The proposed rule correctly provides state governments with the lead authority to make site-specific evaluations to address entrainment. It is vitally important the EPA's final rule retain this compliance flexibility, allowing technology choices to be made on a site-specific basis reflecting costs and benefits. We encourage the EPA to adopt these features in the impingement parts of the rule as well.

Aligned Compliance Deadlines. The final rule should extend the compliance deadline for impingement to the longer proposed deadline for entrainment, thereby providing adequate time to allow companies to make integrated, cost-effective compliance decisions.

Impingement Requirements. The proposed rule includes a stringent national numeric impingement standard that would be impossible for facilities to meet, even those with state-of-the-art controls. In fact, the technology preferred by the EPA – advanced traveling screens and fish return systems – is unable to meet the proposed standard on a reliable basis. We believe the final rule should instead provide multiple pre-approved technologies that would be recognized, once installed and properly operated, as sufficient to address impingement concerns. In cases where such technologies are not feasible or cost-beneficial, the rule should provide an alternative compliance option and relief where it can be shown there are *de minimis* impingement or entrainment impacts on fishery resources.

Definition of Closed-Cycle Cooling. Many facilities today have closed-cycle cooling systems. The rule should ensure that the definition of what qualifies as closed-cycle systems at existing facilities is not more stringent than the one the EPA has already adopted for new facilities. Further, the definition should include any closed-cycle system recirculating water during normal operating conditions; and the definition must not exclude impoundments simply because they are considered waters of the United States.

Public Opinion Survey. We feel strongly that the EPA should not rely upon the "willingness-to-pay" public opinion survey discussed in the second NODA. The public opinion survey method is highly controversial and does not provide a scientific basis for reliable results; and we believe the survey results published thus far by the EPA lack peer review and, consequently, are insufficiently analyzed. This approach to economic analysis is far too speculative to serve as a basis for national regulatory decision-making, presenting very worrisome national, legal, policy, and governance implications which go well beyond this rulemaking.

For these reasons, we believe the EPA should issue the final rule this year without further consideration or inclusion of the public opinion survey results in order to provide regulatory and business certainty to those companies facing significant capital decisions related to compliance with this and other EPA rules. Rather than using a misleading survey to inflate the rule's benefits, the EPA should adopt the above improvements, which would help to reduce the current substantial disparity between the proposed rule's costs and benefits. Such actions by the EPA would also conform to the President's Executive Order 13563, issued in January 2011, directing agencies to adopt rules minimizing regulatory burden and producing maximum net benefits.

Thank you for your consideration of our concerns. We look forward to your response.

Sincerely,

cc: Jacob J. Lew, Chief of Staff, Office of the President
Jeffrey Zients, Acting Director, Office of Management and Budget
Cass R. Sunstein, Administrator, Office of Information and Regulatory Affairs

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Mike Shapiro/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Gregory Peck/OU=DC/O=USEPA/C=US@EPA;CN=Macara Lousberg/OU=DC/O=USEPA/C=US@EPA[]; N=Mike Shapiro/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Gregory Peck/OU=DC/O=USEPA/C=US@EPA;CN=Macara Lousberg/OU=DC/O=USEPA/C=US@EPA[]; N=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Gregory Peck/OU=DC/O=USEPA/C=US@EPA;CN=Macara Lousberg/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Gregory Peck/OU=DC/O=USEPA/C=US@EPA;CN=Macara Lousberg/OU=DC/O=USEPA/C=US@EPA[]; N=Gregory Peck/OU=DC/O=USEPA/C=US@EPA;CN=Macara Lousberg/OU=DC/O=USEPA/C=US@EPA[]; N=Macara Lousberg/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Wanda Fields/OU=DC/O=USEPA/C=US
Sent: Thur 11/1/2012 12:49:54 PM
Subject: AL-12-00-8311 (Markey)
12-001-8311 Markey.pdf

CITIZEN: Markey, Edward J.
PRIMARY SUBJECT: How the EPA Regulates the Effects of Cooling Water Intake Structures
STATUS: Pending
DUE DATE: 11/14/2012
RECEIVED DATE: 10/31/2012
ASSIGNMENT: OST

WANDA R. FIELDS
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EDWARD J. MARKEY OF MASSACHUSETTS
RANKING DEMOCRATIC MEMBER

U.S. House of Representatives
Committee on Natural Resources
Washington, DC 20515

October 31, 2012

The Honorable Lisa Jackson
Administrator
Environmental Protection Agency
USEPA Headquarters
Ariel Rios Building
1200 Pennsylvania Avenue, N. W.
Mail Code: 1101A
Washington, DC 20460

Dear Administrator Jackson:

I am writing to request information about how the Environmental Protection Agency (EPA) regulates the effects of cooling water intake structures on aquatic wildlife, including threatened and endangered species. Through my investigation of the Nuclear Regulatory Commission (NRC) re-licensing proceedings at Pilgrim Nuclear Power Station (PNPS) on Cape Cod Bay in Plymouth, Massachusetts, I have become particularly concerned that in some cases, EPA has failed to ensure that facilities with cooling water intake structures continue to comply with the Clean Water Act. In the case of PNPS, EPA has extended its Clean Water Act permits without review for nearly two decades, despite significant changes in the Cape Cod Bay environment and the status of threatened and endangered species.

To issue a National Pollutant Discharge Elimination System (NPDES) permit, EPA must determine that a facility complies with Section 316(b) of the Clean Water Act, which requires that, "the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact." EPA must re-issue NPDES permits every five years, though in some circumstances permits may be administratively extended.[1] The current NPDES permit for PNPS was issued in 1991 and amended in 1994; it expired in 1996 and has been renewed administratively since then. Thus, it appears that EPA has not evaluated PNPS's 316(b) compliance for nearly two decades. In conversations with EPA staff, I was informed that EPA has once again administratively extended

[1] http://cfpub.epa.gov/npdes/allfaqs.cfm?program_id=0#115

PNPS's permit while it finalizes new regulations for section 316(b), which it now expects to do by June 27, 2013.[2]

A primary way that cooling water intake structures harm wildlife is through the impingement and entrainment of aquatic organisms in cooling systems. Impingement occurs when fish and other aquatic life forms are trapped against cooling water intake screens. Entrainment occurs when aquatic organisms are drawn through a cooling structure and then pumped back out. Aside from these physical impacts, power plants also discharge heated effluent that contains chemical compounds; this thermal and chemical pollution may directly harm organisms, or indirectly harm them by degrading the quality of their habitat.

It is particularly important to consider changes in the effects of thermal pollution in light of climate change, which will decrease the amount of water available for cooling while simultaneously increasing the temperature of the water that is available. Nuclear power plants are already struggling to deal with warming waters, placing even greater demands on aquatic ecosystems and jeopardizing electric power reliability.[3] This summer, a nuclear power plant in Illinois had to petition the NRC for special permission to continue operating while the temperature in its cooling pond spiked to unprecedented levels. Referencing the record-setting water temperature, a spokesman for the company explained that, "clearly, the calculations when the plant was first operated in 1986 are not what is sufficient today, not all the time."[4] Clearly, an updated examination by EPA of the effects of thermal pollution on aquatic ecosystems and the use of once-through cooling is long overdue.

PNPS operations have subjected millions of organisms to thermal pollution, impingement and entrainment,[5] and for more than twenty years, no efforts have been made by federal regulators to ensure that PNPS is using the best available technology to minimize these impacts. Moreover, much has changed about the physical and biological environment of Cape Cod Bay in the past 20 years. The temperature in Cape Cod Bay has increased during the last decades; according to records dating back to 1854, the temperature in the Bay during the first half of 2012 was 1.0 °F higher than the historical average for that time period.[6] In response to these and other stresses, populations of organisms critical to the Cape Cod ecosystem have been declining. For example, the Atlantic sturgeon was recently added to the federal list of threatened species,[7] and river herring have been listed as a species of special concern.[8] It is difficult to imagine how a

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[2] http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/
[3] http://www.ctmirror.org/story/17512/millstone-shutdown-sign-broader-water-power-conflicts-climate-change
[4] http://green.blogs.nytimes.com/2012/07/17/so-how-hot-was-it/
[5] http://www.nrc.gov/reactors/operating/licensing/renewal/applications/pilgrim.html
[6] NOAA Extended Reconstruced Sea Surface Temperature database, available at http://www.ncdc.noaa.gov/ersst/. Data referenced is based on using the 42°N 70°W 2-degree bin, located in Cape Cod Bay.
[7] http://www.nmfs.noaa.gov/pr/species/fish/atlanticsturgeon.htm
[8] http://www.nmfs.noaa.gov/pr/pdfs/species/riverherring_detailed.pdf

permit issued in 1991 would be adequate in this increasingly variable, increasingly sensitive environment.

The NRC licenses new power plants for 40 years and can re-license them for an additional 20 years following an application by the licensee. The licensing and re-licensing processes examine environmental effects and must conduct a full review as specified by the National Environmental Policy Act. In addition, the NRC must comply with other relevant environmental statutes, including the Endangered Species Act and the Magnuson- Stevens Fishery Management Conservation Act. As part of the PNPS re-licensing proceeding, the NRC prepared a Generic Environmental Impact Statement, which EPA commented on in a letter dated August 30, 2007. In this letter, EPA acknowledged that it is not the NRC's responsibility to determine whether PNPS operation complies with the Clean Water Act, as this responsibility is EPA's to undertake through the NPDES permit process. However, EPA raised concerns about effects of impingement and entrainment on aquatic wildlife and requested further information about how these effects would be mitigated.

The NRC also consulted with the National Oceanic and Atmospheric Administration (NOAA) to examine impacts of PNPS relicensing on threatened and endangered species, as well as species managed under the Magnuson-Stevens Fishery Conservation and Management Act. In a letter dated May 17, 2012, NOAA stated that PNPS re-licensing is unlikely to adversely affect threatened and endangered species. However, they concluded the letter by stating that, "if in the future EPA issues a revised NPDES permit for this facility, re-initiation of this consultation, involving both EPA and NRC, is likely to be necessary." With regard to essential habitat for species managed under the Magnuson-Stevens Act, NOAA wrote a letter to the NRC dated January 23, 2007, in which they explained that these issues "would be most appropriately addressed through EPA's NPDES permit renewal process."

Overall, it is evident that despite the fact that EPA's NPDES permit for PNPS is 20 years old and the low likelihood that it will be re-examined in the near-term, both the NRC and NOAA cited EPA's NPDES permitting process as the appropriate way to examine impacts of cooling water intake on threatened and endangered species and other wildlife as part of the decision to allow PNPS to continue to operate until 2032. I am concerned that EPA has been derelict in its duties to protect endangered species and other wildlife from effects of cooling water intake structures at PNPS. I am even more concerned that the issue at PNPS may not be an isolated incident, but may be indicative of an ongoing practice that leaves wildlife entrained in a bureaucratic black hole and without adequate protection.

So that I can better understand the steps that EPA is taking to address effects of cooling water intake structures on endangered and threatened species and other wildlife, I ask you to provide answers to the following questions by November 30, 2012.

1. When EPA issues a NPDES permit for a facility with cooling water intake structures, what actions does it take to ensure that a facility complies with section 316(b) of the Clean Water Act? Please answer this question for NPDES permit renewals and administrative extensions as well.
2. How many facilities with cooling water intake structures currently hold NPDES permits? Of these, how many facilities with cooling water intake structures have had their current NPDES permits administratively extended for more than ten years since the permit was first issued? For each facility, how many years has it been since the original or renewed permit expired? Is EPA aware of any variances from applicable requirements at each of these facilities (*e.g*, a variance that would allow the license holder to exceed thermal loading limits into an aquatic ecosystem)? If so, please provide all relevant documentation. Please also indicate the name, location, type of facility, type of water body the facility draws water from, and which federally listed species (if any) are present in the water body.
3. Once regulations are finalized, how much time will operators have to update their facilities and submit their applications for a new NPDES permit? What measures does EPA plan to take to ensure compliance?
4. Given that EPA will face a substantial backlog of NPDES permit reviews for facilities with cooling water intake structures, how will EPA decide which facilities to review first? Has EPA established a protocol for prioritizing facilities? How long does EPA estimate that it will take to reissue permits for all eligible facilities?

Thank you for your assistance and cooperation in responding to this request. Should you have any questions about this request, please contact Jill Cohen or Michal Freedhoff of the House Committee on Natural Resources Democratic Staff at 202-225-6065.

Sincerely,

Edward J. Markey

Edward J. Markey
Ranking Member
House Committee on Natural Resources

To: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Crystal Penman/OU=DC/O=USEPA/C=US
Sent: Mon 11/19/2012 8:30:00 PM
Subject: Update: § Ex. 5 - Deliberative y re 316 (b)

To: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Crystal Penman/OU=DC/O=USEPA/C=US
Sent: Mon 11/19/2012 8:30:00 PM
Subject: Invitation: **Ex. 5 - Deliberative** 316 (b) (Dec 5 10:00 AM EST in 3219A (Nancy's Office))

Congress of the United States
Washington, DC 20515

July 31, 2012

The Honorable Lisa P. Jackson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., NW
Washington, DC 20460

Dear Administrator Jackson:

We are writing to express our concerns regarding the Environmental Protection Agency's (EPA) proposed rule governing cooling water intake structures under Section 316(b) of the Clean Water Act. This proposed rule will affect more than a thousand coal, nuclear, and natural gas power plants and manufacturing facilities across the country and has the potential to impose enormous costs on consumers without providing human health benefits or significant improvements to fish populations. We believe it is critically important that the final rule provides ample compliance flexibility to accommodate the diversity of these facilities, allows for multiple pre-approved technologies, ensures that the definition of closed-cycle systems at existing facilities is not more stringent than for new facilities, and forgoes the use of its "willingness to pay" public opinion survey.

Flexibility

The proposed rule correctly provides states with the lead authority to make site-specific evaluations to address entrainment. It is vitally important that EPA's final rule retain this compliance flexibility, allowing technology choices to be made on a site-specific basis reflecting costs and benefits. We encourage the EPA to adopt these features in the impingement parts of the rule as well.

Impingement Requirements

The proposed rule includes a stringent national numeric impingement standard that would be extremely difficult for facilities with state-of-the-art controls to meet. Even the technology EPA prefers—advanced traveling screens and fish return systems—cannot meet the proposed standard on a reliable basis. The final rule must, instead, provide multiple pre-approved technologies that, once installed and properly operated, would be recognized as sufficient to address impingement concerns. In cases where such technologies are not feasible or cost-beneficial, we ask that the rule provide an alternative compliance option and relief where it can be shown there are minimal impingement or entrainment impacts on fishery resources. Further, the final rule should extend the compliance deadline for impingement to the longer proposed deadline for entrainment, and provide adequate time to allow companies to make integrated, cost-effective compliance decisions.

Definition of Closed-Cycle Cooling

Many facilities today have closed-cycle cooling systems. The rule must ensure that the definition of what qualifies as closed-cycle systems at existing facilities is not more stringent than the one EPA already has adopted for new facilities. The definition should include any closed-cycle system that

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recirculates water during normal operating conditions, and the definition must not exclude impoundments simply because they are considered waters of the United States.

Public Opinion Survey

We ask that the EPA abandon the use of its "willingness to pay" public opinion survey discussed in its second Notice of Data Availability (NODA). The public opinion survey method is highly controversial and does not provide a basis for reliable results. The survey results EPA has published to date are incomplete, insufficiently analyzed, and lack peer review. This approach to economic analysis is far too speculative to serve as a basis for national regulatory decisionmaking and presents very worrisome national, legal, policy, and governance implications that go well beyond this rulemaking. EPA's conventional cost-benefit analysis produced an unwarranted cost to benefit ratio of 21:1. Using the incomplete public opinion survey approach instead of the accepted conventional cost-benefit analysis causes an alarming shift in this ratio to 1:5, a change of 10,000 percent. Such an extreme change in benefits raises questions about the validity of the survey. Furthermore, the survey itself is misleading and inaccurate. Scientific studies have not demonstrated that reducing impingement and entrainment by regulating cooling water intake structures will result in measurable improvements in fish populations, yet that is what the survey clearly suggests.

We appreciate your consideration of the above improvements to the proposed rule and hope that the EPA will adopt them before finalizing the rule. These changes would help to reduce the current substantial disparity between the proposed rule's costs and benefits. Such actions by the EPA would conform to the President's January 2011 Executive Order 13563, which directs agencies to adopt rules that minimize regulatory burden and produce maximum net benefits.

Sincerely,

Jason Altmire
Member of Congress

Joe Barton
Member of Congress

Mike Pompeo
Member of Congress

Jeff Duncan
Member of Congress

Mark E. Amodei
Member of Congress

W. Todd Akin
Member of Congress

Erik Paulsen
Member of Congress

Bill Shuster
Member of Congress

Jeffrey M. Landry
Member of Congress

Marsha Blackburn
Member of Congress

Patrick T. McHenry
Member of Congress

Sue Wilkins Myrick
Member of Congress

Gregg Harper
Member of Congress

Kurt Schrader
Member of Congress

Bill Johnson
Member of Congress

Rick Berg
Member of Congress

Aaron Schock
Member of Congress

Michael F. Doyle
Member of Congress

Cory Gardner
Member of Congress

Scott R. Tipton
Member of Congress

Kristi L. Noem
Member of Congress

Todd Rokita
Member of Congress

Brett Guthrie
Member of Congress

Rodney Alexander
Member of Congress

Tim Murphy
Member of Congress

Paul C. Broun
Member of Congress

Bob Gibbs
Member of Congress

Gus M. Bilirakis
Member of Congress

John R. Carter
Member of Congress

Tim Walberg
Member of Congress

Leonard Lance
Member of Congress

Steve Scalise
Member of Congress

Ted Poe
Member of Congress

William L. Owens
Member of Congress

Joe Walsh
Member of Congress

John Sullivan
Member of Congress

Mario Diaz-Balart
Member of Congress

Doug Lamborn
Member of Congress

Christopher P. Gibson
Member of Congress

Paul A. Gosar
Member of Congress

Robert T. Schilling
Member of Congress

James Lankford
Member of Congress

Michael Grimm
Member of Congress

Patrick Meehan
Member of Congress

Mick Mulvaney
Member of Congress

Vicky Hartzler
Member of Congress

Leonard L. Boswell
Member of Congress

Tom Reed
Member of Congress

Daniel Webster
Member of Congress

H. Morgan Griffith
Member of Congress

Tim Scott
Member of Congress

Stephen Lee Fincher
Member of Congress

David Schweikert
Member of Congress

Adam Kinzinger
Member of Congress

Robert E. Latta
Member of Congress

Eric A. "Rick" Crawford
Member of Congress

Sam Graves
Member of Congress

Tim Ryan
Member of Congress

Alan Nunnelee
Member of Congress

Charles A. Gonzalez
Member of Congress

Steve Womack
Member of Congress

Reid J. Ribble
Member of Congress

Richard B. Nugent
Member of Congress

Raul R. Labrador
Member of Congress

Renee L. Ellmers
Member of Congress

Billy Long
Member of Congress

Jeff Denham
Member of Congress

Ann Marie Buerkle
Member of Congress

Larry Kissell
Member of Congress

Blaine Luetkemeyer
Member of Congress

John Barrow
Member of Congress

Tom Latham
Member of Congress

Jo Ann Emerson
Member of Congress

Robert E. Andrews
Member of Congress

Cliff Stearns
Member of Congress

Charles F. Bass
Member of Congress

Jerry F. Costello
Member of Congress

Daniel Lipinski
Member of Congress

Mike McIntyre
Member of Congress

Greg Walden
Member of Congress

Mac Thornberry
Member of Congress

Joe Wilson
Member of Congress

Edolphus Towns
Member of Congress

Bobby L. Rush
Member of Congress

Lee Terry
Member of Congress

Ed Whitfield
Member of Congress

Brian P. Bilbray
Member of Congress

Tim Holden
Member of Congress

Cathy McMorris Rodgers
Member of Congress

Frank A. LoBiondo
Member of Congress

Jim Matheson
Member of Congress

Dan Boren
Member of Congress

Denny Rehberg
Member of Congress

C.A. Dutch Ruppersberger
Member of Congress

Tom Cole
Member of Congress

Mike Rogers
Member of Congress

Bill Flores
Member of Congress

Heath Shuler
Member of Congress

Phil Gingrey
Member of Congress

Pete Sessions
Member of Congress

Danny K. Davis
Member of Congress

cc: Michael Goo, EPA
Jim Laity, OMB
Jack Lew, The White House
The Honorable Robert Perciasepe, EPA
Bruce Reed, The White House
Gene Sperling, NEC
The Honorable Cass R. Sunstein, OMB
The Honorable Jeffrey Zients, OMB

United States Senate

WASHINGTON, DC 20510

August 6, 2012

The Honorable Lisa P. Jackson, Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460-0001

Dear Administrator Jackson:

As you are aware, the U.S. Environmental Protection Agency (EPA) recently published two Notices of Data Availability (NODAs) related to the EPA's proposed rule governing cooling water intake structures under Section 316(b) of the Clean Water Act. We agree these NODAs raise critically important issues regarding cost-effective approaches to regulating affected facilities while protecting fishery resources; however, we believe the proposed rule has the potential to impose enormous costs on consumers without providing human health benefits or significant improvements to fish populations.

As a result, we believe the EPA needs to make a number of substantial improvements to the proposed rule before issuing it in final form. In addition, we are concerned by the "willingness-to-pay" public opinion survey, which we believe is misleading and will artificially inflate the rule's purported benefits. This rule will affect more than one thousand coal, nuclear and natural gas power plants and manufacturing facilities. Therefore, we urge you to ensure that the final rule provides ample compliance flexibility to accommodate the diversity of these facilities. Specifically, we request the EPA to address the following critical issues:

Flexibility. The proposed rule correctly provides state governments with the lead authority to make site-specific evaluations to address entrainment. It is vitally important the EPA's final rule retain this compliance flexibility, allowing technology choices to be made on a site-specific basis reflecting costs and benefits. We encourage the EPA to adopt these features in the impingement parts of the rule as well.

Aligned Compliance Deadlines. The final rule should extend the compliance deadline for impingement to the longer proposed deadline for entrainment, thereby providing adequate time to allow companies to make integrated, cost-effective compliance decisions.

Impingement Requirements. The proposed rule includes a stringent national numeric impingement standard that would be impossible for facilities to meet, even those with state-of-the-art controls. In fact, the technology preferred by the EPA – advanced traveling screens and fish return systems – is unable to meet the proposed standard on a reliable basis. We believe the final rule should instead provide multiple pre-approved technologies that would be recognized, once installed and properly operated, as sufficient to address impingement concerns. In cases where such technologies are not feasible or cost-beneficial, the rule should provide an alternative compliance option and relief where it can be shown there are *de minimis* impingement or entrainment impacts on fishery resources.

Definition of Closed-Cycle Cooling. Many facilities today have closed-cycle cooling systems. The rule should ensure that the definition of what qualifies as closed-cycle systems at existing facilities is not more stringent than the one the EPA has already adopted for new facilities. Further, the definition should include any closed-cycle system recirculating water during normal operating conditions; and the definition must not exclude impoundments simply because they are considered waters of the United States.

Public Opinion Survey. We feel strongly that the EPA should not rely upon the "willingness-to-pay" public opinion survey discussed in the second NODA. The public opinion survey method is highly controversial and does not provide a scientific basis for reliable results; and we believe the survey results published thus far by the EPA lack peer review and, consequently, are insufficiently analyzed. This approach to economic analysis is far too speculative to serve as a basis for national regulatory decision-making, presenting very worrisome national, legal, policy, and governance implications which go well beyond this rulemaking.

For these reasons, we believe the EPA should issue the final rule this year without further consideration or inclusion of the public opinion survey results in order to provide regulatory and business certainty to those companies facing significant capital decisions related to compliance with this and other EPA rules. Rather than using a misleading survey to inflate the rule's benefits, the EPA should adopt the above improvements, which would help to reduce the current substantial disparity between the proposed rule's costs and benefits. Such actions by the EPA would also conform to the President's Executive Order 13563, issued in January 2011, directing agencies to adopt rules minimizing regulatory burden and producing maximum net benefits.

Thank you for your consideration of our concerns. We look forward to your response.

Sincerely,

cc: Jacob J. Lew, Chief of Staff, Office of the President
Jeffrey Zients, Acting Director, Office of Management and Budget
Cass R. Sunstein, Administrator, Office of Information and Regulatory Affairs

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]; N=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US
Sent: Wed 11/28/2012 9:53:34 PM
Subject: Fw: Remarks by Julie at National Association of Utility Rate Commissioners Conference in Baltimore 11/13

fyi
----- Forwarded by Elizabeth Southerland/DC/USEPA/US on 11/28/2012 04:53 PM -----

From: Robert Wood/DC/USEPA/US
To: Elizabeth Southerland/DC/USEPA/US@EPA
Date: 11/28/2012 04:38 PM
Subject: Remarks by Julie at National Association of Utility Rate Commissioners Conference in Baltimore 11/13

FYI, Wanted you to see Julie's remarks as reported by Inside EPA. Remember this was the conference she covered for OW and she was on the agenda. The press presence surprised her a bit I think and she handled it well. Her remarks look fine to me. Note Suzanne R's remarks as well.
----- Forwarded by Robert Wood/DC/USEPA/US on 11/28/2012 04:31 PM -----

From: Julie Hewitt/DC/USEPA/US
To: Robert Wood/DC/USEPA/US@EPA, Lynn Zipf/DC/USEPA/US@EPA, Jan Matuszko/DC/USEPA/US@EPA
Date: 11/28/2012 03:03 PM
Subject:

I was starting to think I'd escaped scott-free, but alas, I am quoted from when I made the presentation at the NARUC conference in Baltimore on Nov 13th, and then got asked questions by the reporter afterwards.

PS: I missed the Southern Co's representative talking, which was in the previous session, which I only caught half of. I was asked to react to him. Thank goodness I missed his talk.

http://insideepa.com/Inside-EPA/Inside-EPA-11/23/2012/epa-works-to-coordinate-power-plant-water-discharge-coal-ash-rules/menu-id-67.html

Inside EPA - 11/23/2012
EPA Works To Coordinate Power Plant Water Discharge, Coal Ash Rules
Posted: November 20, 2012
EPA officials are attempting to coordinate "as much as we possibly can" forthcoming rules governing coal ash disposal and wastewater discharges from the power sector, a key concern for industry as attention shifts from a suite of air rules for the sector to the looming waste and water rules.
Agency officials say that coordinating the measures aims to reduce duplicative and perhaps contrary requirements given that the regulations govern related waste streams. "There is an obvious nexus" between addressing waste from coal plants whether it is in a coal ash pond or in the wastewater discharge of a plant, Julie Hewitt, an official in EPA's Office of Water (OW), told Inside EPA on the sidelines of the National Association of Regulatory Utility Commissioners' (NARUC) conference Nov. 13 in Baltimore.
She said officials in OW and the Office of Solid Waste and Emergency Response (OSWER) "have talked a fair bit and have tried to coordinate as much as we possibly can" efforts to revise the agency's power

plant effluent limitation guideline (ELG) and the coal combustion residuals (CCR) disposal rule.
Agency officials are also pointing to the need to coordinate the rules in opposing environmentalists' call for the U.S. District Court for the District of Columbia to set a fixed six-month deadline to finalize the CCR rule.
"EPA does not believe that the schedule proposed by environmental plaintiffs would allow EPA to effectively coordinate these rules to minimize difficulties for facility implementation," OSWER official Suzanne Rudzinski said in an Oct. 11 declaration to the court.
The two pending rules are expected to tamp down on high levels of contaminants in effluent discharges and coal ash given that those concentrations are expected to increase due to installation emissions controls required under the Clean Air Act.
The Clean Water Act (CWA) ELG will revise discharge standards for coal- and gas-fired power plants for the first time since 1982 -- a revision that is expected to include limits for flue gas desulfurization units, more commonly known as "scrubbers, which have been installed on many coal-fired power plants to reduce sulfur dioxide and other pollutants.
EPA is also still weighing a pending final rule to regulate CCRs either as hazardous waste under subtitle C, or as solid waste under subtitle D of the Resource Conservation & Recovery Act (RCRA).
But the regulations are a growing concern for industry. At the NARUC conference, Jeff Burleson of Southern Company included the ELG and the CCR rule along with the utility air toxics rule, a pending cooling water intake structure and potential greenhouse gas (GHG) rules for existing power plants as the key rules that could drive substantial costs for industry in the coming years.
With the exception of the GHG rules, Burleson estimated that the cost to comply could be up to $2,000 per kilowatt, with a capital outlay of between $13 billion and $18 billion and potential rate increases of between 10 and 20 percent. That cost, Burleson noted, came despite Southern revising downward by $900 million its projections on how much the utility air toxics rule would cost. Despite the drop, he said the remaining rules are still expected to be very costly and remain within the $13-$18 billion range, assuming that EPA finalizes a non-hazardous coal ash rule.
While industry groups are concerned about the costs of implementing the pending regulations, the timing of both rules is still uncertain. While EPA has agreed, in a settlement with environmentalists, to propose revisions to its ELG by Dec. 14, industry groups have appealed the suit in an effort to intervene in the settlement. Oral arguments in the case, Defenders of Wildlife, et al. v. EPA, are set for Dec. 5.
On coal ash, EPA proposed RCRA disposal rules for the waste in 2010 but is yet to promulgate a final rule, saying it needs until 2014. Environmentalists and the coal ash recycling industry are suing to set a date-certain deadline, though EPA officials warn that a hard deadline would hurt both the CCR rule as well as the ELG, one of the first clear signs from the agency that it is coordinating the two rules.
In her declaration in the suit Appalachian Voices, et al., v. EPA opposing a deadline, OSWER's Rudzinski argues that RCRA directs EPA to integrate and "avoid duplication, to the maximum extent practicable, with the appropriate provisions of" federal water laws. Any effort to finalize the CCR rule will be complicated by efforts to develop the ELG rule, Rudzinski says, noting that the ELG rule "applies to many of the same disposal units and facilities that will be affected by EPA's disposal rule.
And Hewitt told Inside EPA that the way each statute is written leaves holes that the other needs to fill. "If the statutes were overlapping, we wouldn't need to coordinate, because if we did it, it would answer everything that was in RCRA. But there are aspects to RCRA which the water office doesn't have the authority under the Clean Water Act to deal with and vice versa. That's the sense in which I think there needs to be an agency wide look at -- how do we best protect the environment."
EPA more broadly says in Oct. 11 court filings it will need "a period of considerably greater than six months for the agency to conclude a scientifically sound and legally defensible final action on any revision of its Subtitle D regulations pertaining to coal combustion residuals" and to fully update toxicity information for CCR, contrary to claims EPA Administrator Lisa Jackson made late last year suggesting the rule could be complete in late 2012. (Inside EPA, Oct. 19). -- Jenny Hopkinson & Bobby McMahon
2416781

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]; N=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA[]
From: CN=MichaelE Scozzafava/OU=DC/O=USEPA/C=US
Sent: Tue 12/4/2012 5:32:27 PM
Subject: Draft Agenda for Bob S Weekly

Mahri is out sick so I'll do the agenda for tomorrow. Here's what I came up with (316b was suggested during OD staff meeting last week). Let me know if there's anything that you'd like to add or remove.

Thanks!

Mike

1. 316(b) Schedule
2. Steam Electric
3. WOUS
4. Additional Items

Michael E. Scozzafava
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency

Office: (202) 566-1376
Mobile: (202) 407-2555

To: CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Elizabeth Skane/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]
From: CN=MichaelE Scozzafava/OU=DC/O=USEPA/C=US
Sent: Tue 12/11/2012 7:59:52 PM
Subject: Re: Materials for Ken for Industry Meeting Wednesday 12/12 regarding 316b rule

Understood. Thank you Betsy.

MIke

Michael E. Scozzafava
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency

Office: (202) 566-1376
Mobile: (202) 407-2555

From: Elizabeth Southerland/DC/USEPA/US
To: Ken Kopocis/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA, Ellen Gilinsky/DC/USEPA/US@EPA, MichaelE Scozzafava/DC/USEPA/US@EPA
Cc: Elizabeth Skane/DC/USEPA/US@EPA, Robert Wood/DC/USEPA/US@EPA, Lynn Zipf/DC/USEPA/US@EPA, Julie Hewitt/DC/USEPA/US@EPA, Jeff Lape/DC/USEPA/US@EPA
Date: 12/11/2012 12:04 PM
Subject: Materials for Ken for Industry Meeting Wednesday 12/12 regarding 316b rule

Here are the two papers for Ken, who is attending the Administrator's meeting on Wednesday. Mike, do not forward the synopsis of comments on the NODA to the Administrator. She just needs the first one pager.
----- Forwarded by Elizabeth Southerland/DC/USEPA/US on 12/11/2012 12:01 PM -----

Here are the two 1-pagers.

[attachment "One-Pager for 316(b) meeting with Elec Industry on Wed 12-12-12.docx" deleted by MichaelE Scozzafava/DC/USEPA/US] [attachment "One-pager synopsis of comments on NODA 2 for

316(b) meeting with industry on 12-12-12.docx" deleted by MichaelE Scozzafava/DC/USEPA/US]

OW & Senior Policy Counsel Weekly

December 13, 2012

ARN 3309

AGENDA

Review Agenda

Discussion Topics:

1. Ex. 5 - Deliberative

2. Ex. 5 - Deliberative

3. 316b

4. Ex. 5 - Deliberative

5. Ex. 5 - Deliberative

To: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Crystal Penman/OU=DC/O=USEPA/C=US
Sent: Wed 12/12/2012 9:11:40 PM
Subject: Accepted: Follow up on 316B

Non-Responsive

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=MichaelE Scozzafava/OU=DC/O=USEPA/C=US@EPA;CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Mahri Monson/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Jeff Lape/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Elizabeth Skane/OU=DC/O=USEPA/C=US
Sent: Tue 12/18/2012 4:10:58 PM
Subject: Re: 316b Options Selection Briefing Materials
316(b) Final Rule Option Selection Briefing for the Administrator_12-17-12.pptx
(embedded image)

Sandra should have a hard copy.

Elizabeth for Betsy

From: Nancy Stoner/DC/USEPA/US
To: MichaelE Scozzafava/DC/USEPA/US@EPA
Cc: Ken Kopocis/DC/USEPA/US@EPA, Mahri Monson/DC/USEPA/US@EPA, Elizabeth Southerland/DC/USEPA/US@EPA, Jeff Lape/DC/USEPA/US@EPA, Robert Wood/DC/USEPA/US@EPA
Date: 12/18/2012 10:56 AM
Subject: Re: 316b Options Selection Briefing Materials

haven't seen yet

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From: MichaelE Scozzafava/DC/USEPA/US
To: Nancy Stoner/DC/USEPA/US@EPA, Ken Kopocis/DC/USEPA/US@EPA
Cc: Mahri Monson/DC/USEPA/US@EPA
Date: 12/18/2012 07:51 AM
Subject: 316b Options Selection Briefing Materials

Nancy/Ken:

Did you want one more look at the briefing before I submit it for the Administrator's briefing book? I think you said that during OW Staff yesterday.

I need to send the final version by this afternoon.

Thanks!

Mike

Michael E. Scozzafava
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To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Robert Wood/OU=DC/O=USEPA/C=US
Sent: Thur 4/5/2012 5:44:32 PM
Subject: Re: Administrator just said thanks re 316b schedule info

Thx

From: Nancy Stoner/DC/USEPA/US
To: Elizabeth Southerland/DC/USEPA/US@EPA, Robert Wood/DC/USEPA/US@EPA
Date: 04/05/2012 01:13 PM
Subject: Administrator just said thanks re 316b schedule info

will let you know if I get any more feedback

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To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA;CN=Matthew Klasen/OU=DC/O=USEPA/C=US@EPA;CN=Gautam Srinivasan/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]; N=Matthew Klasen/OU=DC/O=USEPA/C=US@EPA;CN=Gautam Srinivasan/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]; N=Gautam Srinivasan/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Gregory Peck/OU=DC/O=USEPA/C=US
Sent: Thur 4/19/2012 7:02:05 PM
Subject: Inside EPA Articles
2396315
2396300

In case you're not getting your rumor and inuendo fix.....

EPA, Alaska At Odds Over Agency Authority To Study Pebble Mine Impacts
Posted: April 18, 2012
EPA and Alaska officials are arguing over the agency's authority to conduct an ecological risk assessment of a controversial planned hard rock mine, with Alaska saying it will consider "legal options" if EPA uses the assessment to support a first-time preemptive veto of the controversial Pebble Mine, as many stakeholders have demanded.
But EPA says it has full authority under section 104 of the Clean Water Act (CWA) to study the proposed mine's environmental impacts on Bristol Bay, AK, and is emphasizing that the study is not a regulatory action and therefore will have no legal consequences.
In letters addressed to EPA Region X Administrator Dennis McLerran, dated March 9 and April 17, Alaska Attorney General Michael C. Geraghty argues that EPA has no authority under the CWA to conduct its in-depth study of Bristol Bay -- a draft of which is expected by the end of April. Relevant documents are available on InsideEPA.com. (Doc ID: 2396315)
Even though the assessment is designed to help EPA respond to an expected application from Pebble Partnership, the association of mining companies developing Pebble Mine, for a discharge permit under CWA section 404, Geraghty writes in his March 9 letter, the agency's "on-going watershed assessment process is neither delineated in the Section 404 statute, nor set forth in EPA's implementing regulations. . . . [T]his unrestricted analysis of alternatives and activities appears to overstep the Section 404 authority Congress granted to EPA."
Geraghty in his April 17 letter says the state "finds itself in a 'damned if you do, damned if you don't' situation," where the state must choose between participating in "a process which, in our view, lacks authority," and abstaining, in which case "it is argued that we have forfeited our right to complain."
Pebble Mine was proposed in 2007, and the project has begun exploratory excavation across the Bristol Bay area. As a mining project, it is exempt from EPA-managed discharge permits, but requires dredge-and-fill permits from the U.S. Army Corps of Engineers. EPA may "veto" such permits under CWA section 404(c). Activist groups have called on the agency to exercise that power against Pebble Mine out of fears that the mine could devastate nearby salmon fisheries, even though the Pebble Partnership has yet to file a formal application.
Geraghty says a veto would force the state of Alaska to "explore all its legal options," though he does not explicitly threaten legal action. Alaska has vigorously defended in state courts the right to mine, including challenging a successful referendum barring large-scale mining near salmon-bearing waters.
Geraghty's March 9 letter calls EPA's role under section 404 "limited," citing the U.S. Court of Appeals for the District of Columbia Circuit's 2011 ruling in National Mining Association v. Jackson, where the court held that the agency may not "develop a new evaluation or permitting process that expands its role."
A preemptive veto, Geraghty says in his March 9 letter, would "usurp the Corps' role" because CWA section 404(b) assigns the Corps, not EPA, to consider the impacts of, and potential alternatives to, projects proposed for dredge-and-fill permitting.
In his second letter, Geraghty says EPA's authority under the CWA "is not plenary," pointing to the March 23 ruling by the U.S. District Court for the District of Columbia in Mingo Logan v. EPA that found the agency was "not reasonable" when it issued a first-time veto of a permit that had already been issued for

a mountaintop mine in West Virginia.
Environmentalists have used that same ruling to justify calls for a preemptive veto, with one source at the Natural Resources Defense Council saying "the court said EPA needs to act sooner rather than later" (Inside EPA, April 6).
And McLerran, in an April 5 response to Geraghty, defends the agency's authority to study Bristol Bay, citing CWA section 104, which directs the administrator to "establish national programs for the prevention, reduction and elimination of pollution," and to "conduct and promote the coordination and acceleration of research, investigations . . . and studies relating to the causes, effects, extent, prevention, reduction and elimination of pollution."
But in the April 17 letter, Geraghty says the language section 104 is specific to national programs, "not site- or region-specific endeavors that would dramatically impact the regulatory and property rights of certain states," and notes that EPA's Federal Register entry announcing the study claimed authority under section 404.
"It is unfortunate the EPA has chosen to equivocate on this threshold issue," Geraghty says.
"Deciding the 404(c) petition without the benefit of a project application and substantial, scientifically vetted project-specific information would infringe on the State of Alaska's management and use of State lands," potentially infringing on the Alaska Statehood Act, Geraghty says.
The statehood act is a federal law adopted when Alaska became a state in 1958 and, among other provisions, guarantees the state government's mineral rights on all publicly owned land within its borders.
McLerran's response does not address the extent of EPA's veto powers under section 404 or the statehood act, saying only that those arguments "relate to consequences that might flow from a future decision by the EPA to initiate or finalize a Section 404(c) action. I want to be clear that the Watershed Assessment is not a regulatory action, and it will not have any legal consequences. EPA has not initiated any regulatory action under 404(c), or any other authority."
Both officials call for a formal, face-to-face discussion between EPA and Alaska officials, although according to the April 17 letter no date has been set for such a meeting.
Inside EPA - 04/20/2012

Activists' Bid To Limit Cooling Water Cost-Benefit Study May Preview Suit
Posted: April 18, 2012
Environmentalists are urging EPA to use a limited cost-benefit analysis in its pending cooling water intake structure rule and arguing against approaches the agency is said to be considering that would minimize the benefits of a stricter rule, saying the alternatives may be illegal -- hinting at a potential lawsuit activists could file on the final rule.
The push by activists, at an April 10 meeting with EPA and White House Office of Management & Budget (OMB) officials, comes as the agency's acting water chief Nancy Stoner says EPA's upcoming notice of data availability (NODA) on possible revisions to the cost-benefit analysis for the rule will outline "alternatives" for reducing impingement, or number of adult fish trapped on cooling water intakes -- a concession long sought by industry.
At the meeting, representatives of environmental groups including the Natural Resources Defense Council, Sierra Club and Riverkeeper Alliance discussed the agency's cost-benefit analysis for its forthcoming Clean Water Act (CWA) section 316(b) cooling water rule, according to sources familiar with the meeting.
The rule -- proposed in April 2011 and slated for final issuance in July -- will regulate the technologies power plants and other facilities must use to reduce the impact of drawing surface water into their plants for cooling machinery on fish populations. In addition to impingement, or the trapping of live adult fish, the water law applies to entrainment, or the drawing of fish eggs and larvae into the systems, which can affect fish populations.
One source familiar with the OMB meeting says activists hoped to persuade EPA and OMB against either pursuing a more strictly monetized cost-benefit analysis for cooling water intake structures or leaving the analysis to the states -- a move that some critics of the rule have called for, and which EPA appears to be considering.
Both options would minimize the benefits of requiring more stringent fish protection measures, the source says, because healthy fish populations carry value for people not only as a commodity but as part of a thriving ecosystem, and that value is true not only for citizens in proximity to those ecosystems but elsewhere.

"People have put an intrinsic value on species that are not necessarily in their region of the country -- so when you do studies, [they] show that people care about polar bears in Alaska, people in the Midwest care about fish in the oceans," the source says. "So you can't draw too narrow of a line."
EPA's use of cost-benefit analyses in the cooling water rule has long been a source of contention between activists and the agency, culminating in a 2009 ruling by the U.S. Supreme Court in Entergy Corp., et al. v. Riverkeeper, Inc., et al. finding EPA's use of the analysis permissible. Environmentalists in that case argued that section 316 does not mention -- and therefore does not allow EPA to consider costs when developing its cooling water intake requirements, but the court said a cost-benefit analysis is reasonable and therefore within the agency's discretion.
The cost-benefit analysis that EPA has traditionally employed has been the "wholly disproportionate" analysis, which effectively does not consider costs except in cases where the cost to the permit holder or the public is wholly disproportionate to the benefit derived, according to the source familiar with meeting. But the source says that, under the CWA and applicable case law, not only is the wholly disproportionate analysis a good policy for the forthcoming rule, but it is the most stringent cost-benefit analysis that can be applied under the CWA. That line of argument is precisely what the source expects will be argued if and when EPA's final rule is challenged in court. Groups can sue over the rule after EPA publishes the final version.
"We think that's all the cost-benefit that the Clean Water Act allows . . . but that will be determined in court" in the event EPA takes a cost-benefit approach that activists file suit over, the source says. "But we also say that it . . . would be unwise policy to impose a stricter cost-benefit test than 'wholly disproportionate.'"
The "wholly disproportionate" cost-benefit analysis stems from a 1977 ruling by EPA's Environmental Appeals Board, In re: Public Service Company of New Hampshire that found it would not be "reasonable to interpret Section 316(b) as requiring use of technology whose cost is wholly disproportionate to the environmental benefit to be gained."
The board relied in part on House-Senate conference reports on the CWA issued by then-Sen. Edmund Muskie (D-ME), who said that "the balancing test between total cost and effluent reduction benefits is intended to limit the application of technology only where the additional degree of effluent reduction is wholly out of proportion to the costs of achieving such marginal level of reduction for any class or category of sources."
Though the Supreme Court did determine that cost-benefit analyses were permissible in the cooling water intake context, Justice Antonin Scalia, writing for the majority in Entergy, said "other arguments may be available to preclude such a rigorous form of cost-benefit analysis" as the best practicable control technology currently available, but "that question is not before us."
Justice Stephen Breyer in his partially concurring, partially dissenting, opinion in Entergy, went further, saying EPA's use of the "wholly disproportionate" cost-benefit analysis is precisely the version envisioned by the CWA, since it avoids the dual pitfalls of excessively attempting to quantify value or ignoring grossly unfair results.
Another environmentalist says that the environmental community has not yet formulated an opinion on whether the agency should seek an extension to the court-mandated July 27 deadline for EPA to issue the cooling water rule, but the first source says they see no reason why EPA would have to seek an extension. Industry sources have indicated that they expect the agency to seek an extension given the breadth and impact of the rule. -- John Heltman
Inside EPA - 04/20/2012

Perchlorate Industry Urges EPA To Submit Cost-Benefit Analysis To SAB
Posted: April 18, 2012
The makers and users of the rocket fuel ingredient perchlorate are urging EPA to submit not only its draft health effects document to the agency's Science Advisory Board (SAB) for review, but also a draft cost-benefit analysis of promulgating a federal drinking water standard for the chemical.
The call from the Perchlorate Study Group (PSG) for a broader review follows a December announcement from SAB staff that they are forming a new committee to review the draft scientific document that will underpin the agency's decision to regulate perchlorate in drinking water, as required by the Safe Drinking Water Act (SDWA).
The document under SAB review will focus on approaches for setting a health-based maximum contaminant level goal (MCLG), according to a Dec. 16 Federal Register notice requesting nominations of

independent experts to serve on the review panel (Inside EPA, Dec. 23). The agency will then use the MCLG to set an enforceable standard, known as a maximum contaminant level (MCL) that considers costs, technical feasibility and other issues. Drinking water utilities and liable parties at contaminated waste sites must meet the MCL once it has been set.

But the PSG argues that SAB should also review the economic analyses that SDWA requires the agency to conduct before promulgating its drinking water standard. "The PSG also urges EPA to include, as part of the SAB review, its draft health risk reduction and cost analysis ("HRRCA") required by the Safe Drinking Water Act as part of the proposed regulation," writes the PSG's Chairman Jonathan Bode in March 30 comments. PSG's members include Aerojet, Alliant Techsystems, American Pacific Corporation and Lockheed Martin Corporation. Relevant documents are available on InsideEPA.com. (Doc ID: 2396300)

PSG notes that SDWA requires EPA to conduct both the scientific health effects analysis and the cost analysis before issuing rules, and argues the agency should submit the draft HRRCA to SAB along with the health effects document, in order to fulfill congressional intent. "The SDWA Amendments of 1996 direct the Agency to conduct several specific analyses in its HRRCA obligations. The importance of this analysis is underscored by the explicit statutory requirement that the Administrator '. . . publish a determination as to whether the benefits of a maximum contaminant level justify or do not justify the costs . . .' of complying with the level."

Reviewing both the health effects and cost issues "is especially appropriate, given the interrelated roles of science and economics as the Agency simultaneously prepares a MCLG and [MCL] under the amended SDWA," PSG writes.

The SAB notice indicates that EPA "seeks review of a draft Health Effects Support Document for Perchlorate. This draft document is under development and is expected to be available in early 2012." The notice does not mention the costs analysis at all.

An EPA spokeswoman did not return a request seeking comment by press time.

The Obama EPA decided last year to regulate perchlorate, reversing a Bush administration decision that there were insufficient benefits to justify costly perchlorate water rules. EPA Administrator Lisa Jackson announced the decision at a Feb. 2, 2011, hearing before the Senate Environment & Public Works Committee, saying the proposal will be published no later than February 2013.

The chemical can inhibit the body's regular uptake of iodine, a particular concern for infants and fetuses, which can lead to developmental delays and other issues. The Bush administration argued that a more effective way to reduce risk would be to encourage pregnant women to consume iodine supplements.

The PSG also urges SAB to select candidates with a "diverse" set of expertise, and to avoid those that have conflicts of interest, as well as the appearance of such conflict. The group asks SAB to appoint candidates that "includes a balanced and diverse representation of perspectives and professional background including: academia, water purveyors and industry representatives."

PSG targets scientists at state agencies that have regulated perchlorate in drinking water as experts that cannot be viewed as impartial. "It may be difficult for the public or those closely monitoring the Agency's actions to envision how scientists at a state government agency which is already acting on perchlorate would be able to disassociate themselves from their state's process. To this point, we respectfully request the agency to consider the question of whether the credibility of this process would be called into doubt by the inclusion of panelists from any state that is currently involved in a parallel regulatory process or have previously promulgated perchlorate regulations," Bode writes.

California, Massachusetts and New Jersey have all regulated perchlorate in their drinking water at levels ranging from 2 to 6 parts per billion (ppb). California is revising its 6 ppb standard, following the drafting of a stricter public health goal of 1 ppb by its Office of Environmental Health Hazard Assessment.

Of the 49 candidates for membership on the perchlorate panel that SAB lists on its website, six are scientists at those agencies. -- Maria Hegstad

---

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U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

202-564-5778

To: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Donald Maddox/OU=DC/O=USEPA/C=US
Sent: Wed 12/26/2012 3:19:23 PM
Subject: Update: 316b Ex. 5 - Deliberative Review

To: CN=Ken Kopocis/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Donald Maddox/OU=DC/O=USEPA/C=US
Sent: Wed 12/26/2012 3:19:40 PM
Subject: Invitation: 316b Ex. 5 - Deliberative Review (Jan 7 02:00 PM EST in ARN 3309)

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Crystal Penman/OU=DC/O=USEPA/C=US@EPA[]; N=Crystal Penman/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Tue 4/24/2012 1:29:54 PM
Subject: Re: 316b prebrief now at 11

great I can make that -- can we either get call in number or if I am only one call me at **Non-Responsive**
Thanks!

-----Nancy Stoner/DC/USEPA/US wrote: -----
To: Elizabeth Southerland/DC/USEPA/US@EPA, Robert Wood/DC/USEPA/US@EPA, Ellen Gilinsky/DC/USEPA/US@EPA, Ken Kopocis/DC/USEPA/US@EPA, Steven Neugeboren/DC/USEPA/US@EPA, MaryEllen Levine/DC/USEPA/US@EPA, gregory.peck@epa.gov
From: Nancy Stoner/DC/USEPA/US
Date: 04/24/2012 09:14AM
Subject: 316b prebrief now at 11

It had been moved to a time I couldn't do, so we rescheduled for 11. Hope that works for at least most of you. It is in 3233 East

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To: CN=Avi Garbow/OU=DC/O=USEPA/C=US@EPA;CN=Bob Sussman/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Bob Sussman/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]; N=Robert Wood/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Debbie Cash/OU=DC/O=USEPA/C=US
Sent: Tue 4/24/2012 1:32:58 PM
Subject: Cancelled: Pre brief 316B Call in 1-866-299-3188 passcode **Non-Responsive**

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA[]; N=Elizabeth Southerland/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Crystal Penman/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA[]; N=Martha Workman/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Tue 4/24/2012 3:04:25 PM
Subject: Re: 316b prebrief now at 11

are we meeting.....number is Non-Responsive Thanks

-----Nancy Stoner/DC/USEPA/US wrote: -----
To: Ellen Gilinsky/DC/USEPA/US@EPA
From: Nancy Stoner/DC/USEPA/US
Date: 04/24/2012 09:44AM
Cc: Crystal Penman/DC/USEPA/US@EPA, Martha Workman/DC/USEPA/US@EPA
Subject: Re: 316b prebrief now at 11

will call you unless I tell you differently

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To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US[]
Cc: []
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Thur 4/26/2012 2:05:27 PM
Subject: Re: Fw: Broadcast: Meeting with EEI - ARN 3500 (Apr 26 11:00 AM EDT in ARN 3500)
Gilinsky.Ellen@epa.gov

yes I will go and this is the group I met with last month with the Administrator
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
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From: Nancy Stoner/DC/USEPA/US
To: Ellen Gilinsky/DC/USEPA/US@EPA
Date: 04/26/2012 09:28 AM
Subject: Fw: Broadcast: Meeting with EEI - ARN 3500 (Apr 26 11:00 AM EDT in ARN 3500)

I have a conflict. Can you go, Ellen? This is 316b, I assume

Nancy Stoner
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Washington, DC 20004-3302
----- Forwarded by Nancy Stoner/DC/USEPA/US on 04/26/2012 09:27 AM -----

Broadcast: Meeting with EEI - ARN 3500
Thu 04/26/2012 11:00 AM - 12:00 PM

Attendance is required for Nancy Stoner

Chair: Michael Goo/DC/USEPA/US
Sent By: Robin Kime/DC/USEPA/US

Location: ARN 3500

Michael Goo has invited you to a meeting. You have not added this entry to your calendar.

Required: ann.w.loomis@dom.com, Ellen Gilinsky/DC/USEPA/US@EPA, Ken Kopocis/DC/USEPA/US@EPA, Laura Vaught/DC/USEPA/US@EPA, Lynn Zipf/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA, Paul Balserak/DC/USEPA/US@EPA, wood.robert@epa.gov

Optional: Alex Barron/DC/USEPA/US@EPA

Ann W Loomis <ann.w.loomis@dom.com>

Attendees:

Ray Butts - NextEra
Amy Trojecki - Exelon
Eric Svenson - PSEG
Melissa Lavinson - PGE
Cari Boyce - Progress
Rich Bozek - EEI
Carrie Jenks - Michael J. Bradley
Bill Skaff - NEI
Kristy Bulleit - UWAG
Ann Loomis - Dominion

Industry Stakeholder Coffee

Wednesday, September 21, 2011
9:00 - 10:00 a.m.
Room 3233 EPA East, 1201 Constitution Avenue, N.W.
Call-in Number: 1-866-299-3188, conference code: 202-564-5700

AGENDA

STORMWATER UPDATE

1. Update: EPA's activities on stormwater
2. Combined Sewer Overflows and integrated planning for wet weather infrastructure investments

WATER QUALITY UPDATE

3. Status of work with states on nutrient criteria
4. Status of guidance on 303(d) listings based on antidegradation
5. Status of water quality standards rulemaking

REGULATION UPDATE

6. Status of 2010 304(m) Final Plan: Effluent Guidelines
7. Cooling Water Intake Structures Rule 316(b)

DRINKING WATER UPDATE

8. EPA's response to GAO Report "Environmental Health: Action Needed to Sustain Agencies' Collaboration on Pharmaceuticals in Drinking Water"
9. Status of new initiative of looking at regulation of contaminants in drinking water by groups
10. Update: EPA's activities on perchlorate
11. Update: Hydraulic Fracturing Study

To: CN=Ann Campbell/OU=DC/O=USEPA/C=US;CN=Nancy Stoner/OU=DC/O=USEPA/C=US[];
N=Nancy Stoner/OU=DC/O=USEPA/C=US[]
Cc: CN=Donald Maddox/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Thur 9/22/2011 5:37:26 PM
Subject: Re: can we briefly chat today on impingement issues in the 316b rule?
Gilinsky.Ellen@epa.gov
Gilinsky.Ellen@epa.gov

Nancy and I will come over around 2:10 for a brief chat - -we have meeting that runs until then
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

Mailing Address: 1200 Pennsylvania Avenue, NW, Mail Code 4101M, Washington, DC 20460-0001
Physical/FedEx/Courier Address: 1201 Constitution Ave., NW, Rm. 3111 East Bldg., Washington, DC 20004-3302

From: Ann Campbell/DC/USEPA/US
To: Ellen Gilinsky/DC/USEPA/US@EPA
Cc: Bob Sussman/DC/USEPA/US@EPA, Donald Maddox/DC/USEPA/US@EPA
Date: 09/22/2011 01:26 PM
Subject: Re: can we briefly chat today on impingement issues in the 316b rule?

Can you come a little before the KY NPDES meeting which starts at 2:15? Either that or he has some time after the Ches Bay call ends at 3:45.

Ann Campbell
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Mail Code: 1101

P: (202) 566-1370
C: (202) 657-3117
F: (202) 501-1428

From: Ellen Gilinsky/DC/USEPA/US
To: Bob Sussman/DC/USEPA/US@EPA
Cc: Ann Campbell/DC/USEPA/US@EPA, Donald Maddox/DC/USEPA/US@EPA
Date: 09/22/2011 01:08 PM
Subject: Re: can we briefly chat today on impingement issues in the 316b rule?

Nancy here too -- Don can you give us a time that Bob is available

Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
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Physical/FedEx/Courier Address: 1201 Constitution Ave., NW, Rm. 3111 East Bldg., Washington, DC 20004-3302

From: Bob Sussman/DC/USEPA/US
To: Ellen Gilinsky/DC/USEPA/US@EPA
Cc: Ann Campbell/DC/USEPA/US@EPA, Donald Maddox/DC/USEPA/US@EPA
Date: 09/22/2011 12:35 PM
Subject: can we briefly chat today on impingement issues in the 316b rule?

Just need 5 minutes by phone . . .am assuming nancy's not around but if she is, she should join.

Robert M. Sussman
Senior Policy Counsel to the Administrator
Office of the Administrator
US Environmental Protection Agency

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;"Ephraim King" [king.ephraim@epa.gov]; Ephraim King" [king.ephraim@epa.gov]; N=Maryt Smith/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Martha Workman/OU=DC/O=USEPA/C=US
Sent: Thur 9/22/2011 10:50:47 PM
Subject: Re: We need to meet w/Bob S on inpingement by the end of next week

Mary Smith said she would plan to come in and work in the morning and be in meeting in person and Ephraim can call in. Thanks!

Martha Lee Workman
Executive Assistant/Scheduler for
Nancy K. Stoner, Acting Assistant Administrator
Office of Water (4101M)
Immediate Office
1200 Pennsylvania Avenue., NW
Washington, DC 20460
Cubicle 3219D EPA East
Telephone: (202) 564-3774
Fax: (202) 564-0488
E-mail: workman.martha@epa.gov

From: Nancy Stoner/DC/USEPA/US
To: Martha Workman/DC/USEPA/US@EPA
Cc: Ellen Gilinsky/DC/USEPA/US@EPA, "Ephraim King" <king.ephraim@epa.gov>
Date: 09/22/2011 06:25 PM
Subject: Re: We need to meet w/Bob S on inpingement by the end of next week

I'd like to meet in person w/anyone who is in the office. We can call the others
Nancy K. Stoner

----- Original Message -----
From: Martha Workman
Sent: 09/22/2011 05:07 PM EDT
To: Nancy Stoner
Cc: Ellen Gilinsky; "Ephraim King" <king.ephraim@epa.gov>
Subject: Re: We need to meet w/Bob S on inpingement by the end of next week

We have a conference call scheduled on calendar for tomorrow at 10:45 so Nancy and Ellen can talk to Ephraim and Mary Smith prior to scheduling a meeting with Bob Sussman on the Inpingement (316B) subject. Thanks

Martha

Martha Lee Workman
Executive Assistant/Scheduler for
Nancy K. Stoner, Acting Assistant Administrator
Office of Water (4101M)
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1200 Pennsylvania Avenue., NW
Washington, DC 20460
Cubicle 3219D EPA East
Telephone: (202) 564-3774
Fax: (202) 564-0488
E-mail: workman.martha@epa.gov

From: Nancy Stoner/DC/USEPA/US
To: "Ephraim King" <king.ephraim@epa.gov>, Ellen Gilinsky/DC/USEPA/US@EPA
Cc: Martha Workman/DC/USEPA/US@EPA
Date: 09/22/2011 03:10 PM
Subject: We need to meet w/Bob S on inpingement by the end of next week

I asked him re the timing. Pre-mtg needs to occur before then.

Cc: martha
Nancy K. Stoner

To: CN=Lynn Zipf/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ann Campbell/OU=DC/O=USEPA/C=US@EPA;CN=Ephraim King/OU=DC/O=USEPA/C=US@EPA;CN=Kendra Scott/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Ephraim King/OU=DC/O=USEPA/C=US@EPA;CN=Kendra Scott/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Kendra Scott/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Donald Maddox/OU=DC/O=USEPA/C=US
Sent: Fri 9/23/2011 12:04:32 PM
Subject: Re: Request for meeting

Lynn

Bob would like to do this on Tuesday. Bob will be out of the office on Thursday and would like to get to as much as possible early in the week.

Let me know if this is going to be a problem?

Don

Don Maddox
Office of Robert Sussman
Senior Advisor to the Administrator
U.S. Environmental Protection Agency
email: maddox.donald@epa.gov
Office: 202.564.8443
Direct: 202.564.7207
Cell: 202.731.6711

From: Lynn Zipf/DC/USEPA/US
To: Donald Maddox/DC/USEPA/US@EPA
Cc: Nancy Stoner/DC/USEPA/US@EPA, Kendra Scott/DC/USEPA/US@EPA, Ephraim King/DC/USEPA/US@EPA, Ann Campbell/DC/USEPA/US@EPA, Martha Workman/DC/USEPA/US@EPA
Date: 09/22/2011 11:23 AM
Subject: Request for meeting

Nancy would like to have a meeting next Thursday or Friday to discuss impingement for 316(b) Cooling Water Intake

Subject: Impingement for 316(b)

When: September 29 or September 30 for 45 minutes

Who: Julie Hewitt, Maryt Smith, Ephraim King, Ellen Gilinsky (is on travel next week), Nancy Stoner, Bob Sussman

Thank you

Lynn Zipf
Special Assistant
Office of Science and Technology
Office of Water
MC: 4301T

P: (202) 564-1509

To: CN=Donald Maddox/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ann Campbell/OU=DC/O=USEPA/C=US@EPA;CN=Ephraim King/OU=DC/O=USEPA/C=US@EPA;CN=Kendra Scott/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Ephraim King/OU=DC/O=USEPA/C=US@EPA;CN=Kendra Scott/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Kendra Scott/OU=DC/O=USEPA/C=US@EPA;CN=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Martha Workman/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Lynn Zipf/OU=DC/O=USEPA/C=US
Sent: Fri 9/23/2011 12:14:00 PM
Subject: Re: Request for meeting

Don - here is the rationale given as to why Thursday/Friday. There are meetings scheduled Ex. 5 - Deliberative
Ex. 5 - Deliberative These meetings are scheduled for Tuesday/Wednesday of next week. The thinking is to meet with Bob Sussman after gathering that information.

Lynn Zipf
Special Assistant
Office of Science and Technology
Office of Water
MC: 4301T

P: (202) 564-1509

From: Donald Maddox/DC/USEPA/US
To: Lynn Zipf/DC/USEPA/US@EPA
Cc: Ann Campbell/DC/USEPA/US@EPA, Ephraim King/DC/USEPA/US@EPA, Kendra Scott/DC/USEPA/US@EPA, Martha Workman/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 09/23/2011 08:04 AM
Subject: Re: Request for meeting

Lynn

Bob would like to do this on Tuesday. Bob will be out of the office on Thursday and would like to get to as much as possible early in the week.

Let me know if this is going to be a problem?

Don

Don Maddox
Office of Robert Sussman
Senior Advisor to the Administrator
U.S. Environmental Protection Agency

email: maddox.donald@epa.gov
Office: 202.564.8443
Direct: 202.564.7207
Cell: 202.731.6711

From: Lynn Zipf/DC/USEPA/US
To: Donald Maddox/DC/USEPA/US@EPA
Cc: Nancy Stoner/DC/USEPA/US@EPA, Kendra Scott/DC/USEPA/US@EPA, Ephraim King/DC/USEPA/US@EPA, Ann Campbell/DC/USEPA/US@EPA, Martha Workman/DC/USEPA/US@EPA
Date: 09/22/2011 11:23 AM
Subject: Request for meeting

Nancy would like to have a meeting next Thursday or Friday to discuss impingement for 316(b) Cooling Water Intake

Subject: Impingement for 316(b)

When: September 29 or September 30 for 45 minutes

Who: Julie Hewitt, Maryt Smith, Ephraim King, Ellen Gilinsky (is on travel next week), Nancy Stoner, Bob Sussman

Thank you

Lynn Zipf
Special Assistant
Office of Science and Technology
Office of Water
MC: 4301T

P: (202) 564-1509

To: CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ann Campbell/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Fri 9/23/2011 8:06:43 PM
Subject: Re: Call for agenda items for 9/26 Sussman/OW Weekly

316b

----- Original Message -----
From: Mahri Monson
Sent: 09/23/2011 03:58 PM EDT
To: Nancy Stoner
Cc: Ellen Gilinsky; Ann Campbell
Subject: Call for agenda items for 9/26 Sussman/OW Weekly

So far we have:
- Nutrient Indicators Dataset

Anything else? We can identify on Monday as well.

Mahri Monson
Special Assistant, Office of Water
(202) 564-2657

Mailing Address:
1200 Pennsylvania Avenue, NW, MC: 4101M, WDC 20460-0001

Visitors/FedEx/UPS/Courier Address:
1201 Constitution Ave., NW, Rm. 3311P East Bldg., WDC 20004-3302

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Help eliminate environmental violations - report tips and complaints at:

http://www.epa.gov/compliance/complaints/index.html

To: Nancy Stoner/DC/USEPA/US@EPA[]
Cc: CN=Ephraim King/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;Lynn Zipf/DC/USEPA/US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;Lynn Zipf/DC/USEPA/US@EPA[]; N=Julie Hewitt/OU=DC/O=USEPA/C=US@EPA;Lynn Zipf/DC/USEPA/US@EPA[]; ynn Zipf/DC/USEPA/US@EPA[]
From: CN=Maryt Smith/OU=DC/O=USEPA/C=US
Sent: Mon 9/26/2011 4:27:32 PM
Subject: 316b one pager for impingement proposal
CEG Impingment.docx

Nancy --

At Friday's meeting on 316b impingement you asked for a one pager on CEG's impingement proposal and next steps for Bob.

Mary

Mary T. Smith, Director
Engineering and Analysis Division
U.S. EPA
1200 PA Ave., NW (4303T)
Washington, D.C. 20460
Phone: 202-566-1056
Fax: 202-566-1053
http://www.epa.gov/waterscience

To: CN=Bob Sussman/OU=DC/O=USEPA/C=US@EPA[]
Cc: "Nancy Stoner" [Stoner.Nancy@epamail.epa.gov]
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Wed 10/5/2011 3:44:40 PM
Subject: Re: Fw: Fw: 316b letter
Gilinsky.Ellen@epa.gov

How did the meeting go yesterday?
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

Mailing Address: 1200 Pennsylvania Avenue, NW, Mail Code 4101M, Washington, DC 20460-0001
Physical/FedEx/Courier Address: 1201 Constitution Ave., NW, Rm. 3111 East Bldg., Washington, DC 20004-3302

To: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Bob Sussman/OU=DC/O=USEPA/C=US
Sent: Wed 10/5/2011 7:46:25 PM
Subject: Re: Fw: Fw: 316b letter
Gilinsky.Ellen@epa.gov

Was pretty high-level. They were all CEOs.

----- Original Message -----
From: Ellen Gilinsky
Sent: 10/05/2011 11:44 AM EDT
To: Bob Sussman
Cc: Nancy Stoner
Subject: Re: Fw: Fw: 316b letter
How did the meeting go yesterday?
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

Mailing Address: 1200 Pennsylvania Avenue, NW, Mail Code 4101M, Washington, DC 20460-0001
Physical/FedEx/Courier Address: 1201 Constitution Ave., NW, Rm. 3111 East Bldg., Washington, DC 20004-3302

To: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Bcc: []
From: CN=Ann Campbell/OU=DC/O=USEPA/C=US
Sent: Fri 10/7/2011 3:07:17 PM
Subject: Re: Tuesday's OW-Bob Mtng
Gilinsky.Ellen@epa.gov

What about the 316b letter--anything needed there? Or the KY 402 issues?--OW is drafting the response to the Beshear letter and Bob met with Gwen yesterday to discuss One more, just in case there wasn't enough to think about---is there a need to discuss next steps after **Ex. 5 - Deliberative**

Ex. 5 - Deliberative

Ann Campbell
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Mail Code: 1101

P: (202) 566-1370
C: (202) 657-3117
F: (202) 501-1428

From: Ellen Gilinsky/DC/USEPA/US
To: Ann Campbell/DC/USEPA/US
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:52 AM
Subject: Re: Tuesday's OW-Bob Mtng

lets add florida it wouldnt be a meeting without that! in particular progress on **Ex. 5 - Deliberative**

Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

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From: Ann Campbell/DC/USEPA/US
To: Mahri Monson/DC/USEPA/US@EPA
Cc: Ellen Gilinsky/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:10 AM

Subject: Tuesday's OW-Bob Mtng

Mahri - just getting to ball rolling on an agenda for Tuesday. I think Bob would like to catch up on Ex. 5 - Deliberative

Ex. 5 - Deliberative

Ann

Ann Campbell
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Mail Code: 1101

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F: (202) 501-1428

To: CN=Ann Campbell/OU=DC/O=USEPA/C=US[]
Cc: CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US[]
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Fri 10/7/2011 3:09:53 PM
Subject: Re: Tuesday's OW-Bob Mtng
Gilinsky.Ellen@epa.gov
Gilinsky.Ellen@epa.gov

yes to 316 for me
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

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From: Ann Campbell/DC/USEPA/US
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Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 11:07 AM
Subject: Re: Tuesday's OW-Bob Mtng

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Ex. 5 - Deliberative

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Special Assistant
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From: Ellen Gilinsky/DC/USEPA/US
To: Ann Campbell/DC/USEPA/US
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:52 AM

Subject: Re: Tuesday's OW-Bob Mtng

lets add florida it wouldnt be a meeting without that! in particular progress on Ex. 5 - Deliberative

Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

Mailing Address: 1200 Pennsylvania Avenue, NW, Mail Code 4101M, Washington, DC 20460-0001
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From: Ann Campbell/DC/USEPA/US
To: Mahri Monson/DC/USEPA/US@EPA
Cc: Ellen Gilinsky/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:10 AM
Subject: Tuesday's OW-Bob Mtng

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Ex. 5 - Deliberative

Ann

Ann Campbell
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Mail Code: 1101

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F: (202) 501-1428

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA[]; N=Mahri Monson/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Ann Campbell/OU=DC/O=USEPA/C=US
Sent: Fri 10/7/2011 3:24:28 PM
Subject: Re: Tuesday's OW-Bob Mtng
Gilinsky.Ellen@epa.gov
Gilinsky.Ellen@epa.gov

Will do.

Ann Campbell
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Mail Code: 1101

P: (202) 566-1370
C: (202) 657-3117
F: (202) 501-1428

From: Nancy Stoner/DC/USEPA/US
To: Ellen Gilinsky/DC/USEPA/US@EPA
Cc: Ann Campbell/DC/USEPA/US@EPA, Mahri Monson/DC/USEPA/US@EPA
Date: 10/07/2011 11:20 AM
Subject: Re: Tuesday's OW-Bob Mtng

yes, re MTM. I thought we had finished the 316b letter. Ann, can you find out from OCIR if there are outstanding issues? Bob and I both gave Arvin our comments.

Nancy Stoner
Acting Assistant Administrator for Water
US Environmental Protection Agency

Telephone: (202) 564-5700
FAX: (202) 564-0488

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Washington, DC 20004-3302

From: Ellen Gilinsky/DC/USEPA/US
To: Ann Campbell/DC/USEPA/US
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US
Date: 10/07/2011 11:09 AM

Subject: Re: Tuesday's OW-Bob Mtng

yes to 316 for me
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
Room 3111 East
Telephone: (202) 564-2549
Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

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From: Ann Campbell/DC/USEPA/US
To: Ellen Gilinsky/DC/USEPA/US@EPA
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 11:07 AM
Subject: Re: Tuesday's OW-Bob Mtng

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Ex. 5 - Deliberative

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Special Assistant
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To: Ann Campbell/DC/USEPA/US
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:52 AM
Subject: Re: Tuesday's OW-Bob Mtng

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Ellen Gilinsky

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Office of Water

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To: Mahri Monson/DC/USEPA/US@EPA
Cc: Ellen Gilinsky/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:10 AM
Subject: Tuesday's OW-Bob Mtng

Mahri - just getting to ball rolling on an agenda for Tuesday. I think Bob would like to catch up on Ex. 5 - Deliberative

Ex. 5 - Deliberative

Ann

Ann Campbell
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Mail Code: 1101

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C: (202) 657-3117
F: (202) 501-1428

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Mahri Monson/OU=DC/O=USEPA/C=US@EPA[]; N=Mahri Monson/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Ann Campbell/OU=DC/O=USEPA/C=US
Sent: Fri 10/7/2011 3:31:12 PM
Subject: Re: Tuesday's OW-Bob Mtng
Gilinsky.Ellen@epa.gov
Gilinsky.Ellen@epa.gov

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Cc: Ann Campbell/DC/USEPA/US@EPA, Mahri Monson/DC/USEPA/US@EPA
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Nancy Stoner
Acting Assistant Administrator for Water
US Environmental Protection Agency

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Washington, DC 20004-3302

From: Ellen Gilinsky/DC/USEPA/US
To: Ann Campbell/DC/USEPA/US
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US

Date: 10/07/2011 11:09 AM
Subject: Re: Tuesday's OW-Bob Mtng

yes to 316 for me
Ellen Gilinsky
Senior Policy Advisor
Office of Water

US Environmental Protection Agency
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Email: Gilinsky.Ellen@epa.gov

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To: Ann Campbell/DC/USEPA/US
Cc: Mahri Monson/DC/USEPA/US@EPA, Nancy Stoner/DC/USEPA/US@EPA
Date: 10/07/2011 10:52 AM
Subject: Re: Tuesday's OW-Bob Mtng

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From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Fri 10/7/2011 3:31:55 PM
Subject: Re: Tuesday's OW-Bob Mtng
Gilinsky.Ellen@epa.gov
Gilinsky.Ellen@epa.gov
Gilinsky.Ellen@epa.gov

plus I would like to hear what happened at their meeting with the CEOs on the topic
Ellen Gilinsky
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Office of Water

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To: CN=Arvin Ganesan/OU=DC/O=USEPA/C=US@EPA[]
Cc: CN=Bob Sussman/OU=DC/O=USEPA/C=US@EPA;CN=Michael Goo/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Michael Goo/OU=DC/O=USEPA/C=US@EPA;CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]; N=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Greg Spraul/OU=DC/O=USEPA/C=US
Sent: Wed 10/12/2011 12:07:22 PM
Subject: Final version of Andrews 316b letter - ready for signature
316bv3s.docx
316bv3s-final.doc

All - Attached is the clean final version.

Nancy - I have prepared a hard copy package for your signature and I will bring it to you between 10:30 and 11 during your meeting with Greg Peck for you to sign before you leave for Philly.

Greg Spraul
Congressional Liaison
Water, Pesticides, and Toxics Team
Office of Congressional Affairs
U.S. Environmental Protection Agency
email: spraul.greg@epa.gov
Ph: 202.564.0255

From: Arvin Ganesan/DC/USEPA/US
To: Nancy Stoner/DC/USEPA/US@EPA
Cc: Bob Sussman/DC/USEPA/US@EPA, Michael Goo/DC/USEPA/US@EPA, Greg Spraul/DC/USEPA/US@EPA
Date: 10/11/2011 02:18 PM
Subject: Re: Andrews comments w/Bob's edits

I think we can close this out now. Nancy, I took all your edits and only made a couple minor edits. Can you please sign this for tomorrow?

Thanks.

-----Arvin Ganesan/DC/USEPA/US wrote: -----
To: Nancy Stoner/DC/USEPA/US@EPA
From: Arvin Ganesan/DC/USEPA/US
Date: 10/05/2011 09:58PM
Cc: Bob Sussman/DC/USEPA/US@EPA, Michael Goo/DC/USEPA/US@EPA
Subject: Re: Andrews comments w/Bob's edits

thanks nancy. we'll get back to you tomorrow.

-----Martha Workman/DC/USEPA/US wrote: -----
To: Arvin Ganesan/DC/USEPA/US@EPA
From: Nancy Stoner/DC/USEPA/US

Sent by: Martha Workman/DC/USEPA/US
Date: 10/05/2011 05:49PM
Subject: Andrews comments w/Bob's edits

(See attached file: 2011_10_05_17_48_05.pdf)

Nancy Stoner
Acting Assistant Administrator for Water
US Environmental Protection Agency

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[attachment "2011_10_05_17_48_05.pdf" removed by Arvin Ganesan/DC/USEPA/US]

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US[]
Cc: []
From: CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US
Sent: Wed 10/12/2011 9:49:17 PM
Subject: Re: Fw: next version of 316(b)
Gilinsky.Ellen@epa.gov

did htis letter ever get sent?
Ellen Gilinsky
Senior Policy Advisor
Office of Water

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Cell : (202) 236-6882
Email: Gilinsky.Ellen@epa.gov

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From: Nancy Stoner/DC/USEPA/US
To: Ellen Gilinsky/DC/USEPA/US@EPA
Date: 10/05/2011 04:28 PM
Subject: Fw: next version of 316(b)

OK with this?
Nancy K. Stoner

----- Original Message -----
From: Arvin Ganesan
Sent: 10/05/2011 02:59 PM EDT
To: Nancy Stoner; Bob Sussman; Michael Goo
Subject: next version of 316(b)

Nancy,
thanks for the talk yesterday. Attached is a new version of the letter, which is made on top of some of your edits from yesterday. I think as phrased, it preserves the EPA decision making structure. Do you feel comfortable with version?

[attachment "316b-includ_ganesan_edits.docx" deleted by Ellen Gilinsky/DC/USEPA/US]

Industry Stakeholder Coffee

Wednesday, November 16, 2011
9:00 - 10:00 a.m.
Room 3233 EPA East, 1201 Constitution Avenue, N.W.
Call-in Number: Non-Responsive conference code: Non-Responsive

AGENDA

STORMWATER UPDATE

1. Status of national stormwater (post construction) rulemaking and report to Congress

WATER QUALITY UPDATE

2. Status of Florida nutrients criteria and independent applicability

3. Status of proposal to revise water quality standards regulation

4. Status of any water quality criteria guidance documents under review

5. Update: selenium, ammonia, and chloride criteria

6. Update: Pinto Creek/122.4(i)

REGULATION UPDATE

7. Waters of the United States

8. Effluent Guidelines Limitations (ELGs) for the utility sector

9. Cooling Water Intake Structures Rule 316(b)

DRINKING WATER UPDATE

10. EPA's IRIS chloroform review

11. Update on perchlorate MCL process

To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA;CN=Paul Anastas/OU=DC/O=USEPA/C=US@EPA;CN=Michael Goo/OU=DC/O=USEPA/C=US@EPA;CN=Bob Rose/OU=DC/O=USEPA/C=US@EPA;CN=Jennifer Orme-Zavaleta/OU=RTP/O=USEPA/C=US@EPA;CN=Leslie Gillespie-Marthaler/OU=DC/O=USEPA/C=US@EPA;CN=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]; N=Paul Anastas/OU=DC/O=USEPA/C=US@EPA;CN=Michael Goo/OU=DC/O=USEPA/C=US@EPA;CN=Bob Rose/OU=DC/O=USEPA/C=US@EPA;CN=Jennifer Orme-Zavaleta/OU=RTP/O=USEPA/C=US@EPA;CN=Leslie Gillespie-Marthaler/OU=DC/O=USEPA/C=US@EPA;CN=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]; N=Michael Goo/OU=DC/O=USEPA/C=US@EPA;CN=Bob Rose/OU=DC/O=USEPA/C=US@EPA;CN=Jennifer Orme-Zavaleta/OU=RTP/O=USEPA/C=US@EPA;CN=Leslie Gillespie-Marthaler/OU=DC/O=USEPA/C=US@EPA;CN=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]; N=Bob Rose/OU=DC/O=USEPA/C=US@EPA;CN=Jennifer Orme-Zavaleta/OU=RTP/O=USEPA/C=US@EPA;CN=Leslie Gillespie-Marthaler/OU=DC/O=USEPA/C=US@EPA;CN=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]; N=Jennifer Orme-Zavaleta/OU=RTP/O=USEPA/C=US@EPA;CN=Leslie Gillespie-Marthaler/OU=DC/O=USEPA/C=US@EPA;CN=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]; N=Leslie Gillespie-Marthaler/OU=DC/O=USEPA/C=US@EPA;CN=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]; N=Philip Metzger/OU=DC/O=USEPA/C=US@EPA[]
Cc: []
From: CN=Charles Imohiosen/OU=DC/O=USEPA/C=US
Sent: Fri 11/18/2011 3:32:38 AM
Subject: WATER: Western utilities face technology, planning challenges in water-constrained future
mime.htm
EMAIL EMAIL
PRINT PRINT
READ FULL EDITION READ FULL EDITION
CUSTOMIZE EDITION CUSTOMIZE EDITION
report
report
10-Year Regional Transmission Plan

WATER:

Western utilities face technology, planning challenges in water-constrained future

Tasha Eichenseher, special to E&E

Published: Thursday, November 17, 2011

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Growing water demand among Western electric power plants threatens to further heighten long-standing

tensions among water users in the arid West and nationwide, according to two recent reports exploring the relationship between power generation and water consumption.

In water-stressed Arizona and Colorado -- two states that may be ahead of the game, according to report authors -- utilities are starting to take a closer look at how to avoid conflict and plan for an increasingly uncertain future.

"There is a growing recognition in states like Arizona and Colorado that have suffered from drought in recent years that these energy choices are long-term," said Stacy Tellinghuisen, a senior energy and water policy analyst at Western Resource Advocates and a co-author of a Union of Concerned Scientists report on freshwater consumption by U.S. power plants, released Tuesday.

The 4,000-megawatt Palo Verde Nuclear Generating Station was built in the 1970s and uses nearly 20 billion gallons of treated wastewater every year from Phoenix and other cities. Photo courtesy of Arizona Public Service.

"A power plant is in the ground for 40 to 50 years or longer; we are committing water to that use for decades," Tellinghuisen said.

In arid Arizona -- home to the world's only nuclear plant that relies on recycled water for cooling, according to utility officials -- worrying about the water limitations of energy production and security is nothing new.

The 4,000-megawatt Palo Verde Nuclear Generating Station was built in the 1970s and uses nearly 20 billion gallons of treated wastewater every year from Phoenix and other cities.

A nearby gas-fired thermoelectric plant that went online in 2002 uses recycled cooling water up to 25 times before discharging it, said Robert Lott, water resources manager at Arizona Public Service Co., which supplies electricity to Phoenix and the surrounding area.

It's not easy to use recycled water, Lott explained. "You have to understand the chemistry. We built a treatment facility ... that reduces ammonia, the hardness of water and silica so we can use the water as efficiently as possible."

Because of limited water resources, Arizona withdraws the least amount of water per kilowatt hour of any state, at 0.5 gallon per kilowatt-hour, according to Heather Cooley, the lead author of a Pacific Institute report on the energy-water nexus released earlier this month.

In general, Western states withdraw less water than the national average of 23 gallons per kilowatt-hour because most thermoelectric plants in the region employ dry cooling or closed-loop cooling systems. In the East and South, once-through systems that rely on surface water or groundwater are more common.

Water and renewables

Water-saving energy strategies can come at a cost even with renewables.

Last year, Hualapai Valley Solar LLC proposed building a 340-megawatt concentrated solar power plant in Mohave County, Ariz., that would have required more than 2.1 million gallons a day from the Hualapai Valley Aquifer.

Developers proposed using treated effluent from the city of Kingman, but in the end the Arizona Corporation Commission, which approves new plants, decided to approve the project only if it could employ dry or hybrid cooling. Whether the project can meet the stricter water requirements remains unclear due to increased costs and potential efficiency losses associated with the required technologies, officials said.

In Colorado, Xcel Energy's decision last year to convert 900 MW of coal-fired generation to natural gas was based entirely on emissions, according to Randy Rhodes, senior water resources analyst at Xcel. But the move also led to a 7 percent water-use reduction due to generating station closures and switching from conventional steam generation to combined cycle systems that convert waste heat into a steam generation source, he explained.

While acknowledging that more unpredictable precipitation patterns are on the horizon, Rhodes said he hasn't observed a tightening of water supplies beyond what the utility already faces under current conditions. "Water has always been a concern [in Colorado]," he said.

"It hasn't affected our choice of technology to date, because it hasn't been necessary. I feel very confident that we have a reliable water supply and can meet all needs through [water] rights and contracts."

Rhodes was also stressed that water use for thermoelectric power plants remains relatively small compared to consumption by agricultural and municipal users.

Planning for the future

Even so, public utility commissions in both Arizona and Colorado have recently incorporated water considerations into their planning documents.

In 2010, the Colorado Public Utilities Commission adopted a rule requiring investor-owned utilities to report on water usage for existing and proposed plants and renewable energy installations. Water rights for new facilities are governed by the Colorado Division of Water Resources, but PUC has acknowledged, "it may be helpful to understand the water consumption associated with existing and proposed generation resources when considering the overall resource selection."

The Arizona Corporation Commission, meanwhile, has asked APS to report back on energy-water nexus issues, and the commission also accepts information on the estimated financial value of water used in electricity generation.

The Pacific Institute's Cooley said she is encouraged by recent recommendations from the Western Governors' Association and the Western Electricity Coordinating Council -- which helps coordinate the utility operations in parts of 14 Western states as well as parts of Canada and Mexico -- to look at water availability when siting power plants and transmission lines.

In WECC's 10-Year Regional Transmission Plan, the organization outlines the preliminary results of an energy-water analysis conducted with the WGA's Western States Water Council, U.S. Department of Energy and national laboratories.

The results are supposed to help identify regions where electricity generation is at risk because of potential water scarcity and to "prepare governors, industry, and regulators to understand the long-term challenges and potential tradeoffs associated with electricity and water supply decisions."

The WGA water research group found that consumptive water demands of thermoelectric power plants could rise 20 percent by 2020 to 46 million gallons a day. Most of the projected growth is expected for watersheds either already experiencing or expected to experience water-related stress, such as the Colorado River Basin.

Despite such projections, some policy experts seem optimistic.

"The good news is that there is a huge potential to reduce water use," said Cooley. "We're starting to see examples of where power plants are installing dry cooling systems or using recycled water. We'll start to see old plants retrofitted, or hybrid cooling. And we're starting to see renewables, not explicitly because of water benefits, but that is a co-benefit."

Tasha Eichenseher is a freelance journalist based in Boulder, Colo.

Charles Imohiosen
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(202) 564-9025

To: "Nancy Stoner" [Stoner.Nancy@epamail.epa.gov]; Gina McCarthy" [McCarthy.Gina@epamail.epa.gov]
Cc: "Bob Perciasepe" [Perciasepe.Bob@epamail.epa.gov]
From: CN=Charles Imohiosen/OU=DC/O=USEPA/C=US
Sent: Mon 11/21/2011 4:41:45 PM
Subject: Have heard about these UCS reports?

News

Environmentalists Hope Major Power Plant Water Study Tightens EPA Rule

Posted: November 18, 2011

A report by the Union of Concerned Scientists (UCS) and other researchers finds that the massive water use needs of coal-fired, nuclear and other power plants not only create ecosystem stresses but also put water-dependent electricity generators at risk from water supply shortages. Environmentalists hope the findings will influence utility technology choices and bolster a stricter policy in the final EPA cooling water intake rule regarding the best technology to prevent damage to rivers and lakes.

Despite power plants' massive water use, federal data on the activity are fraught with discrepancies and deficiencies, according to the report. Water issues are also a primary controversy for shale gas development -- further underscoring the critical tie between energy and water.

The Nov. 16 report, “Freshwater use by U.S. power plants: Electricity’s thirst for a precious resource,” was developed by the Energy and Water in a Warming World Initiative, a UCS collaborative effort with more than a dozen independent experts. The report adopts new analytical approaches to profile “the water use characteristics of virtually every electricity generator in the United States” in 2008, the date of the latest data collected by the Energy Information Administration (EIA), the Department of Energy's statistical arm.

It is “the first systematic assessment of both the effects of power plant cooling on water resources across the United States and the quality of information available to help public- and private-sector decision makers make water-smart energy choices,” according to the report.

The report is intended “to shine a much brighter spotlight” on power plants' use of freshwater, not only on the scale of that use but also on “how little we know about that” use and “the fact that we've been flying blind” on those issues, says a UCS senior researcher. EIA in 2002 ceased requiring nuclear power plants to report their water use, a policy not reversed until this year. The report makes a clear case for “why we need better information on the connection” between power plants and freshwater supplies, the source says.

A DOE official says the analysis of the deficiencies in data quality is significant and is “a new area people haven't looked at before.” The findings about the “huge discrepancies” in data collection and quality will help EIA and the U.S. Geological Survey (USGS) ask the right questions about power plant freshwater use, the source says.

The UCS analysts found that, on average, water-cooled power plants in 2008 every day withdrew 60-170 billion gallons of freshwater from rivers, lakes, streams, and aquifers, and consumed 2.8-5.9 billion gallons of that water, with coal plants alone accounting for 67 percent of those withdrawals and 65 percent of that consumption. “Withdrawal” refers to the total amount of water taken out of a river, lake or other water body for cooling, some of which is returned. “Consumption” refers to the amount of water lost to evaporation during cooling processes.

Power plants' dependence on water “could get them into trouble” because the imbalance between supply and demand will only increase with population growth, climate change and other pressures, the source says. “Collisions are happening now” between power plant demands and limited supplies, the source

says, with a number of them described in the report.

Without recommending any particular technology, the report notes: “Choices about the future mix of plants used to generate electricity can ease the tension between water and energy. Renewable energy technologies such as wind turbines and photovoltaic panels use little or no water and emit no carbon pollution in producing electricity.”

In addition, the report says: “Even fossil-fueled technologies provide opportunities to reduce water demand while also addressing carbon missions. Natural gas combined-cycle plants have lower carbon emissions than coal plants, for example, and, because of greater efficiencies, produce less waste heat. Novel cooling technologies, such as dry cooling and hybrid systems, can also reduce pressure on water systems.”

'Policy Relevant,' Not 'Policy Prescriptive'

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Cc: CN=Bob Rose/OU=DC/O=USEPA/C=US@EPA;CN=Bob Sussman/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Maryt Smith/OU=DC/O=USEPA/C=US@EPA[]; N=Bob Sussman/OU=DC/O=USEPA/C=US@EPA;CN=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Maryt Smith/OU=DC/O=USEPA/C=US@EPA[]; N=Ellen Gilinsky/OU=DC/O=USEPA/C=US@EPA;CN=Maryt Smith/OU=DC/O=USEPA/C=US@EPA[]; N=Maryt Smith/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Ephraim King/OU=DC/O=USEPA/C=US
Sent: Mon 11/21/2011 8:09:50 PM
Subject: Re: Fw: Have heard about these UCS reports?

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Fax: (202) 566-0441
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To: Ephraim King/DC/USEPA/US@EPA, Maryt Smith/DC/USEPA/US@EPA, Ellen Gilinsky/DC/USEPA/US@EPA, Bob Rose/DC/USEPA/US@EPA
Cc: Bob Sussman/DC/USEPA/US@EPA
Date: 11/21/2011 01:59 PM
Subject: Fw: Have heard about these UCS reports?

fyi

Nancy Stoner
Acting Assistant Administrator for Water
US Environmental Protection Agency

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Washington, DC 20004-3302
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From: Charles Imohiosen/DC/USEPA/US
To: "Nancy Stoner" <Stoner.Nancy@epamail.epa.gov>, "Gina McCarthy" <McCarthy.Gina@epamail.epa.gov>
Cc: "Bob Perciasepe" <Perciasepe.Bob@epamail.epa.gov>
Date: 11/21/2011 11:41 AM
Subject: Have heard about these UCS reports?

News

Environmentalists Hope Major Power Plant Water Study Tightens EPA Rule

Posted: November 18, 2011

A report by the Union of Concerned Scientists (UCS) and other researchers finds that the massive water use needs of coal-fired, nuclear and other power plants not only create ecosystem stresses but also put water-dependent electricity generators at risk from water supply shortages. Environmentalists hope the findings will influence utility technology choices and bolster a stricter policy in the final EPA cooling water intake rule regarding the best technology to prevent damage to rivers and lakes.

Despite power plants' massive water use, federal data on the activity are fraught with discrepancies and deficiencies, according to the report. Water issues are also a primary controversy for shale gas development -- further underscoring the critical tie between energy and water.

The Nov. 16 report, “Freshwater use by U.S. power plants: Electricity’s thirst for a precious resource,” was developed by the Energy and Water in a Warming World Initiative, a UCS collaborative effort with more than a dozen independent experts. The report adopts new analytical approaches to profile “the water use characteristics of virtually every electricity generator in the United States” in 2008, the date of the latest data collected by the Energy Information Administration (EIA), the Department of Energy's statistical arm.

It is “the first systematic assessment of both the effects of power plant cooling on water resources across the United States and the quality of information available to help public- and private-sector decision makers make water-smart energy choices,” according to the report.

The report is intended “to shine a much brighter spotlight” on power plants' use of freshwater, not only on the scale of that use but also on “how little we know about that” use and “the fact that we've been flying blind” on those issues, says a UCS senior researcher. EIA in 2002 ceased requiring nuclear power plants to report their water use, a policy not reversed until this year. The report makes a clear case for “why we need better information on the connection” between power plants and freshwater supplies, the source says.

A DOE official says the analysis of the deficiencies in data quality is significant and is “a new area people haven't looked at before.” The findings about the “huge discrepancies” in data collection and quality will help EIA and the U.S. Geological Survey (USGS) ask the right questions about power plant freshwater use, the source says.

The UCS analysts found that, on average, water-cooled power plants in 2008 every day withdrew 60-170 billion gallons of freshwater from rivers, lakes, streams, and aquifers, and consumed 2.8-5.9 billion gallons of that water, with coal plants alone accounting for 67 percent of those withdrawals and 65 percent of that consumption. “Withdrawal” refers to the total amount of water taken out of a river, lake or other water body for cooling, some of which is returned. “Consumption” refers to the amount of water lost to evaporation during cooling processes.

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From: CN=Maryt Smith/OU=DC/O=USEPA/C=US
Sent: Mon 11/21/2011 8:27:46 PM
Subject: Re: Fw: Have heard about these UCS reports?

Wasn't aware of it but it's at http://www.ucsusa.org/clean_energy/technology_and_impacts/impacts/freshwater-use-by-us-power-plants.html and I am printing a copy now.

Mary T. Smith, Director
Engineering and Analysis Division
U.S. EPA
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Washington, D.C. 20460
Phone: 202-566-1056
Fax: 202-566-1053
http://www.epa.gov/waterscience

From: Ephraim King/DC/USEPA/US
To: Nancy Stoner/DC/USEPA/US@EPA
Cc: Bob Rose/DC/USEPA/US@EPA, Bob Sussman/DC/USEPA/US@EPA, Ellen Gilinsky/DC/USEPA/US@EPA, Maryt Smith/DC/USEPA/US@EPA
Date: 11/21/2011 03:04 PM
Subject: Re: Fw: Have heard about these UCS reports?

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Ephraim King
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fyi

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Washington, DC 20004-3302
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To: "Nancy Stoner" <Stoner.Nancy@epamail.epa.gov>, "Gina McCarthy" <McCarthy.Gina@epamail.epa.gov>
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Sent via Blackberry

To: Bob Rose/DC/USEPA/US@EPA[]
Cc: Nancy Stoner/DC/USEPA/US@EPA[]
From: "Fleischli, Steve"
Sent: Wed 5/2/2012 6:37:11 PM
Subject: Water-Energy Nexus
Final Comment Letter Long.pdf
sfleischli@nrdc.org
www.nrdc.org

Bob,

It was nice to meet you today at the EPA brownbag lunch on water. Attached is the comment letter I mentioned regarding power plant cooling water issues. I think both you and Nancy might find the discussion on pages 16-22 and 110-117 relevant to your water-energy nexus work. Please let me know if you have any questions or would like additional details.

Sincerely,

Steve

Steve Fleischli | Senior Attorney, Water Program | Natural Resources Defense Council

Office: 202.289.2394 Cell: 415.577.2206 | 1152 15th Street NW, Suite 300, Washington, DC 20005

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

National Pollutant Discharge Elimination System – Cooling Water Intake Structures at Existing Facilities and Phase I Facilities

76 Fed. Reg. 22,174 (April 20, 2011)

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COMMENTS OF RIVERKEEPER, INC., NATURAL RESOURCES DEFENSE COUNCIL, SIERRA CLUB, WATERKEEPER ALLIANCE, EARTHJUSTICE, ENVIRONMENTAL LAW AND POLICY CENTER, CLEAN AIR TASK FORCE, NETWORK FOR NEW ENERGY CHOICES, CALIFORNIA COASTKEEPER ALLIANCE, SOUNDKEEPER, INC., DELAWARE RIVERKEEPER NETWORK, SAVE THE BAY – RHODE ISLAND, FRIENDS OF CASCO BAY, NY/NJ BAYKEEPER, HACKENSACK RIVERKEEPER, SANTA MONICA BAYKEEPER, SAN DIEGO BAYKEEPER, SCENIC HUDSON, AMERICAN LITTORAL SOCIETY, AND CONSERVATION LAW FOUNDATION

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[1] To aid the reader, we have included here a one-page abridged summary of the Table of Contents, containing all of the major headings and condensed versions of some of the subheadings.

EXECUTIVE SUMMARY

When EPA promulgates the final version of this rule in 2012, four decades will have passed since Congress first directed the agency to stop power plant fish kills, yet the staggering aquatic mortality continues unabated as if it were still 1972. Today, Americans use electricity to power their cell phones and tablet PCs instead of rabbit-eared televisions, but cooling water regulation remains frozen in time as the plants supplying that power continue to kill enormous numbers of fish, overheat our waterways, and severely damage aquatic ecosystems using exactly the same once-through cooling systems as they did two generations ago. Unfortunately, the proposed rule[2] does little to solve this problem, despite the ready availability of modern technology that can nearly eliminate it.

In January 1993, when George H. W. Bush was still president, Riverkeeper and several of the other commenters sued EPA to compel issuance of the intake structure regulations mandated by the 1972 Clean Water Act.[3] Late last year, Administrator Lisa Jackson wrote to Representative Fred Upton of Michigan, who had requested that EPA delay issuance of the Proposed Rule beyond the March 2011 deadline that was agreed upon after the courts remanded EPA's prior rule for existing power plant intake structures. The Administrator refused to postpone the new rule, explaining to the Congressman:

> By the time the agency takes final action in July 2012, industry will have been waiting nearly twenty years [since Riverkeeper's 1993 lawsuit] for the *regulatory certainty that facilitates sound investment decisions*. The public will have been waiting just as long for *reassurance that the aquatic environment is being protected*. I do not want to delay any longer.[4]

Astonishingly, having recognized the need for both regulatory certainty and environmental protection – and the need to end decades of inaction – EPA has now issued a proposal that could hardly be less certain, less protective, or less expeditious. Contrary to the Clean Water Act's mandate, the Proposed Rule entrusts states with the task of stopping the annual slaughter of a trillion aquatic organisms by 1,200 power plants and manufacturers – one plant at a time. Worse yet, the Proposed Rule then burdens those state agencies with a complex yet indeterminate, subjective, standardless and undeniably lengthy case-by-case process that EPA knows full well cannot be effectively accomplished. The only "regulatory certainty" EPA has bestowed upon industry is the certainty of knowing that they can continue to run their plants with antiquated technology and thereby kill fish with impunity. Meanwhile, the public has been deprived of any semblance of reassurance that the aquatic environment is being protected.

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[2] *See* 76 Fed. Reg. 22,174 (April 20, 2011) (National Pollutant Discharge Elimination System – Cooling Water Intake Structures at Existing Facilities and Phase I Facilities) (the "Proposed Rule").

[3] *See Cronin v. Reilly*, 93 Civ. 0314 (SDNY).

[4] Letter from Administrator Lisa P. Jackson to Congressman Fred Upton, December 16, 2010, at 1 (emphasis added), submitted as Exhibit 1 to these comments. Hereinafter, all citiations to comment exhibits include the exhibit number in this format: (Exh. #). In additon, Appendices A through I are also submitted herewith.

These comments make the following key points:[5]

The Proposed Rule is Illegal and Will Not Protect the Environment

Approach to "Best Technology Available" (BTA)

- ***EPA proposes to unlawfully reject uniform, national, categorical, technology-based, and technology-forcing standards*** in favor of case-by-case assessments of consequential water quality effects. EPA begins with an unlawful premise that a technology must be capable of being implemented universally as a prerequisite for setting national categorical standards and proceeds to ignore nearly all of the fundamental precepts that Congress established as the foundation of the Clean Water Act's technology-based framework.

- ***EPA's reliance on open-ended cost-benefit considerations is unlawful***. While not prohibited, cost-benefit analysis can be used only as a secondary tool to screen out absurd results and not as a primary decision-making criterion based on the flawed cost-benefit balancing exercise EPA has attempted here. Congress knew that attempts to quantify and monetize environmental benefits would hinder regulation, rather than improve it. EPA's cost-benefit folly in this rulemaking illustrates exactly why Congress meant to constrain EPA's discretion in that regard.

Entrainment

- ***The Proposed Rule does little to change the unacceptable status quo and protect the aquatic environment from entrainment. EPA should establish an entrainment standard based on closed-cycle cooling as envisioned in the agency's Option 3.*** The agency had before it a regulatory option – a national categorical standard based on the performance of closed-cycle cooling systems (Option 3) – that would protect the environment at a reasonable cost to industry, create jobs, and cause no significant adverse effects on the environment, electric reliability, or consumer prices. EPA unlawfully rejected that option in favor of preserving the status quo. Closed-cycle cooling is a feasible and readily affordable technology. A national, categorical entrainment standard based on that technology could include a narrow safety-valve variance to properly take account of site-specific factors for those plants fundamentally different than the majority. Parameters for such a variance are proposed below.

- ***Contrary to industry's hyperbolic claims, Option 3 would not cause electric reliability problems and would barely increase electricity prices.*** EPA estimates that if the total cost of Option 3 were to be passed on to ratepayers, those costs would total only $1.47 per month per household. Conversely, if 100 percent of the costs fell upon power companies, the majority of parent entities would incur annualized costs of less than one percent of revenues. Further, assuming none of those costs could be passed on, plant retirements caused by Option

[5] These comments are submitted without waiver of, or prejudice to, any previously stated positions (or, potentially, any future positions) taken in litigation or adjudication with respect to contested aspects of power plant permitting and cooling water intake regulation (including, without limitation, the illegality of formal cost-benefit analyses in this context). The commenters reserve all rights in this regard.

3 would represent less than 1.5 percent of total capacity, which could be easily replaced by new, cleaner generation.

- ***EPA's economic findings are unambiguous: the stronger the regulation, the greater the boost to the economy and job creation***. At either discount rate EPA used in its analysis, Option 3 creates jobs and stimulates the economy to a greater degree than any of the other options. At a 7 percent discount rate, it produces 10,102 new jobs under EPA's analysis, but the actual benefits to the economy of Option 3 are likely much greater. Option 3 is therefore a job-creating rule that will improve the economy.

- ***EPA's national cost-benefit analysis is deeply flawed and illegal.*** These comments and the attached reports of the Stockholm Environment Institute ("SEI") and Powers Engineering identify significant flaws in EPA's national cost-benefit analysis. Making only partial and conservative corrections to EPA's analysis, the monetizable benefits of a national standard based on the performance of closed-cycle cooling systems (Option 3) exceed its costs.

- ***In place of Option 3 (or Option 2, a watered-down version of Option 3), EPA has illegally substituted Option 1, a case-by-case decision making process that is legally infirm.*** A nationally uniform entrainment standard based on the performance of closed-cycle cooling systems, like Option 3, is technologically and economically feasible. Therefore, EPA's case-by-case approach to standard setting (Option 1) is a wholesale abdication of its statutory duties.

- ***The Proposed Rule will turn permitting proceedings into an endless quagmire because states are incapable of developing permit requirements in the absence of national categorical standards.*** As states repeatedly have told EPA and EPA has itself recognized, state permitting agencies lack the resources to undertake or review the multiple engineering, biological, economic and other studies that the Proposed Rule requires as a condition of permitting. States are particularly incapable of conducting cost-benefit analysis in the context of NPDES permit proceedings, but the Proposed Rule contemplates 1,200 such analyses in the coming years (one for every plant subject to the rule), even though EPA itself, with all of its resources and many years to do it, has still never come close to monetizing more than a few percent of the benefits in its national rulemakings under Section 316(b).

- ***OMB took EPA's illegal and weak proposal and made it worse.*** The agency sent OMB a proposal designed around a case-by-case format in which state permitting authorities would begin with a rebuttable presumption that closed-cycle cooling was the best technology available. EPA also sought to avoid making cost-benefit analysis a primary consideration, using it only to eliminate extreme results under a "wholly disproportionate" test. That regulatory approach was insufficient to begin with, but OMB further weakened it, leaving a completely rudderless decision-making process that allows state agencies to consider an open-ended set of factors the director deems to be "relevant" and then choose the technologies the agency deems "warranted." The Proposed Rule now invites those permitting directors to determine that "no additional control requirements are necessary beyond what a facility is already doing." OMB's changes thus render the entire rule an elaborate ruse for doing nothing at all.

Impingement

- ***EPA should establish a national categorical impingement standard based on closed-cycle cooling.*** The Proposed Rule does not do this, but instead provides a choice among options that are clearly less protective.

- ***EPA should also establish an additional impingement standard based on the 0.5 ft/s velocity limit*** and allow a carefully crafted variance for facilities that legitimately cannot meet it. Because the velocity limit will not eliminate impingement, EPA should also retain the requirements to install protective devices on travelling screens, install barrier nets for shellfish in marine waters, and provide a mechanism for "entrapped" fish (for example, those caught in a forebay) to escape.

- ***Although EPA found that reducing intake velocity to 0.5 feet per second would be more protective than other impingement mortality standards it considered, EPA nevertheless gave existing facilities the choice between the velocity limit and meeting a twelve-percent-annual impingement mortality standard (i.e., meaning that no more than twelve percent of impinged fish may die in a given year).*** The twelve-percent standard, however, is not only weaker than the velocity limit but would also require extensive monitoring and latent mortality testing that will inevitably lead to vague, controversial and inconclusive results as to the percentage of impinged fish that have survived impingement.

- ***To measure performance against the twelve percent standard, plant operators would be required to hold impinged organisms for 24 to 48 hours, yet latent impingement mortality can occur 96 hours after the impingement event.*** Moreover, there are no agreed-upon protocols for handling and holding impinged fish, and it is difficult to determine whether fish have died from impingement or some other cause. Because certain species are more susceptible to impingement and less likely to survive, the twelve percent standard would disproportionately affect those species, and would cause plant operators to seek to invoke a provision of the Proposed Rule that would allow permit writers to exclude certain species from monitoring requirements and calculations.

Definition of "New Unit"

- ***EPA should revert to the new units definition and standards that it proposed to OMB with minor revisions suggested below.*** The version of the proposed rule that EPA sent to OMB would have required all replacements, repowerings, and rebuilt power plants to meet standards based on closed-cycle cooling because those plants have the ability to include closed-cycle cooing systems as part of the initial design of the rebuilt, repowered or replacement plant. But OMB modified those provisions such that only "new units at existing facilities," a very narrowly defined class of entities, now have to meet the closed-cycle cooling standards. That OMB change would allow the operators of the worst fish-killing plants in the country to demolish their plants and rebuild entirely new plants from scratch without having to install modern equipment.

Other Critical Provisions

- ***EPA should define and protect "species of concern."*** Previously, EPA has explained that "species of concern" are species that may be "in need of conservation actions, but are not currently listed as threatened or endangered under State or Federal law."[6] Sadly, a decades-long backlog of endangered species listings means that hundreds of species whose claims to endangered or threatened status are supported by substantial scientific evidence fit into this category. EPA should define and extend additional protections to species of concern, as it did in the original Phase II rulemaking.

- ***EPA should prevent states from excluding any species from the rule's scope.*** The provision contained in proposed 40 CFR § 125.98(c)(6), mentioned above in the context of impingement, should be revised to prevent state permit directors from excluding "other specific species," which are neither invasive nor naturally moribund, from monitoring, sampling, and study requirements. Since BTA determinations and compliance with BTA standards will be in large part determined through monitoring, sampling and studies, this "species of [no] concern" provision would allow states to simply ignore, rather than minimize, mortality to certain species.

- ***EPA should assume that entrainment mortality is 100 percent in all cases.*** Assessing entrainment mortality on a site-specific and species-specific basis is administratively unworkable. It will lead to significant delays in the permitting of cooling water intake structures, for little, if any, gain. EPA should presuppose, in all cases, that entrainment mortality is 100 percent.

- ***EPA should specify minimum monitoring requirements.*** EPA lays out its minimum expectations with respect to monitoring practices in the preamble, but then, inexplicably, leaves the final determination to state regulators. It is inefficient for each state to reinvent monitoring requirements dozens of times – once for each facility. EPA should specify in the rule uniform minimum monitoring requirements that meet the expectations it laid out in the preamble.

- ***EPA should prohibit the use of freshwater for once-through cooling in arid regions or those at risk of drought.*** BTA must be defined to require reclaimed water use as the potential benefits of using reclaimed water for power plant cooling are immense and would result in additional environmental protection and water savings and improved reliability at both once-through and closed-cycle facilities that utilize freshwater intake. EPA's proposed approach fails to fully recognize either the availability of reclaimed water or the public and environmental benefits of using reclaimed water for cooling and fails explicitly to require local consideration of this readily available option.

- ***EPA should not exempt cooling water withdrawals that are also used for desalination.*** The proposed exclusion of seawater used for both cooling and desalination from the definition of "cooling water" would allow the power plant to contend that the water is drinking water and

[6] 69 Fed. Reg. 41,576, 41,587 (col. 1) (July 9, 2004) (National Pollutant Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities).

the desalination plant to contend that the water is cooling water, leaving the withdrawal completely unregulated, contrary to the intent of Section 316(b).

- ***EPA should require that if a calculation baseline is used by permit writers, it must reflect the actual operation of the facility, not a fictional "full flow" baseline.*** EPA acknowledges that one of the most "challenging" aspects of the 2004 Phase II rule was the calculation baseline; EPA claims to have developed an approach that does not use a calculation baseline. In fact, EPA has just punted the calculation baseline issue to the states. Consequently, EPA should either make clear in the rule that no calculation baseline can be used in implementing the rule or, if a calculation baseline may be used, then the rule should require that the operational component of the calculation baseline – which is the most controversial baseline issue – reflect actual plant operation, not a fictional "full-flow" baseline.

- ***EPA should remove the special site-specific BTA determination for nuclear facilities.*** It is extremely unlikely that a BTA requirement could conflict with NRC requirements because the cooling water system used to condense steam used in generating electricity (which is the subject of this rulemaking) is completely separate from and independent of the "service water" system which cools reactors, spent fuel pools and other critical plant systems in the event of an accident. Moreover, existing NRC regulations adequately address proposed changes to a nuclear facility, rendering an additional process unnecessary and potentially confusing as part of a BTA determination. At a minimum, EPA should revert to the version of the nuclear facility provision contained in the version of the proposed rule sent to OMB.

- ***EPA should require interim measures to protect aquatic ecosystems until long term compliance solutions are in place.*** We request that EPA include in the rule a requirement for interim measures that most plants can use to reduce their intake of cooling water, particularly at peak spawning times. Such measures could include installation of variable speed pumps or drives at peaking facilities or scheduling regular maintenance outages during peak spawning periods whenever feasible. Until full compliance at a site is achieved, these interim measures should be implemented as NPDES permit conditions, without allowing them to supplant permanent measures.

- ***EPA should clarify that only offshore seafood processing facilities, not onshore facilities, are exempt from the Rule.*** EPA intended to exempt seagoing vessels from the rule because of concerns about space limitations and retrofits that could compromise the seaworthiness of drilling rigs, liquefied natural gas terminals, and fishing boats. But EPA should include the word "offshore" before "seafood processing facilities" in its exemption at 40 C.F.R. § 125.91(d) to make it clear that only vessels, and not coastal fish processing plants, are exempt.

- ***EPA must consult with the National Marine Fisheries Service and the Fish and Wildlife Service.*** EPA must obtain the opinions of its sister federal agencies on the Proposed Rule's impact upon threatened and endangered species and the advisability of reasonable and prudent alternatives, such as a nationally uniform closed-cycle cooling standard. In declining to set such a standard, EPA is authorizing existing facilities to continue to take endangered species and to adversely modify habitat that is critical to multiple endangered species.

Cost-Benefit Analysis

- ***If EPA persists in employing a cost-benefit analysis for the national rulemaking (which is neither required, nor useful) that analysis must be significantly improved by valuing more of the benefits in the manner suggested by economists Frank Ackerman and Elizabeth Stanton in their attached Stockholm Environmental Institute (SEI) comments.*** Not only does EPA's approach to cost-benefit analysis exceed the restrictions imposed by Congress (as noted above), EPA also vastly underestimated the benefits and overestimated the costs of the rulemaking options. EPA used old data which do not reflect current conditions and fish kill levels and then monetized only a very small fraction of the benefits. EPA also used a misleading and distorted industry model, rather than its own model, and thereby overstated the costs by approximately a factor of two. A more accurate cost-benefit analysis, (although still limited by existing economic tools) shows that the benefits of Option 3 clearly exceed the costs.

- ***The substantial shortcomings in EPA's cost-benefit analysis demonstrate conclusively why state permitting agencies should be forbidden from considering costs in relation to benefits in the site-specific context.*** No cost-benefit analysis is to be conducted under EPA's Phase I rule for new facilities, the new oil rig regulations in the Phase III rule, or the "new units" requirements of this rule. None should be conducted by states under this rule either.

- ***However, to the extent that states are authorized to conduct site-specific cost-benefit analyses for existing facilities, EPA should set very specific requirements for states to follow***, as suggested by Ackerman and Stanton in the attached SEI comments, so that such analyses do not undermine the purpose of the rule and of Section 316(b) – to minimize the adverse environmental impacts of cooling water intake structures using the best technology available.

Revision to the Phase I Rule

- ***EPA should make clear in the regulatory text of the Phase I rule that a facility choosing Track II must aim for 100 percent of the entrainment and impingement reductions of Track I, and if it falls short within 10 percent, that will be acceptable, but may not aim for 90 percent and achieve only an 89 percent reduction.*** EPA is proposing to delete the references to "restoration measures" in the Phase I rule because the Second Circuit held in *Riverkeeper I* (and again in *Riverkeeper II*) that the statute does not authorize use of such measures to comply with Section 316(b). At the same time, EPA should make an additional revision to the Phase I rule in order to implement the finding of the Second Circuit in *Riverkeeper I* that under Track II, it would be inappropriate for EPA to use 90 percent as a benchmark and allow an additional margin of error in measuring compliance with that benchmark.

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I.

BACKGROUND

A. Factual Background: Once-Through Cooling Causes Adverse Environmental Impacts of Staggering Proportions.

Power plants and other industrial facilities use cooling water intake structures to withdraw massive volumes of water from natural waterbodies for cooling. The overwhelming majority of that water is drawn by plants using "once-through" cooling systems, which, as their name suggests, do not recirculate cooling water after its use. Instead, they pump cold water through a condenser just once, return the now-heated water to the water body from which it was withdrawn, and continually draw more cold water for further cooling.

The profligate withdrawal of such large volumes of water causes – as EPA first explained a decade ago – "multiple types of undesirable and unacceptable adverse environmental impacts," including but not limited to entrainment and impingement; reductions of threatened, endangered or other protected species; damage to critical aquatic organisms, including important elements of the food chain; diminishment of a population's compensatory reserve; losses to populations including reductions of indigenous species populations, commercial fisheries stocks, and recreational fisheries; and stresses to overall communities and ecosystems as evidenced by reductions in diversity or other changes in system structure and function.[7]

In the *Riverkeeper I* case, the Second Circuit observed that "[t]he environmental impact of [cooling water intake] systems is staggering: A single power plant might impinge a million adult fish in just a three-week period, or entrain some 3 to 4 billion smaller fish and shellfish in a year, destabilizing wildlife populations in the surrounding ecosystem."[8]

Not only have EPA and the courts previously recognized and documented the staggering adverse environmental impacts of once-through cooling systems, but other federal and state agencies, and biologists and other professionals in the private sector have as well. In the preambles to the Phase I, Phase II and Phase III rules, EPA included lengthy discussions of these impacts under the heading "Environmental Impact(s) Associated with Cooling Water Intake Structures."[9] Astonishingly, in this rulemaking, the agency did not even bother to include (or,

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[7] 66 Fed. Reg. 65,256, 65,292 (Dec. 18, 2001) (Final Rule - National Pollution Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities); *see also* 69 Fed Reg. at 41,586.

[8] *Riverkeeper v. EPA*, 358 F.3d 174, 181 (2d Cir. 2004) (hereinafter "*Riverkeeper I*").

[9] 65 Fed. Reg. 49,060, 49,071-75 (col. 3) (Aug. 10, 2000) (National Pollution Discharge Elimination System–Regulations Addressing Cooling Water Intake Structures for New Facilities); 66 Fed. Reg. at 65,262 (col. 3); 67 Fed. Reg. 17,122, 17,136-40 (col. 1) (Apr. 9, 2002) (National Pollution Discharge Elimination System–Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities); 69 Fed. Reg. at 41,586-90 (col. 1); 69 Fed. Reg. 68,444, 68,461-66 (col. 2) (Nov. 24, 2004) (National Pollution Discharge Elimination System–Proposed Regulations To Establish Requirements for Cooling Water Intake Structures at Phase III Facilities); 71 Fed. Reg. 35,006, 35,012-14 (col. 3) (June 16, 2006) (National Pollutant Discharge Elimination System–Final Regulations To Establish Requirements for Cooling Water Intake Structures at Phase III Facilities). The rulemaking record for this rule includes "the data and information contained in the records supporting the Phase I, Phase II, and Phase III rulemakings." 76 Fed. Reg. at 22,184 (col. 1).

perhaps, studiously avoided including) a similar discussion of adverse impacts in the preamble. Instead, this important discussion is buried in a supporting document (the EEBA), which the vast majority of even the interested public will not read. That failure is emblematic of EPA's current dereliction of its responsibility to protect the aquatic environment. While EPA's discussion of adverse environmental impacts has faded into the support documents, the impacts themselves continue unabated, and are discussed in these comments immediately below.

1. Massive Water Withdrawals

Virtually all of the adverse environmental impacts of cooling water intake structures are caused by the massive withdrawal of water into the plants through those structures. With an actual daily intake volume in excess of 200 billion gallons per day, or 75 trillion gallons per year, industrial cooling water systems are, by far, the largest source of water withdrawals in the United States.[10] Steam-electric power plants use the vast majority of this massive volume, accounting for 93 percent of the total saltwater use, 41 percent of total freshwater use, and 49 percent of all water use nationwide.[11] Power plants use more water than any other industry sector in the country, withdrawing more than all irrigation and public water supplies combined.[12] Manufacturing facilities (primarily in the pulp and paper, chemicals, primary metals, and petroleum refining sectors) also use appreciable volumes of water, but far less than power plants.

EPA estimated that 633 presently operating power plants have a design intake flow (DIF) greater than 2 million gallons per day (MGD).[13] Collectively, these power plants have the capacity to withdraw more than 370 billion gallons per day (BGD) – more than 135 trillion gallons per year – from our nation's waters for cooling.[14] A typical power plant using once-through cooling withdraws hundreds of millions to several billion gallons of water per day. EPA estimated that 112 power plants have DIFs greater than one BGD and another 145 have DIFs between 500 MGD and 1 BGD.[15] Approximately 21 percent of the plants withdraw from an ocean, estuary or tidal river; seven percent from the Great Lakes; and approximately 72 percent

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[10] EPA, Environmental and Economic Benefits Analysis of the Proposed Section 316(b) Existing Facilities Regulation (March 28, 2011)("2011 EEBA"), at 1-3, Table 1-1 (note unweighted, increase by less than 10%); *see also* J.F. Kenny et al., *Estimated Use of Water in the United States in 2005*, U.S. Geological Survey Report, Circular 1344 (2009), at 38, (Exh. 2), *also available at* http://pubs.usgs.gov/circ/1344/pdf/c 1344.pdf (last visited July 2011).

[11] J.F. Kenny et al., Estimated Use of Water in the United States in 2005, U.S. Geological Survey Report, Circular 1344 (2009), at 38, (Exh. 2), *also available at* http://pubs.usgs.gov/circ/1344/pdf/c 1344.pdf (last visited July 2011).

[12] *Id.*

[13] EPA estimated from its 1999 and 2000 questionnaires that there were 671 power plants above the 2 MGD threshold and that 38 have ceased operation, leaving 638 facilities still operating. *See* EPA, Technical Development Document for the Proposed Section 316(b) Phase II Existing Facilities Rule (2011), (hereinafter "2011 TDD"), at 4-4, Exh. 4-1, Cooling Water Use in Surveyed Industries (estimating that 671 electric generating facilities withdraw more than 2 MGD); *see also* 76 Fed. Reg. at 22,190 ("According to the 2007 EIA database, 38 of the 671 facilities have ceased operation since the Survey"). It should also be noted that the reference to "Phase II" in the title of the 2011 TDD appears to be a vestige that should have been deleted, given that the existing (power plant and manufactuers) rule is no longer referred to as Phase II.

[14] 2011 TDD, at 4-4, Exh. 4-1.

[15] 2011 TDD, Exh. 4-3. Note that these numbers were based on EPA's 1999/2000 questionnaires; EPA more recently estimated that 38 of the 671 power plants have closed. *See* footnote 13, *supra*.

from a freshwater (non-Great) lake, river, stream or reservoir.[16] Although EPA's presentation of the data is very unclear it appears that approximately 75 percent of the cooling systems are once-through and about 25 percent are closed-cycle.[17] Adding manufacturing facilities, which have a collective capacity of 39 BGD, yields a grand total of 409 BGD or nearly 150 trillion gallons per year of cumulative design intake capacity by the approximately 1,200 industry facilities subject to the rule.[18]

2. Impingement and Entrainment

Because cooling water intake structures remove such extraordinarily large amounts of water from natural waterbodies, their withdrawals necessarily affect the full spectrum of organisms at all life stages in the aquatic ecosystem, killing billions of fish, destroying habitats and destabilizing aquatic populations.[19] The principal environmental damage is the mortality of aquatic organisms through entrainment and impingement.

Entrainment occurs when fish and shellfish, eggs, larvae, and other organisms too small to be screened out are drawn through a cooling water intake structure into a plant's cooling system. As small, fragile entrained organisms pass through the cooling system, they are subject to mechanical, thermal, and toxic stress: including physical impacts in the pumps and condenser tubing; pressure changes caused by diversion of the cooling water into the plant or by the hydraulic effects of the condensers; sheer stress; thermal shock in the condenser and discharge tunnel; and, chemical toxemia induced by antifouling agents such as chlorine. Few, if any, entrained organisms survive.[20]

Impingement occurs when larger fish and other aquatic organisms become trapped on screening devices or other barriers installed at the entrance of the intake structure. Impingement is caused by the force of water passing through the intake structure and can result in starvation and exhaustion (when organisms are trapped against an intake screen), asphyxiation (when organisms are forced against a intake barrier by velocity forces that prevent proper gill movement or when organisms are removed from the water for prolonged periods of time), descaling (when organisms are removed from an intake screen by a wash system), and other physical harms.[21] A substantial number of the aquatic organisms entrained and impinged are killed or subjected to significant harm.[22]

Cooling water withdrawals kill the full spectrum of organisms in the aquatic food chain: phytoplankton (tiny, free-floating photosynthetic organisms); zooplankton (small aquatic

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[16] 2011 TDD, Exh. 4-6.

[17] 2011 TDD, Exh. 4-8.

[18] 2011 TDD, Exh. 4-1.

[19] *See Riverkeeper v. EPA*, 358 F.3d 174, 181 (2d Cir. 2004) ("*Riverkeeper I*"); *Cronin v. Browner*, 90 F.Supp.2d 364, 366 (S.D.N.Y. 2000) ("[C]ooling water systems 'may interfere with the maintenance or establishment of optimum yields of sport or commercial fish and shellfish, decrease populations of endangered organisms, and seriously disrupt sensitive ecosystems.'").

[20] 66 Fed. Reg. at 65,263 (col. 1); see also 65 Fed. Reg. at 49,072.

[21] 66 Fed. Reg. at 65,263 (col. 1).

[22] *Id.* (col. 2-3).

organisms that consume phytoplankton); fish, shellfish, crustaceans, reptiles (such as sea turtles) and marine mammals (such as seals and sea lions) at all life stages, including eggs, larvae, juvenile, and adult; and many other forms of aquatic life, including threatened, endangered and other protected species.[23]

The death toll of wildlife from power plant intakes is staggeringly high. As EPA acknowledges, it is impossible to quantify with any precision the extent of the adverse environmental impacts caused by the withdrawal of more than 75 trillion gallons of water per year (actual flow) by power plant cooling water intake structures.[24] Nonetheless, by EPA's own highly conservative estimates, and looking only to fish and shellfish mortality, industrial cooling water withdrawals annually result in the death of at least 2.2 billion age one-equivalent[25] fish, crabs, and shrimp, and a minimum of 528 billion eggs and larvae that serve as the basis of the aquatic food chain.[26] The actual mortality figures are likely much higher. As Drs. Peter Henderson and Richard Seaby of PISCES Conservation, Ltd. point out in their attached report, there are many issues with the quality of the data EPA used to make these estimates. For example, many of the data sets used in the calculations are old and many of the studies do not report all species caught, which causes some species to be underrepresented in the national calculations. Thus, EPA's estimate of the fish killed by power plants is likely an underestimate – potentially a significant underestimate – of the actual mortality numbers.[27] A table in the 2011 EEBA states that 1,055,936,410,000 (that is, more than a *trillion*) organisms are killed by in-scope facilities every year, which is double the estimate of 528 billion individuals given in the preamble.[28] Although, according to EPA, that discrepancy resulted from a programming error in the algorithm used to compile Appendix C of the EEBA,[29] the

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[23] 66 Fed. Reg. at 65,262-263; 69 Fed. Reg. at 41,586; 66 Fed. Reg. at 65,262-263; California Environmental Protection Agency, State Water Resources Control Board, *Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, Final Substitute Environmental Document* (May 4, 2010), hereinafter ("Calif. OTC Policy SED") (Exh. 3), *also available at* http://www.waterboards.ca.gov/board_info/minutes/2010/ may/ 050410_5_staffpresentation.pdf (last visited May 16, 2011).

[24] 67 Fed. Reg. at 17,139 (col. 3) ("Studies like those described ... may provide only a partial picture of the severity of environmental impact associated with cooling water intake structures. ....[T]he methods for evaluating adverse environmental impact used in the 1970s and 1980s, when most section 316(b) evaluations were performed, were often inconsistent and incomplete...").

[25] According to EPA, "[t]he Equivalent Adult Model (EAM) is a method for converting organisms of different ages (life stages) into an equivalent number of individuals in any single age. For its 316(b) analyses, EPA standardized all I&E mortality losses into equivalent numbers of 1-year-old fish, a value termed age-1 equivalents (A1Es)." 2001 EEBA at 3-2 (internal citation omitted). This adult or age-1 "equivalent" method, however, is ecologically bankrupt, misleading, and illegal, and therefore should not be used, as a measure of the impacts caused by cooling water intake strucutres or the benefits of installing protective technologies because large number of eggs and larvae are not "equivalent" to smaller numbers of adult fish. In addition to becoming juveniles and then adults in later life stages, eggs and larvae also play a highly significant role in the aquatic ecoystem, which the EAM and A1E metrics ignore.

[26] 76 Fed. Reg. at 22,239 (col. 1).

[27] *See Biological comments on the US EPA's 2011 proposed rule for cooling water intake structures at existing facilities*, Henderson, P.A. and Seaby, R. M. H., PISCES Conservation, Ltd., hereinafter ("PISCES Report") (attached as Appendix B).

[28] 2011 EEBA, Table C-16, p. C-27.

[29] Communication between Tom Born and Reed Super, June 14, 2011.

actual fish and shellfish losses at all life stages may well be closer to that one trillion figure. In many cases, the toll on fisheries by power plants rivals or exceeds that of the fishing industry.

As just several examples of the devasting aquatic mortality at hundreds of power plants across the country:

- The Salem Nuclear Generating Station in New Jersey withdraws over 3 billion gallons per day from Delaware Bay and kills an estimated 375,000 white perch, 281,746 herrings (alewife & blueback), 305,000 spot, 61,100 Atlantic croaker, 3,239 striped bass, 842,000,000 bay anchovy and 1,120,000 weakfish annually – four times as many bay anchovy and weakfish each year than are commercially caught in the Delaware Estuary.[30]

- The Northport power plant on the north shore of Long Island, New York, withdraws up to 939 million gallons per day from Long Island Sound and entrains an estimated 8,430,808,238 fish eggs and larvae of all species each year.[31]

- The Brunswick nuclear plant on the Cape Fear estuarine system in North Carolina, has entrained as much as 3-4 billion individual fish and shellfish at early life stages annually. Studies there have predicted an associated 15-35 percent reduction in populations, which may be altered beyond recovery;[32]

- On Florida's Gulf Coast, the Crystal River power plant seriously reduces forage species and recreational and commercial landings (e.g., 23 tons per year);[33]

- On Lake Michigan, the D.C. Cook nuclear plant killed one million fish during a three-week study period.[34]

- Huge numbers of fish are also entrained at the Indian Point power plant, situated in a narrow section of the Hudson River estuary just south of Peekskill. As reported by

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[30] Versar, *Technical Review and Evaluation of Thermal Effects Studies and Cooling Water Intake Structure Demonstration of Impact for the Salem Nuclear Generating Station* at § VI-4 (Revised Final Report) (1989) (Exh. 4) (reported on an "equivalent adult" basis). 30 million pounds of bay anchovy and weakfish are lost each year due to entrainment and impingement at Salem compared to 6.8 million pounds of yearly commercial landings between 1975-1980.

[31] New York State Department of Environmental Conservation, *Best Technology Available (BTA) for Cooling Water Intake Structures, DEC Policy Issuing Authority*, Draft, March 4, 2010, Appendix A: BTA Policy Technical Document, Table 1: Estimated Entrainment and Impingement at Major New York Facilities Using Once-Through Cooling Water, p. 2 of 20 (hereinafter "DEC Draft BTA Policy") (Exh. 5); *see also* Network for New Energy Choices, *Reeling in New York's Power Plants: The Case for Fish-Friendlier Power* (June 2010) (Exh. 6)

[32] 67 Fed. Reg. at 17,138.

[33] *Id.*

[34] *Id.*

the New York State Department of Environmental Conservation, 1.2 to 1.3 billion fish eggs and larvae are entrained at Indian Point each year.[35]

- Cumulatively, the five power plants on the Hudson River (Indian Point, Bowline, Roseton, Lovett[36] and Danskammer) have caused year-class reductions estimated to be as much as 79 percent, depending on fish species.[37] The generators' 2000 analysis of three of these plants completed in predicted year-class reductions of up to 20 percent for striped bass, 25 percent for bay anchovy, and 43 percent for Atlantic tomcod, even without assuming 100 percent entrainment mortality.[38] New York State has concluded that these losses could seriously deplete any reserve or compensatory capacity needed to survive unfavorable environmental conditions.[39] Indeed, data shows that in the Hudson River, 10 of 13 key species are in decline.[40]

- The Brayton Point facility in Somerset, Massachusetts withdraws 1.3 billion gallons per day from Mt. Hope Bay and has apparently caused an 87 percent reduction in finfish abundance since a 50 percent increase in its cooling water withdrawal in 1985.[41]

- At the San Onofre Nuclear Generating Station on the Southern California coast, in a normal (non-El Niño) year, 121 tons of midwater fish are entrained, causing a 34-70 percent decline in Pacific Ocean fish populations within 3 kilometers.[42]

- A 2005-6 study commissioned by the owner of the Bayshore power plant on Lake

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[35] New York State Notice of Intention to Participate and Petition to Intervene, *In re: License Renewal Application Submitted by Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc.*, U.S. Nuclear Regulatory Commission Docket Nos. 50-247-LR and 50-286-LR, ASLBP No. 07-858-03-LR-BD01, DPR-26, DPR-64 (Nov. 30, 2007), p. 286 (Exh. 7), *also available at* http://www.dec.ny.gov/docs/permits_ej_operations_pdf /noiindianpoint.pdf (last visited June 2011).

[36] The Lovett plant has since closed.

[37] 67 Fed. Reg. at 17,138, citing John Boreman and Phillip Goodyear, *Estimates of Entrainment Mortality for Striped Bass and Other Fish Species Inhabiting the Hudson River Estuary*, American Fisheries Society Monograph 4:152-160, 1988 (Exh. 8).

[38] *Id.*, citing Consolidated Edison Company of New York, Draft environmental impact statement for the state pollutant discharge elimination system permits for Bowline Point, Indian Point 2 & 3, and Roseton steam electric generating stations (2000).

[39] 67 Fed. Reg. at 17,138, citing New York Department of Environmental Conservation, Internal memorandum provided to the USEPA on NYDEC's position on SPDES permit renewals for Roseton, Bowline Point 1 & 2, and Indian Point 2 & 3 generating stations (2000).

[40] A report commissioned by Riverkeeper and released on May 15, 2008, *The Status of Fish Populations and the Ecology of the Hudson*, produced by Pisces Conservation Ltd., reveals that many Hudson River fish are in serious long-term decline. Of the thirteen key species studied, ten have declined in abundance since the 1980s (shad, tomcod, bay anchovy, alewife, blueback herring, rainbow smelt, hogchoker, white catfish, weakfish and white perch) (Exh. 9) *also available at* http://www.riverkeeper.org/documen t.php/758/THE_STATUS_OF_F.pdf .

[41] 67 Fed. Reg. at 17,138, citing Gibson, Mark R., R.I. Div. Fish and Wildlife, *Comparison of Trends in the Finfish Assemblage of Mt. Hope Bay and Narragansett Bay in Relation to Operations at the New England Power Brayton Point Station* (1996) (Exh. 10). Brayton is retrofitting cooling towers to address this damage.

[42] 67 Fed. Reg. at 17,139 (col. 1), citing S. Swarbrick and R.F. Ambrose (1988).

Erie in Ohio estimated that more than 60 million adult fish and more than 2.5 billion fish eggs and larvae were killed in a given year.[43] A later study of the Bayshore plant by the University of Toledo put the number of fish eggs and larvae killed at more than 12 billion per year.[44]

- New York's Huntley Generating station, located along the Niagara River, which connects Lake Ontario to Lake Erie near the world-famous Niagara Falls, is estimated to entrain over 105 million fish eggs and larvae per year, with annual impingement of well over 96 million adult and juvenile fish – the largest impingement toll of any power plant in the state.[45]

- On the shores of Lake Michigan in Wisconsin, the Oak Creek power plant was estimated by its operator to impinge well over 2 million fish weighing 57-plus tons in a single year on its intake screens. In addition, between April and October of 2002, it entrained over 6 million larvae and over 9 million fish eggs.[46]

3. Taking of Endangered and Threatened Species

Since power plant cooling water intake structures generally suck in a cross-section of all species present in the waterbody, any plant located near the habitat or range of a rare or special status species is likely to be impinging and/or entraining individuals of that species. EPA explained in the preamble that cooling water intake structures may harm threatened or endangered species in several ways: populations of protected species may suffer direct harm as a result of impingement or entrainment mortality; they may suffer indirect harm if the withdrawals alter food webs; and intake structures may alter habitat critical to their long-term survival.[47]

EPA identifies 88 threatened or endangered species at risk from cooling water intakes (which is more than a third of the threatened or endangered species EPA assessed) and more than 130,000 baseline losses of threatened and endangered species annually.[48] Yet EPA acknowledges even these numbers are likely to be underreported.[49] Significantly,

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[43] Kinetrics, *Bay Shore Power Plant Cooling Water Intake Structure Information and I&E Sampling Data* (January 2008) (Exh. 11), *also available at* http://www.epa.state.oh.us/portals/35/permits/bayshore_IE_data_c ollection.pdf (last visited May 2011).

[44] Christine Mayer, University of Toledo, *Effects of Bayshore Power Plant on Ecosystem Function in Maumee Bay, Western Lake Erie, Annual Progress Report to NOAA: October 2010-February 2011* (Exh. 12), *also available at* http://www.utoledo.edu/as/lec/research /be/docs/maumee_bay_mayer_etal_annual_r.pdf (last visited July 2011).

[45] DEC Draft BTA Policy, Appendix A: BTA Policy Technical Document, Table 1: Estimated Entrainment and Impingement at Major New York Facilities Using Once-Through Cooling Water, p. 2 of 20 (Exh. 5).

[46] Public Service Commission, Wisconsin Department of Natural Resources, *Final EIS for the Elm Road Power Plant*, Chapter 8 (Exh. 13); *see also* Sierra Club, *Giant Fish Blenders: How Power Plants Kill Fish & Damage Our Waterways (And What Can Be Done To Stop Them)*, July 2011 (Exh 14).

[47] 76 Fed. Reg. at 22,244 (col. 2-3).

[48] 2011 EEBA at 5-3 and 5-8.

[49] 2011 EEBA at 5-8. Because threatened and endangered species are, by definition, rare, they will appear in samples in much lower frequency than common species and since sampling is limited, may be missed entirely; further, there is a strong disincentive for plant operators to report the taking of threatened and endangered species, which may be prohibited by federal and/or state law.

"[impingement and entrainment] mortality may either lengthen population recovery time, or hasten the demise of these species."[50]

As just several examples,

- The Pittsburg and Contra Costa Plants in the San Francisco Bay Delta in northern California can impinge and entrain more than 300,000 endangered and threatened species per year, including Delta smelt, Sacramento splittail, Chinook salmon, steelhead trout.[51]

- From 1976 to 1994, approximately 3,200 threatened or endangered sea turtles entered enclosed cooling water intake canals at the St. Lucie Nuclear Generating Plant in Florida.[52] In the first 13 years of that period, 122 (7.5%) of the 1,631 loggerheads, 18 (6.7%) of the 269 green turtles, and four Kemp's ridleys entrapped in the canal were found dead.[53]

- From 1992–2004, a total of 32 sea turtles – loggerhead, green and Kemp's ridley – were found captured from the intake trash bars at the Oyster Creek Generating Station.[54]

4. Fish Population Declines

As EPA has recognized, "studies estimating the impact of impingement and entrainment on populations of key commercial or recreational fish have predicted *substantial declines in population* size. This has lead to concerns that some populations may be *altered beyond recovery*."[55] Moreover, even where a fish population has not yet experienced a documented decline, the loss of large numbers of individuals deplete the species' ability to survive other unfavorable environmental conditions, whether man-made or natural, such as drought and climate change.[56] EPA has also noted the concerns of its sister agencies in this regard:

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[50] 2011 EEBA at 2-12.

[51] *Id.* (numbers of fish expressed as age 1 equivalents).

[52] 66 Fed. Reg. at 65,263 (col. 3), citing, Florida Power and Light Company, *Assessment of the impacts at the St. Lucie Nuclear Generating Plant on sea turtle species found in the inshore waters of Florida* (August 1995) [DCN 10-5516] (Exh. 15).

[53] Committee on Sea Turtle Conservation, National Research Council (U.S.), Decline of the sea turtles: causes and prevention, at 112, National Academies Press (1990) [DCN 10-4845]; *see also* Florida Power & Light Co., *Assessment of the Impacts of the St. Lucie Nuclear Generating Plant on Sea Turtle Species Found in the Inshore Waters of Florida*, at 5 (August 1995) [DCN 10-5516] (Exh. 15) (The St. Lucie plant has impinged five species of endangered sea turtles—loggerhead, green, Kemp's ridley, leatherback and hawksbill).

[54] Amergen Energy Company, LLC, *Assessment of the Impacts of the Oyster Creek Generating Station on Kemp's Ridley, Loggerhead, and Atlantic Green Sea Turtles* at 6-32, Table 6-2 "Mortality of Sea Turtles Captured From Intake Trash Bars at the Oyster Creek Generating Station 1969-2004 (Live/Dead)" (Dec. 2004) (Exh. 16).

[55] 66 Fed. Reg. at 65,264 (col. 1) (emphasis added).

[56] 69 Fed. Reg. at 41,588 (col. 1).

> … NMFS [the National Marine Fisheries Service] documented in several fishery management plans that cooling water intake structures are one of the threats that may adversely affect fish stocks and their habitats.[57]
>
> … NOAA documents in a number of their fishery management plans that cooling water intake structures, particularly once-through cooling water systems that withdraw large volumes of water, cause adverse environmental impacts due to significant impingement of juveniles and entrainment of eggs and larvae."[58]

5. Depressed Commercial and Recreational Fishing Yields

Because impingement and entrainment cause fish populations to decline, there are fewer fish available to be caught by commercial and recreational fisherman, thereby depressing their harvests. Although estimating the extent of these depressed fishery yields is highly imprecise, and depends on, among other things, rudimentary assumptions about the relationship between fish stock and harvest,[59] EPA estimated annual commercial and recreational fishing losses due to impingement and entrainment losses as follows:

Region	Commercial Fishing Losses (pounds)	Recreational Fishing Losses (number of harvest-able adult fish)
California	1,379,000	1,022,339
North Atlantic	430,000	761,183
Mid-Atlantic	10,672,000	9,081,061
South Atlantic	99,000	133,897
Gulf of Mexico	5,559,000	2,851,347
Great Lakes	346,000	349.648
Source: 2011 EEBA, Chs. 6, 7		

For the reasons discussed above, these are likely significant underestimates.

6. Aquatic Community and Ecosystem Impacts

Impingement and entrainment mortality "has immediate and direct effects on the population size and age distribution of affected species, and may cascade through food webs."[60] In particular, EPA has recognized that "the loss of large numbers of aquatic organisms" may affect not only "stocks of various species" and their compensatory reserve, but also "the overall

[57] 66 Fed. Reg. at 65,295 (col. 1) (citing DCN# 2– 024M, 2–024N, and 2–024O).

[58] 66 Fed. Reg. at 65,297 (col. 3).

[59] For example, EPA assumed a linear relationship between stock and harvest, meaning, for example, that a 10 percent decrease in a fish population would reduce the harvest by 10 percent.

[60] 2011 EEBA at 2-9.

health of ecosystems."[61] In addition to altered food webs, in the 2011 EEBA, EPA discusses several other related aquatic community and ecosystem impacts, including "altered community structure and patchy distribution of species," "reduced taxa and genetic diversity," and "nutrient cycling effects."[62]

Significantly, in a 2004 Federal Register publication, EPA approvingly cited an analysis of such ecosystem effects prepared by the New York State Department of Environmental Conservation (NYSDEC) in connection with the permitting of three Hudson River power plants. NYSDEC found that entrainment not only reduces adult populations of the species whose eggs and larvae are entrained and depletes the species' ability to survive unfavorable environmental conditions, but, perhaps most significantly, diminishes the forage base, which disrupts the food chain, transferring energy from higher to lower trophic[63] levels and compromising the health of the entire aquatic community.[64] In particular, as NYSDEC and EPA explained, using a simplified example, if an individual bay anchovy is killed via entrainment and disintegrated upon passage through an intake structure it is no longer available as food to striped bass and other top predators, and is instead consumed only by lower trophic level organisms, such as detritivores (organisms that feed on dead organic material), thus transferring energy from the top of the ecosystem to the bottom and affecting the integrity and proper functioning of the system. Likewise, the entrained bay anchovy would no longer be available to consume phytoplankton, which upsets the distribution of nutrients in the ecosystem.[65]

Furthermore, while often overlooked, intake structures destroy countless small organisms (some of which are microscopic) that are ecologically important. These include benthic organisms (i.e., "bottom dwellers" such as mussels, anemones, crabs and shrimp) and planktonic organisms (i.e., free-floating microscopic plants and animals), which "are an important source of food for other aquatic organisms and an essential component of the food chain in aquatic ecosystems."[66]

7. Reduced Ecological Resilience

As EPA has recognized, the effect of long-term or chronic impingement and entrainment mortality may lead to a decrease in ecosystem resistance and resilience – that is, the ability of ecosystems to resist and recover from disturbances such as invasive species and unusual weather events like hurricanes or severe flooding. Consequently, EPA found that mortality caused by cooling water intake structures is "likely to reduce the ability of ecosystems to withstand and recover from adverse environmental impacts, whether those impacts are due to anthropogenic effects or natural variability."[67]

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[61] 66 Fed. Reg. at 65,292 (col. 2).

[62] 2011 EEBA, pp. 2-16 to 2-17.

[63] The term "trophic" refers to the feeding habits or food relationship of different organisms in a food chain.

[64] 69 Fed Reg. at 41,587-88, citing NYS DEC, 2003, Final Environmental Impact Statement: Concerning the Applications to Renew NY SPDES Permits for the Roseton 1 & 2, Bowline 1 & 2 and Indian Point 2 & 3 Steam Electric Generating Stations.

[65] *Id.*

[66] 66 Fed. Reg. at 65,263 (col. 1 at fn 2).

[67] 2011 EEBA, p. 2-17, citing C. Folke, S. Carpenter, et al., "Regime Shifts, Resilience, and Biodiversity in

8. Thermal Discharges

The discharge of heated water from cooling systems has also been shown to harm fish and wildlife and has long been recognized to have effects upon the structure and function of ecosystems.[68] The operational differences between once-through cooling systems and closed-cycle cooling systems will significantly reduce the thermal load of the discharge to surface water. Unlike once-through cooling systems, where the entire thermal load is delivered to the surface water body, in a closed-cycle cooling system most of the heat is transferred to the air resulting in evaporation.[69] Thus, irrespective of how the flows are configured, there will be a substantial reduction in the thermal load of the effluent from a closed-cycle system compared to a once-through system.

In the EEBA, EPA notes that:

> Numerous studies have shown that thermal discharges may substantially alter the structure of the aquatic community by modifying photosynthetic, metabolic, and growth rates, and reducing levels of DO [dissolved oxygen]. Thermal pollution may also alter the location and timing of fish behavior including spawning, aggregation, and migration, and may result in thermal shock-induced mortality for some species. Thus, thermal pollution is likely to alter the ecological services provided by ecosystems surrounding facilities returning heated cooling water into nearby waterbodies.[70]

The EEBA also explains that facility-specific factors control the degree to which thermal pollution will affect an aquatic ecosystem. These factors include the volume of the waterbody source, other heat loads, the rate of water exchange, the presence of nearby areas whose climate remains habitable for rare or endangered species when that of the surrounding area has been changed, and the extent that nearby fish species congregate.[71] As expected, adverse temperature effects may also be more prominent in ecosystems that are already subject to other environmental stressors such as high biochemical oxygen demand (BOD) levels, sediment contamination, or pathogens.[72] Additionally, there are indirect effects on fish and other

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Ecosystem Management," 35(1) *Annual Review of Ecology, Evolution, & Systematics* 557 (2004) [DCN 10-4770] (Exh. 17) and L.H. Gunderson, "Ecological Resilience – In Theory and Application." 31 *Annual Review of Ecology, Evolution, & Systematics* 425 (2000) [DCN 10-4785].

[68] *Cronin*, 90 F. Supp. at 366, citing James R. May & Maya K. van Rossum, "The Quick and the Dead: Fish Entrainment, Entrapment, and the Implementation and Application of Section 316(b) of the Clean Water Act," 20 *Vt. L. Rev.* 373, 382 (1995) (Exh. 18).

[69] B. Dziegielewski and T. Bik, Southern Illinois University Carbondale, *Water Use Benchmarks for Thermoelectric Power Generation in the United States* (prepared for United States Geological Survey) (2006) (Exh. 19).

[70] 2011 EEBA at 2-12, citing Bulthuis 1987; Chuang et al. 2009; Martinez-Arroyo et al. 2000; Poornima et al. 2005; Leffler 1982.

[71] 2011 EEBA at 2-12-2-13.

[72] 2011 EEBA at 2-12.

vertebrate populations caused by thermal discharge, which include increased pathogen growth and infection rates.[73]

Indeed, there is a great deal of scientific literature addressing the harm to aquatic ecosystems caused by thermal pollution.[74] As noted by two research professors at the University of Maryland Center for Environmental Science, "temperature has long been recognized as a major environmental factor at the molecular, cellular, tissue, organism and ecosystem levels of biological hierarchy."[75]

Increased demand for electricity in the 1960s and 1970s led to the expansion of steam-electric power plants. That boom accelerated researchers' and environmental managers' interest in temperature effects. Researchers became even more concerned when it became apparent that the steam-electric power plant sector proposed to "heat virtually 100 percent of large non-tidal riverine flows during summer low-flow conditions."[76]

Elevated temperature induces behavioral changes that have been documented in important managed species such as bluefish, fluke, winter flounder, and tautogs.[77] Some of these behavioral changes include:

- Avoidance of parts or all of a waterbody by certain species during summer and early fall;[78]
- Attraction to parts or all of a waterbody during winter by species that should have migrated out of the area due to cold temperatures.[79]
- Large-scale mortality (due to thermal shock from a rapid drop in temperature) resulting from the failure to migrate followed by a planned or emergency shutdown.[80]

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[73] 2011 EEBA at 2-12.

[74] *See* Kennedy & Mihursky, *The Effects of Temperature on Invertebrates and Fish: A Selected Bibliography*, University of Maryland Center for Environmental Science (Exh. 20), *available at* http://www.mdsg.umd.edu/issues/chesapeake/habitat/fishtemp/.

[75] *Id.*

[76] *Id.*

[77] O. Donovan, D. Doyle, C. O'Neill and E. Kearns, "Thermal Plume Impact on Fish Distributions in Barnegat Bay," 10(3) *Bull. Amer. Lit. Soc.* 14 (1977) (Exh. 21).

[78] M.J. Kennish, "State of the Estuary and Watershed: An Overview," SI 32 *Journal of Coastal Research* 243 (2001) (Exh. 22).

[79] M.J. Kennish, M.B. Roche and T.R. Tatham, "Anthropogenic effects on aquatic organisms," in M.J. Kennish and R.A. Lutz (eds.), *Ecology of Barnegat Bay, New Jersey*, at 318-338 Springer-Verlag (1984) (Exh. 23), *available at* http://yosemite.epa.gov/water/owrccat_alog.nsf/7322259e90d060c885256f0a0055db68/3c2b3d081f4714fd85256b06007233ee!OpenDocument.

[80] Oyster Creek Nuclear Generating Station Fish Kill Monitoring Report, NRC ML#003684420 (January 2000) (Exh. 24); Oyster Creek 2001 Annual Environmental Operating Report, NRC ML#020660222 (February 2002) (Exh. 25); A. Cradic, New Jersey Department of Environmental Protection, *Oyster Creek Generating Station fined for water violations and fish kills: DEP seeks compensation for Natural Resources Damages* (December 12, 2002) (Exh. 26), *also available at* http://www.state.nj.us/dep/n ewsrel/releases/02_0131.htm.

- Metabolic rate of organisms increases with increased temperatures resulting in decreased growth and survival,[81] especially during summer months when ambient water temperatures are at their peak.

- Tropical/subtropical invasive species are able to thrive in the surrounding warm water plume.[82]

- Calefaction or thermal loading directly interferes with physiological processes of biota, such as enzyme activity, feeding, reproduction, respiration, and photosynthesis. Less conspicuous, indirect effects, which are difficult to quantify, include greater vulnerability to disease, to changing gaseous solubilities, and to chemical toxicants associated with thermal enrichment.[83]

9. Chemical Discharges

As EPA notes in the EEBA:

> One of the environmental impacts associated with power plant operations is the release of chemicals in the discharge of once-through cooling waters. These chemicals include metals from internal corrosion of pipes, valves and pumps (e.g., chromium, copper, iron, nickel, and zinc), additives (anti-fouling, anticorrosion, and anti-scaling agents) and their byproducts, and materials from boiler blowdown and cleaning cycles.[84]

These anti-fouling and cleaning chemicals can pose a risk to aquatic organisms downstream of the CWIS discharge, potentially causing organisms to develop acute and residual effects.[85] As the EEBA explains, "[a] typical biofouling procedure is continuous low-level chlorination at chronic toxicity levels with an occasional high ("shock") dose," while the "use of oxidants (chlorine, bromide) can give rise to residuals and/or disinfection byproducts (DBPs) such as trihalomethanes, haloacetic acid, bromoform, and others."[86] Although the effects of some discharge chemicals are not well documented, in most cases, these effects, along with thermal and mechanical effects, are believed to be an additional component of the cumulative stress of entrainment on local aquatic ecosystems: "[C]oncentrations of these chemicals may be additive to low-level chronic adverse effect with other anthropogenic stressors identified above."[87]

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[81] T. L. Beitinger, W. A. Bennett, R. and W. McCauley, (2000) *Temperature Tolerances of North American Freshwater Fishes Exposed to Dynamic Changes in Temperature*. Environmental Biology of Fishes, 58(3): 237 – 275 [DCN 10-4716].

[82] M.J. Kennish (2001) *State of the Estuary and Watershed: An Overview*. Journal of Coastal Research, SI 32: 243-273 (Exh. 22).

[83] *Id.*

[84] 2011 EEBA at 2-13.

[85] 2011 EEBA at 2-14, citing Kelso and Milburn 1979.

[86] 2011 EEBA at 2-14, citing Taylor 2006.

[87] 2011 EEBA at 2-14.

10. Cumulative Impacts

Cooling water intake structures also cause cumulative impacts, understood to refer to impacts caused by multiple power intake structures on the same waterway as well as the impacts of the intake structures combined with fishing and other pressures. EPA has delineated these cumulative impacts in this rulemaking (in the EEBA) and previously in the preamble to EPA's prior Section 316(b) rules:[88]

> In addition to impingement and entrainment losses associated with the operation of the cooling water intake structure, EPA is concerned about the cumulative overall degradation of the aquatic environment as a consequence of (1) multiple intake structures operating in the same watershed or in the same or nearby reaches and (2) intakes located within or adjacent to an impaired waterbody. Historically, impacts related to cooling water intake structures have been evaluated on a facility-by-facility basis.[89]
>
> Cumulative effects of CWISs are likely to occur if multiple facilities are located in close proximity such that they impinge or entrain aquatic organisms within the same source waterbody, watershed system, or along a migratory pathway of a specific species (e.g., striped bass in the Hudson River). The cumulative impacts of CWISs may be exacerbated by the presence of other anthropogenic stressors.[90]
>
> There is concern ... about the effects of multiple intakes on fishery stocks. ... EPA analyses suggest that over 99 percent of the existing facilities with cooling water withdrawal that EPA surveyed in its Section 316(b) survey of existing facilities are located within 2 miles of waters that are identified as impaired and listed by a State or Tribe as needing development of a total maximum daily load (TMDL) to restore the waterbody to its designated use. EPA notes that the top four leading causes of waterbody impairment (siltation, nutrients, bacteria, and metals) affect the aquatic life uses of a waterbody. The Agency believes that cooling water intakes potentially contribute additional stress to waters already showing aquatic life impairment from other sources such as industrial discharges and urban stormwater.[91]

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[88] Tellingly, however, the only references to "cumulative impacts" in the preamble to the Proposed Rule are three mentions of the cumulative *financial* burdens on power companies from EPA's air, water, and hazardous waste rules. After years of cumulative impacts from intake structures taking their toll on waterways, EPA is now apparently more concerned about the cumulative effect of regulation on industry's bottom line than the effect on aquatic resources.

[89] 66 Fed. Reg. at 65,263 (col. 2).

[90] 2011 EEBA at 2-17 (internal citation omitted).

[91] 66 Fed. Reg. at 65,263 (col. 2).

11. Habitat Loss

As EPA also recognizes, "[m]ost 316(b) facilities have been built on shoreline locations where power-generation buildings, roadways, CWISs [cooling water intake structures], canals, impoundments, and other water storage or conveyance structures have often been constructed at the cost of natural habitat, including terrestrial, aquatic, and wetlands."[92] Moreover, the loss of fish habitat due to construction of a power plant and its intake structure combined with the direct losses of fish from operation of the intake exert even greater pressures on aquatic species:

> Habitat loss in adjacent shoreline areas exacerbates the effect of CWIS losses, since many fish species affected by I&E [impingement and entrainment] mortality (e.g., bay anchovy, winter flounder) rely on coastal wetlands as nursery areas.[93]

12. Altered Flow Patterns in Source and Receiving Waters

Another adverse impact of cooling water intake structures recognized by EPA is that their massive withdrawals and discharges significantly alter patterns of flow within receiving waters both in the immediate area of the intake and discharge pipes, and in mainstream waterbodies, particularly in inland riverine settings.[94] In some ecosystems intake structures may cycle a substantial proportion of the water body through the power plant's cooling system. EPA noted that "of the 521 facilities that are located on freshwater streams or rivers, 31 percent (164) of these facilities have average intake greater than 5 percent of the mean annual flow of the source waters."[95] Even if the volume of water in the river stays relatively constant, "the flow characteristics of the waterbody, including turbulence and water velocity, may be significantly altered. This is particularly true in locations with multiple CWISs located close to each other."[96] Significantly, as EPA found:

> Altered flow velocities and turbulence may lead to several changes in the physical environment, including sediment deposition (Hoyal et al. 1995), sediment transport (Bennett and Best 1995), and turbidity (Sumer et al. 1996), each of which play a role in the physical structuring of ecosystems. Biologically, flow velocity is a dominant controlling factor in aquatic ecosystems. Flow has been shown to alter feeding rates, settlement and recruitment rates (Abelson and Denny 1997), bioturbation activity (Biles et al. 2003), growth rates (Eckman and Duggins 1993), and population dynamics (Sanford et al. 1994). In addition to flow rates, turbulence plays an important role in the ecology of small organisms, including fish eggs and larvae, phytoplankton, and zooplankton. In many cases, the turbulence of a waterbody directly affects the behavior of aquatic organisms, including fish, with respect to swimming speed (Lupandin 2005), location preference with a waterbody (Liao 2007), predator-prey interactions (Caparroy et

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[92] 2011 EEBA, pp. 2-2 to 2-3.

[93] 2011 EEBA, p. 2-3.

[94] 2011 EEBA, p. 2-15.

[95] *Id.*

[96] *Id.*

> al. 1998; MacKenzie and Kiorboe 2000), recruitment rates (MacKenzie 2000; Mullineaux and Garland 1993), and the metabolic costs of locomotion (Enders et al. 2003). The sum of these effects may result in changes to the food web or the location of used habitat, and thereby substantially alter the aquatic environment.[97]

These problems will likely be exacerbated by climate change.[98]

13. Water Availability and Related Energy Impacts

The enormous amount of water required for power plant water withdrawals threatens not only electrical power generation, but the general sustainability of water use in the U.S. In 2005, cooling water withdrawals accounted for nearly 41 percent of all freshwater withdrawals and 49 percent of all water withdrawals (fresh and saline) in the United States.[99] With hundreds of U.S. power plants still relying on once-through cooling, power plants are the largest water users in the country. The use of once-through cooling also represents an enormous opportunity cost to other water users. If cooling water is needed for downstream power plants, then upstream users must forego their use of this water to accommodate the needs of the power plants. This is particularly a problem in places where power plants are located near thirsty cities and other users.

EPA's Proposed Rule makes mention of the supposed reliability threats the power sector may face due to modernization to closed-cycle cooling.[100] However, nowhere does EPA discuss the threats to power generation and water supplies if facilities continue to utilize once-through cooling. These threats must be considered and incorporated into any BTA determination.

a. Impacts on Upstream Beneficial Uses of Water

The massive amounts of water withdrawn by power plants' once-through cooling systems affect water resource planning and land use policy in several fundamental ways. As an extremely telling example, consider the 1,021 MW coal-fired Gorgas Steam Plant in north central Alabama, which uses a once-though cooling system to withdraw up to 978 million gallons of cooling water per day from the Black Warrior River. Like many power companies, Alabama Power has resisted upgrading the cooling system to a once-through system, even though that would reduce the intake flow by approximately 95 percent. The adverse impacts of Gorgas's massive withdrawals are, however, not limited to entrainment, impingement, thermal discharges, and their consequential effects (which are felt not only at the intake and downstream, but also upstream). That is because Alabama Power also operates a hydroelectric dam (known as the Lewis Smith development as part of the Warrior River Hydroelectric Project) above the Gorgas Plant and, since 1974, the company has operated the dam so as to ensure that Gorgas' massive water requirements are met. The steam plants' extremely large cooling water demands

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[97] *Id.*

[98] *Id.*

[99] J.F. Kenny et al., Estimated Use of Water in the United States in 2005, U.S. Geological Survey Report, Circular 1344 (2009), at 38, (Exh. 2), *also available at* http://pubs.usgs.gov/circ/1344/pdf/c 1344.pdf (last visited July 2011).

[100] *See, e.g.*, 76 Fed. Reg. at 22,229.

affect Alabama Power's decisions both as to when to release water from the dam and how much water to release.

Because of the purported "need" to ensure massive flows to the downstream power plant, Alabama Power has opposed an alternative operational plan, proposed by residents, which would provide higher and more stable reservoir elevations in Smith Lake and thereby improve habitat for fish and wildlife (including a federally-listed species of mussel) and recreation in and on the lake.[101] If, however, plants like Gorgas were required to retrofit to closed-cycle cooling, the upstream dam could be operated in a more environmentally and socially appropriate manner.

This sort of competition for water will only worsen as droughts intensify and temperatures increase due to climate change. Often, the result will be that other beneficial uses of water upstream, including not only habitat and recreation but also drinking water and agriculture, will be curtailed in order to supply the power plant.

As the Atlanta Journal and Constitution reported in 2007, industry's contention that once-through cooling systems do not "consume" water fails to acknowledge the competition with upstream uses for those flows:

> Utility water use has escaped scrutiny, in part, because false assumptions have guided public policy in water planning. Utilities have argued for years that their use doesn't matter because they return virtually all the water they use.
>
> But use does matter when drought shrinks the water supply, and consumption from other sources puts pressure on reservoirs and rivers.
>
> A Southern Co. coal-fired plant in Florida or its Farley nuclear plant in Alabama may put at least half of the water used back into the Chattahoochee River. But that water isn't going back to Lake Lanier.
>
> Power plants also require minimum river flows to keep operating. Low flows on the Coosa River forced Georgia Power to cut back energy output at one plant this summer.[102]

Another example of power plants' massive water needs driving water resource and land use policies concerns flood-plain development. In a draft policy proposal, the White House Council on Environmental Quality (CEQ) recommended that development and other unwise use of floodplains and flood-prone areas be avoided in order to serve a variety of goals including to "[p]reserve and restore the hydrologic and natural resources functions" of those areas.[103] In

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[101] *See* Federal Energy Regulatory Commission, *Final Environmental Assessment for Hydropower License, Warrior River Hydroelectric Project* at 15-16, 40, 136, P-2165-022 (March 2009) (Exh. 27).

[102] Ken Foskett, Margaret Newkirk, Stacy Shelton, "Georgia's Water Crisis: The Power of Water," *Atlanta Journal Constitution* (November 18, 2007) (Exh. 28).

[103] *See* Council on Environmental Quality, *Proposed National Objectives, Principles and Standards for Water and Related Resources Implementation Studies* at 6 (Dec. 3, 2009) (Exh. 29), *also available at* http://www.whitehouse.gov /administration/eop/ceq/initiatives/PandG/. *See also* 74 Fed. Reg. 65,102 (Dec. 9, 2009)

response, the Edison Electric Institute (EEI), sought to perpetuate the status quo and urged CEQ to factor the "availability of cooling water" into its water resource decisions, arguing that "cooling water intake structures are necessarily built in flood plains" and that such development should not be considered "inappropriate or ... discouraged."[104] Of course, EEI has it backwards: EPA should discourage the continued use of fragile, precious waterfront land by power plants, rather than accept or encourage it. The demonstrated ability of facilities in the Southwest to locate away from waterbodies and out of flood plains proves that power plants are not water-dependent.

b. Threats to Power Generation and Grid Reliability

Furthermore, in many cases and increasingly frequently, power plants relying on once-through cooling will be unable to operate due to the lack of sufficient volumes of water or because the water may not be sufficiently cool. The threats posed to reliable power generation by water availability and temperature issues are real and well known.[105] According to DOE, "[w]ater shortages, potentially the greatest challenge to face all sectors of the United States in the 21st century, will be an especially difficult issue for thermoelectric generators due to the large amount of cooling water required for power generation."[106] Even industry recognizes these threats to reliability at once-through facilities due to water shortages.[107] For facilities using once-through cooling, "[i]f cooling water sources fall below the established minimum water level, or if the maximum thermal threshold for the discharge of cooling water cannot be met, a facility is required to power down or go offline."[108]

In 2003, an EPRI study presented county-level thermoelectric power generation constraints in the year 2025 based on projected water availability and electricity demands. As

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(Council on Environmental Quality: Draft Principles and Standards Sections of the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies"; Initiation of Revision and Request for Comments).

[104] Letter from C. Richard Bozek, EEI's Director of Environmental Policy to Mr. Terrance L. Breyman, Deputy Associate Director for Natural Resources, CEQ at 5, 3 (April 5, 2010) (Exh. 30).

[105] *See* Lisa Song, "Heat Waves Putting Pressure on Nuclear Power's Outmoded Cooling Technologies," *SolveClimate News* (May 4, 2011) (Exh. 31), *also available at* http://www.reuters.com/article /2011/05/04/idUS163919996420110504 . *See also* National Research Council, *Adapting to the Impacts of Climate Change* at 73 (2010) (Exh. 32), *also available at* https://download.nap.edu/catalog.php?record_id=12783 .

[106] National Energy Technology Laboratory ("NETL"), *Estimating Freshwater Needs to Meet Future Thermoelectric Generation Requirements: 2010 Update* at 9 (Sept. 30, 2010) [hereinafter "NETL 2010"] (Exh. 33).

[107] Brent Barker, "Running Dry at the Power Plant," *EPRI Journal* at 29-30 (Summer 2007) ("It is critical to recognize . . . that although the once-through plant consumes only a small fraction of the water it withdraws, it needs the withdrawal to operate. Hence, under drought conditions, a generating plant may have to be shut down or severely curtailed in operation because of its inability to withdraw a sufficient amount of water to meet its thermal discharge permit.") (Exh. 34).

[108] Nicole T. Carter, Congressional Research Service, *Energy's Water Demand: Trends, Vulnerabilities, and Management* at 6 (January 5, 2011)[hereinafter "CRS 2011"] (Exh. 35), *also available at* http://www.fas.org/sgp/crs/misc/R41507.pdf .

shown in Appendix E, the report projected that thermoelectric cooling water withdrawals would be constrained in hundreds of U.S. counties by the year 2025.[109]

Some of the underlying assumptions in the study may be outdated because the study has not been updated to reflect recent changes in power demand predictions[110] and climate change impacts to water availability.[111] Nonetheless, the study highlights the critical relationship between water and energy and the possible threats to energy generation under the assumed withdrawal scenarios.

More recently, the Union of Concerned Scientists compiled a sampling of reliability problems that have already occurred at once-through facilities because of water-related constraints, including:[112]

- In 2006, high intake water temperatures during a heat wave forced four nuclear plants in the Midwest to reduce their electrical output when it was needed most. One plant in Prairie Island, MN, was forced to reduce output by 50%.

- Only by relying on water from irrigation supplies did the 1,650 mw coal-fired Laramie River Station in Wheatland, WY, avert impacts to power production in 2008.

- In the summer of 2010, the Browns Ferry nuclear plant in Athens, AL, significantly reduced output for five weeks because of high discharge water temperature. This same facility had to reduce output for similar reasons in 2007.[113]

As the UCS report and others highlight, threats to energy generation because of source water concerns arise not only in the arid areas of the western U.S., but also in an "increasing number of water bodies in the East."[114] The threats to energy reliability will only get worse with increases in energy use[115] and climate change,[116] and competition from other water users – such

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[109] Sujoy B. Roy, Karen V. Summers & Robert A. Goldstein, "Water Sustainability in the United States and Cooling Water Requirements for Power Generation," 126 *Water Resources Update* 94 (Nov. 2003) (Exh. 36), *also available at* http://opensiuc.lib.siu.edu/jcwre/vol127/iss1/12/ .

[110] Interview with Sujoy Roy (Apr. 6, 2011).

[111] CRS 2011 at 7.

[112] Union of Concerned Scientists, *The Energy-Water Collision: Power and Water at Risk* (June 2011) (internal citations omitted) (Exh. 37), *also available at* http://www.ucsusa.org/assets/documents/clean_energy/ew3/power-and-water-at-risk-with-endnotes.pdf .

[113] CRS 2011 at 6.

[114] *Id.* (citing U.S. Department of Agriculture Forest Service, *2000 RPA Assessment of Forest and Range Lands*, FS-687, at 14 (Feb. 2001) (Exh. 38)).

[115] NETL 2010 at 1 (citing Energy Information Administration, *Annual Energy Outlook 2010 with Projections to 2035* (Exh. 39) *also available at* http://www.eia.doe.gov/oiaf/aeo/index.html).

[116] CRS 2011 at 8; *See also* Mitch Weiss, Associated Press, *Southern Drought May Force Nuclear Plants to Shut Down* (Jan. 24, 2008) ("The water was low on the Tennessee River and had become warmer than usual under the hot sun. By the time it had been pumped through the Browns Ferry plant, it had become hotter still – too hot to release back into the river, according to the TVA. So the utility shut down a reactor.") (Exh. 40).

as domestic and agricultural – will only get more intense,[117, 118] as the Associated Press has reported:

> An Associated Press analysis of the nation's 104 nuclear reactors found that 24 are in areas experiencing the most severe levels of drought. All but two are built on the shores of lakes and rivers and rely on submerged intake pipes to draw billions of gallons of water for use in cooling and condensing steam after it has turned the plants' turbines.
>
> Because of the yearlong dry spell gripping the region, the water levels on those lakes and rivers are getting close to the minimums set by the Nuclear Regulatory Commission. Over the next several months, the water could drop below the intake pipes altogether. Or the shallow water could become too hot under the sun to use as coolant.
>
> "If water levels get to a certain point, we'll have to power it down or go off line," said Robert Yanity, a spokesman for South Carolina Electric & Gas Co., which operates the Summer nuclear plant outside Columbia, S.C.
>
> * * *
>
> During Europe's brutal 2006 heat wave, French, Spanish and German utilities were forced to shut down some of their nuclear plants and reduce power at others because of low water levels – some for as much as a week.[119]

In addition to these vulnerabilities due to inadequate water supply or increased water temperature, power plants using once-though cooling are also vulnerable due to the sheer volume of aquatic life being withdrawn from the source water:

- In September 1984, a flotilla of jellyfish blocked the intake at the St. Lucie nuclear plant in Florida, forcing both of its nuclear reactors to shut down for several days due to lack of cooling water.[120]
- In July 2011, five generators were shut down due to jellyfish in Japan, Israel and Scotland.[121]

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[117] NETL 2010 at 9.

[118] "According to a GAO 2003 report, national water availability has not been comprehensively assessed in 25 years, thus water availability on a national level is ultimately unknown. However, as the report goes on to say, current trends indicate that demands on the nation's supplies are growing while the nation's capacity to store surface-water is increasingly more limited and ground-water is being depleted." NETL 2010 at 9 (internal citations omitted).

[119] Mitch Weiss, Associated Press, *Southern Drought May Force Nuclear Plants to Shut Down* (Jan. 24, 2008) (Exh. 40).

[120] Union of Concerned Scientists, *Got Water?* at 5 (Dec. 4, 2007) (Exh. 41), *also available at* http://www.ucsusa.org/nuclear_power/nuclear_power_technology/ got-water-nuclear-power.html.

- In March 2011, the McGuire nuclear plant was forced to shut down both reactors because of "macro-fouling" – where fish from Lake Norman clogged the plant's water system.[122]

Meanwhile, EPA seems well aware of these types of risks and of the benefits closed-cycle cooling can provide. Indeed, EPA visited a number of sites that already have retrofitted to closed-cycle cooling for a variety of reasons:[123]

- McDonough (GA), Yates (GA), Canadys (SC) and Wateree (SC) converted all generating units to closed-cycle cooling.[124]
- Nearman Creek (KS) converted its generating units to reduce the need for cooling water at times of the year (summer) when the source water level is low.[125] [During EPA's site visit, facility representatives noted that its closed-cycle recirculating cooling system is easy to operate and actually leads to slightly *better* performance by the generating units, as the return water from the tower is cooler than river water.][126]
- Linden (NJ) constructed several new combined cycle units to replace retiring fossil units and uses grey water from a nearby treatment plant for its makeup water.[127]

EPA notes that, "[w]hile the reasoning for some retrofits may not explicitly include consideration of 316(b), flow reduction is clearly an issue in the forefront of permitting and operational decisions at many facilities. Even in cases where 316(b) was not a consideration, the benefits to aquatic communities are realized nonetheless."[128]

c. Water Supply Sustainability Risks in a Changing Climate

This sort of competition for water will only worsen as droughts intensify and temperatures increase due to climate change. Climate change will have a significant impact on the sustainability of water supplies in the coming decades, by increasing the risk that water supplies will not be able to keep pace with withdrawals in many areas of the United States. A

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[121] Peter Hanlon, *Jellyfish to Power Plants: You Suck*, http://www.ecocentricblog.org/2011/07/26/jellyfish-to-power-plants-you-suck/ (July 26, 2011) (Exh. 42).

[122] U.S. Nuclear Regulatory Commission, McGuire Nuclear Station Licensee Event Report 369/2011-01, Revision 1 (Apr. 1, 2011) (Exh. 43), *available at* http://pbadupws.nrc.gov/docs/ML1110/ML111020305.pdf .

[123] 2011 TDD at 2-14.

[124] *See* Site Visit Report for McDonough-Atkinson Power Plant, February 11, 2009 [DCN 10-6536], Site Description Report for Yates Power Plant, February 11, 2009 [DCN 10-6538]; Site Visit Report for Canadys Station, February 10, 2009 [DCN10-6535] and Site Visit Report for Wateree Station, February 10, 2009 [DCN 10-6534], respectively.

[125] 2011 TDD at 2-14.

[126] Site Visit Report of Nearman Creek Power Station, March 3, 2009, at 4 [DCN 10-6524].

[127] *See* Site Visit Report for Linden Generating Station, May 26, 2010 [DCN 10-6557].

[128] 2011 TDD at 2-14.

2010 study conducted by Tetra Tech for the Natural Resources Defense Council (NRDC) found that in many parts of the nation, water withdrawals already outpace renewable water supply. The Tetra Tech report also found that "[t]he impacts of climate change will greatly increase the number of areas where renewable water supply will be lower than withdrawal, therefore increasing the number of areas vulnerable to future water shortages."[129]

The Tetra Tech study projected that water withdrawals in 2050 will greatly outpace available precipitation in many U.S. counties, as is shown in Appendix F. After considering a number of sustainability factors such as population and economic growth, the Tetra Tech study further concluded that more than 1,100 U.S. counties in the lower 48 states will have higher risk of water shortages by 2050 as a result of climate change, as shown in Appendix G.

As EPA notes, the Proposed Rule has the potential to address over half of the water withdrawals in the entire nation.[130] Unfortunately, as is highlighted herein, the proposed rule does little if anything to curtail these significant water withdrawals.

14. Industrial Use of Valuable, Scenic Waterfront Land

It is no coincidence that power plants are located along the country's mightiest rivers and on highly valued and scenic locations adjoining our most treasured oceans, lakes and estuaries: plants using once-through cooling need cooling water in volumes that can only be found at the edge of a major waterbody. Closed-cycle cooling, however, lowers intake volumes to levels which can be met by alternative water sources as such municipal water supplies, ground water, or treated sewage effluent discharges. By using such alternative water sources, power plants can be located away from waters of the U.S. Closed-cycle cooling thus decouples industrial cooling water needs from the need to site plants on sensitive, scenic and valuable waterfront property. Such facilities can locate in brownfields or industrial parks, avoiding incompatibility of land uses. This significant increase in siting flexibility, particularly for replaced, rebuilt or repowered facilities, is yet another advantage of moving away from once-through cooling and towards closed-cycle cooling.

B. Statutory Background: Congress Enacted Section 316(b) as Part of the 1972 Clean Water Act Amendments to Standardize Permitting and Minimize Once-Through Cooling's Massive Water Withdrawals and Fish Kills.

When Congress enacted Section 316(b) as part of the sweeping 1972 amendments to the Clean Water Act, it was well aware of the enormity of once-through cooling water withdrawals, fish kills and thermal discharges, as well as the superiority of closed-cycle cooling. The provision was intended to standardize permitting and require the Best Technology Available – which was then and still is closed-cycle cooling – to minimize the water withdrawals and fish kills.

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[129] Sujoy Roy et al., Tetra Tech, *Evaluating Sustainability of Projected Water Demands Under Future Climate Change Scenarios* (2010) (Exh. 44), *also available at* http://rd.tetratech.com/climatechange/projects/nrdc_climate.asp .

[130] 76 Fed. Reg. at 22,189.

1. In 1972 Congress Was Well Aware of the Enormous Damage Caused by Once-Through Cooling.

Although once-through cooling systems have been in use for more than a century, and the size of U.S. power plants dramatically increased after World War II, it was not until the late 1960s that federal policymakers turned their attention to the environmental damage caused by intake structures. In 1967, Senator Warren Magnuson warned that "by 1980 thermal power plants throughout the nation will require an amount of cooling water greatly in excess of the average flow of the mighty Mississippi at St. Louis."[131] Congress first considered the impacts of power plants' massive water usage during extensive hearings on the effects of waste heat discharged from industrial facilities.[132] The White House was similarly concerned, and in 1968 President Lyndon Johnson's staff issued a report explaining that "the large volumes of water withdrawn in once-through cooling processes [can have] as much or more effect on aquatic life than the waste discharges on which control measures are required."[133]

In the early 1970s, a number of well-publicized massive fish kills occurred at U.S. power plants, such as the Brayton Point Power Station in Mt. Hope Bay, Massachusetts, which killed an astonishing 164.5 million menhaden and river herring in just one day, July 2, 1971,[134] the P.H. Robinson plant in Galveston Bay, Texas, which impinged more than 7 million fish in 12 months in 1969 and 1970, the Indian Point No. 1 nuclear facility on New York's Hudson River, which killed 1.3 million fish over a 10 week period,[135] and the Millstone nuclear plant in Niantic Bay, Connecticut, where more than 2 million dead menhaden clogged the intake screens in the late summer of 1971.[136]

Public concern over these and other incidents prompted Congress to add Section 316(b) to the Clean Water Act amendments of 1972.[137] Significantly, during debate over the Clean

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[131] 113 Cong. Rec. 30129 (1967) (Exh. 45).

[132] *Thermal Pollution, Hearings before the Subcomm. on Air and Water of the Senate Comm. on Public Works*, 90th Cong., pts 1-4 (1968); *id.* at 1 (statement of Sen. Muskie) ("[b]y the end of the next decade, approximately one-sixth of the total fresh-water runoff in the United States will be required for cooling and condensing purposes.") (Exh. 46); *id.* at 98-102, 104, 112-13, 137-38, 143 (testimony on intake impact on aquatic organisms); *Environmental Effects of Producing Electric Power, Hearings before the Joint Committee on Atomic Energy*, 91st Cong., pt. 1, 341-345, 375-76 (1969) (intake impact).

[133] Office of Science and Technology of the Executive Office of the President, *Considerations Affecting Steam Power Plant Site Selection*, 46 (1968) (Exh. 47).

[134] U.S. EPA, Development Document for Best Technology Available for the Location, Design, Construction and Capacity of Cooling Water Intake Structures for Minimizing Adverse Environmental Impact, 1976 at p. 9, table I-3 (Exh. 48). EPA reported that the fish were "mangled." Id.

[135] Clark and Brownell, *Electric Power Plants in the Coastal Zone: Environmental Issues,* American Littoral Society Special Publication at V-8, tbl. V-B (1973) (Exh. 49); *see also New York Times Abstracts*, May 24, 1972, p. 94, col. 1 ("alleged 'massive' killing of fish at [Con Ed's] No. 2 nuclear-power plant at Indian Point on the Hudson River") and *New York Times Abstracts*, March 1, 1972, p. 77, col. 3 ("more than 100,000 fish have been killed in last wk [at Indian Point]") (Exh. 50).

[136] Clark and Brownell, *Electric Power Plants in the Coastal Zone: Environmental Issues,* American Littoral Society Special Publication (1973), p. V-8, tbl. V-B (Exh. 49); *see also New York Times Abstracts*, August 16, 1972, p. 41, col. 1 ("massive fish kill in Apr at Millstone Point nuclear power complex") (Exh. 51).

[137] Although Section 316(b) has been occasionally described as "something of an afterthought," (*Riverkeeper I*, 358 F.3d at 187 n.12) because of the minimal discussion of that provision in the *published* legislative history of the

Water Act, Senator James Buckley of New York cited with approval two newspaper articles reporting a decision of the Atomic Energy Commission (AEC) to require Consolidated Edison to install closed-cycle cooling at Indian Point.[138] The articles noted that the plants withdrew massive amounts of water from the Hudson River, entraining thousands of organisms per minute, and that the AEC had ordered Consolidated Edsion to stop removing such large volumes of water from the River and to install closed-cycle cooling in order to abate these massive fish kills.[139] Troubled by the extraordinary mortality at Indian Point, Senator Buckley sought to ensure that regulatory agencies could require closed-cycle cooling at power plants. In response, Senator Edmund Muskie of Maine, the chief architect of the Act, assured Senator Buckley that EPA would have that authority.[140]

2. The 1972 CWA Amendments Fundamentally Restructured U.S. Water Pollution Regulation by Replacing Ineffectual Site-Specific Assessments of Water Quality with National Technology-Based Standards.

The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[141] In furtherance of this goal, in 1972, Congress fundamentally reformed the Act in what has been described as a "sea change" in this country's water pollution control strategy.[142] Prior law had failed because, among other things, it "focused on the tolerable effects rather than the preventable causes of water pollution."[143] Indeed, Congress passed the Federal Water Pollution Control Act Amendments of 1972 (now known as the Clean Water Act) because it recognized that "'the Federal water pollution control program …ha[d] been inadequate in every vital aspect …'"[144]

Clean Water Act, that is plainly incorrect. More voluminous *unpublished* materials documenting the committee negotiations on the precise wording of what was eventually codified into the three subsection of Section 316 show that, during extensive six-month negotiations, the committee discussed and debated intake structure regulations at length. These materials are all available in the National Archives and located in a series of "Cartons" labeled "Accession No. 46-75-003, Senate Public Works Committee, Subcommittee on Environmental Pollution, Federal Water Pollution Legislation Files." Within each box there are "Folders" with topic labels and often smaller individual "Files" with topic labels. In particular, there are five highly relevant committee files: (1) a File labeled "316," containing drafts of Section 316, in a Folder labeled "Conference Committee Language" contained in Carton No. 2; (2) a file containing correspondence on "Phase I and Phase II," in that same Folder and Carton; (3) files labeled "9/13" and "9/14," containing notes on the individual sessions of the House and Senate conferees held on September 13th and 14th, 1972, in a Folder labeled "Conference Committee Conference Sessions," in Carton No. 2; (4) a File labeled "General," containing internal committee memoranda to Senate Muskie and to the Senate Conferees in a file labeled "General" in Carton No. 2; and (5) a File labeled "Thermal" in Carton No. 1. Those files are submitted herewith as Exhibit 52 (Exh. 52).

[138] 1 *Legislative History of the Water Pollution Control Act Amendments of 1972*, 196-97 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-1 (1973) (Exh. 53).

[139] *Id.*

[140] *Id.*; see also *In the Matter of: Carolina Power & Light Company (Brunswick Steam Electric Plant)*, USEPA, Decision of the General Counsel, EPA GCO 41 at 178 (June 1, 1976) (noting that Congress was "well aware" of the impacts of intake structures when it enacted the CWA) (Exh. 54).

[141] CWA § 101(a), 33 U.S.C. § 1251(a). The Act defines "pollution" to include "the man-made or man-induced alteration of the … biological … integrity of water." CWA § 502(19), 33 U.S.C. § 1362(19).

[142] *Riverkeeper I*, 358 F.3d at 184.

[143] *EPA v. California*, 426 U.S. 200, 202-03 (1976).

[144] *Milwaukee v. Illinois*, 451 U.S. 304, 310 (1981), quoting S. Rep. No. 92-414, 7 (1971), 2 Legislative History of

The 1972 "Amendments were viewed by Congress as a 'total restructuring' and 'complete rewriting' of the existing water pollution legislation."[145] The single most important regulatory reform achieved by the 1972 Act was the seemingly paradoxical notion that the nation's ambitious water quality goals could best be achieved if they were no longer tied to compliance with water quality standards. Congress concluded that past efforts to maintain such a regulatory link had failed because the science of water ecology was too complex to measure the "tolerable effects" with the precision necessary to have water quality standards serve as the primary touchstone for determining the appropriate level of control.[146]

Congress deliberately established the NPDES program to relieve permitting agencies of the need to conduct costly, lengthy, and indeterminate ecological studies to issue permits. Congress's focus on uniform technology standards in the 1972 amendments was an explicit repudiation of unsuccessful predecessor statutes that relied on "water quality standards" as the primary method of pollution control. Prior to 1972, sources were regulated "based on their effect on the surrounding water" and discharges were limited only if they caused water quality to drop below an acceptable level.[147] But that approach created a "virtually unbridgeable causal gap" because "proving that a particular polluter had caused the water quality to dip below the standards was all but impossible to satisfy."[148] Thus, "Congress realized not only that its [pre-1972] water pollution efforts … had failed, but also that reliance on receiving water capacity as a crucial test for pollution levels had contributed greatly to that failure."[149]

To reverse the anarchy and ineffectiveness of case-by-case regulation, Congress required EPA to set standards for categories of polluters:

> In presenting the Conference Report to the Senate, Senator Muskie, perhaps the Act's primary author, emphasized the importance of uniformity in setting § 301 limitations….[which] required that EPA focus on classes or categories of sources in formulating effluent limitations….
>
> "The Conferees intend that the factors [for permitting standards]… be considered only within classes or categories of point sources and that such factors not be considered at the time of the application of an effluent limitation to an individual point source within such a category or class." 118 Cong. Rec. 33697 (1972), Leg.

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the Water Pollution Control Act Amendments of 1972, 1452 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-1 (1973).

[145] *Id.*, 451 U.S. at 317, quoting House Debate on H.R. 11896, 1 Leg. Hist. 350-51, 359-60 (remarks of Reps. Blatnik and Jones). 1 *Legislative History of the Water Pollution Control Act Amendments of 1972* 350 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-1 (1973) (Exh. 55).

[146] *EPA v. California State Water Resources Control Board*, 426 U.S. 200, 202-03 (1976).

[147] *Riverkeeper I* at 189, citing *CPC Int'l v. Train*, 515 F.2d 1032, 1034-35 (8th Cir. 1975).

[148] *Id.* at 189-90, quoting *CPC*, 515 F.2d at 1035 and *Bethlehem Steel Corp. v. EPA*, 538 F.2d 513, 515 (2d Cir. 1976).

[149] *Weyerhaeuser*, 590 F.2d at 1042.

Hist. 172.[150]

The Senate Public Works Committee explained the Act's requirement for standardized effluent limits and this "shift to end-of-pipe standards":[151]

> The Committee adopted this substantial change ...because of the great difficulty associated with establishing reliable and enforceable precise effluent limitations on the basis of a given stream quality. Water quality standards, in addition to their deficiencies in relying on the assimilative capacity of receiving waters, often cannot be translated into effluent limitations – defendable in court tests, because of the imprecision of models for water quality and the effects of effluents in most waters.....
>
> With effluent limits, the Administrator can require the best control technology; he need not search for a precise link between pollution and water quality.[152]

"Government regulators were therefore freed from the 'need [to] search for a precise link between pollution and water quality in enforcing pollution controls."[153] Moreover, the new approach to regulation also:

> implemented changing views as to the relative rights of the public and of industrial polluters. Hitherto, the right of the polluter was pre-eminent, unless the damage caused by pollution could be proven. Henceforth, the right of the public to a clean environment would be pre-em inent, unless pollution treatment was impractical or unachievable. ... This new view of relative rights was based in part on the hard-nosed assessment of our scientific ignorance: "we know so little about the ultimate consequences of injection of new matter into water that (the Act requires) a presumption of pollution. . . ."[154]

Under the 1972 Act:

> a discharger's performance is ... measured against strict technology-based effluent limitations [setting forth] specified levels of treatment to which it *must conform* ... This new approach reflected developing views on practicality and rights. Congress concluded that water pollution seriously harmed the environment, and that although the cost of control would be heavy, the nation would benefit from controlling that pollution. Yet *scientific uncertainties made it difficult to assess the benefits to particular bodies of receiving water*.[155]

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[150] *E. I. du Pont. v. Train,* 430 U.S. 112, 130 (1977).

[151] *Id.* at 163.

[152] S. Rep. No. 414, 92d Cong., 1st Sess. 8 (1971) (Exh. 56).

[153] *Friends of the Earth, Inc. v. Gaston Copper Recycling Corp.*, 204 F.3d 149, 151 (4th Cir. 2000), citing legislative history (internal citations omitted).

[154] *Weyerhaeuser v. Costle*, 590 F.2d 1011, 1043 (D.C. Cir. 1978), citing legislative history (internal citations omitted).

[155] *Weyerhaeuser*, 590 F.2d at 1042 (emphasis added).

A significant objective of Congress was to standardize permitting and to have EPA set a federal floor for environmental protection in order to avoid a "race to the bottom" by state regulators, which commonly occurred before 1972, when States competed to attract industries by relaxing control requirements:

> [B]y eliminating the issue of the capacity of particular bodies of receiving water, Congress made nationwide uniformity in effluent regulation possible. Congress considered uniformity vital to free the states from the temptation of relaxing local limitations in order to woo or keep industrial facilities. In addition, national uniformity made pollution clean-up possible without engaging in the divisive task of favoring some regions of the country over others.[156]

In particular, the 1972 Act fundamentally restructured the law to rely in the first instance on the imposition of a series of categorically-determined technology-based standards to be promulgated by EPA that did not themselves depend on site-specific showings of impact of particular activities on water quality. These technology-based standards are designed to achieve the maximum reduction in activities that degraded water quality, by focusing on the extent to which certain technology was, depending on the type of source or pollutant, "practicable," "achievable," "available" or "demonstrated."[157]

Water quality standards were retained in the 1972 Act only as a supplementary mechanism that – except in the case of thermal pollution under section 316(a), which is a "notable exception" – can only be used to set limitations stricter, but not more lenient, than technology-based limitations.[158] In 1977, Congress also observed that its "one experiment in the Act with allowing consideration of receiving water capacity," section 316(a), "had led to a regulatory breakdown. 'Heat has thus become an unregulated pollutant, clearly not the intent of the Congress. . . . That limited exemption has been turned into a gaping loophole.'"[159]

Congress intended the CWA's technology-based standards to become more stringent over time. For permits issued before EPA had promulgated national standards, NPDES permit writers used their "best professional judgment" (BPJ) on a case-by-case basis.[160] Next, by 1977, discharges from existing facilities were to be brought in line with the "best practicable control technology currently achievable" (BPT).[161] In the next phase, by 1989, most facilities

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[156] *Weyerhaeuser,* 590 F.2d at 1042; *see also Natural Resources Defense Council, Inc. ("NRDC") v. Train*, 510 F.2d 692, 709-10 (D.C. Cir. 1974) (explaining that Congress intended uniform federal requirements to "safeguard against industrial pressures by establishing a uniform 'minimal level of control imposed on all sources within a category or class'").

[157] See CWA sections 301(b), 304(b), 306; 33 U.S.C. §§ 1311(b), 1314(b), 1316.

[158] See CWA section 301(b)(1)(C), 33 U.S.C. § 1311(b)(1)(C); *EPA v. California,* 426 U.S. at 205 n. 12; *Riverkeeper*, 358 F.3d at 184 n. 10, 190; *Weyerhaeuser*, 590 F.2d at 1043.

[159] *Id.* at 1044, citing legislative history.

[160] 33 U.S.C. § 1342(a)(1)(B). Even in BPJ cases, the conditions are to reflect best practices in the industry rather than local conditions. *See Natural Resources Defense Council ("NRDC") v. EPA*, 863 F.2d 1420, 1425 (9th Cir. 1988).

[161] BPT represents the "average of the best existing performance by plants ... within each industrial category. This average is not based upon a broad range of plants within an industrial category or subcategory, but is based upon

nationwide would be required to step up the level of pollution control to standards based on the "best available technology economically achievable" (BAT).[162]

Finally, for new facilities, Congress created the strictest standard in the Act, "new source performance standards," which require the application of "best available demonstrated control technology" (BADT).[163] These standards are similar to the technology-based limitations established for existing sources, except that no cost-based variances are allowed during permitting.[164] Indeed, with the passage of time and the tightening of the standards, cost considerations were to be relegated to a more peripheral role in the selection of best technology.[165] Courts have consistently held that a central statutory objective of technology standards is to "predicate[] pollution control on the application of control technology *on the plants themselves*"[166] to reduce pollution's impacts "at their source."[167]

Consequently, the Clean Water Act's technology-based limitations were designed to force the iterative development of more protective technologies, and to ratchet down discharges and other impairments to water quality until they could be eliminated.[168] Congress and numerous federal courts have emphasized this "technology-forcing" character of the Act's categorical standards within the context of the section 301 BAT requirement. Indeed, the most critical aspect of BAT is that it compels polluting industries to meet ever more stringent limitations on the path towards complete elimination of water pollution.[169] BAT must be "at a minimum, established with reference to the best performer in any industrial category."[170] "The BAT standard reflects the intention of Congress to use the latest scientific research and technology in setting effluent limits, pushing industries toward the goal of zero discharge as quickly as possible. In setting BAT, EPA uses not the average plant, but the optimally operating plant, the pilot plant which acts as a beacon to show what is possible."[171]

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performance levels achieved by exemplary plants." *EPA v. National Crushed Stone Assoc.*, 449 U.S. 64, 76 n.15 (1980).

[162] 33 U.S.C. § 1311(b)(2). BAT uses "the optimally operating plant, the pilot plant which acts as a beacon to show what is possible." *Kennecott v. EPA*, 780 F.2d 445, 448 (4th Cir. 1985).

[163] CWA § 306; 33 U.S.C. § 1316.

[164] *E.I. du Pont de Nemours & Co. v. Train*, 430 U.S. 112, 137 (1977).

[165] *NRDC v. EPA*, 822 F.2d 104, 110 (D.C. Cir. 1987); *see also Riverkeeper I*, 358 F.3d at 185 (EPA "should give decreasing weight to expense as facilities have time to plan ahead to meet tougher restrictions.").

[166] *Hooker Chems. & Plastics Corp. v. Train,* 537 F.2d 620, 623 (2d Cir. 1976) (emphasis added).

[167] *Bethlehem*, 538 F.2d at 515.

[168] The use of national, uniform standards also promotes the Congressional interest in "horizontal equity," *i.e.*, that similar facilities be treated similarly under the CWA insofar as possible. *NRDC v. EPA*, 859 F.2d 156, 200 (D.C. Cir. 1988) ("[O]ne congressional purpose in this respect was clear: ... to maximize horizontal equity."); *American Iron & Steel Inst. v. EPA*, 526 F.2d 1027, 1044 (3d Cir. 1975) ("[T]he intent is that effluent limitations applicable to individual point sources be as uniform as possible.").

[169] *NRDC v. EPA*, 822 F.2d 104, 123 (D.C. Cir. 1987).

[170] Conf. Rep. on S. 2770 (October 4, 1972), 1 *Legislative History of the Federal Water Pollution Control Act of 1972* 170 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-1 (1973) (Exh. 57).

[171] *Kennecott v. EPA*, 780 F.2d 445, 448 (4th Cir. 1985), citing legislative history 1 *Legislative History of the Federal Water Pollution Control Act of 1972*, 798 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-1 (1973) (Exh. 58).

"[I]t is clear that Congress did not intend by that phrase [i.e., BAT] to limit the technology to that which is widely in use. … 'It will be sufficient, for the purpose of setting the level of control under available technology, that there be one operating facility which demonstrates that the level can be achieved or that there is sufficient information and data from a relevant pilot plant.'"[172] BAT must "utilize the latest technology to reach 'the greatest attainable level … which could be achieved.[173] As explained by the U.S. Court of Appeals for the District of Columbia Circuit:

> [T]he [Clean Water Act's] regulatory scheme is structured around a series of increasingly stringent technology-based standards … *[T]he most salient characteristic of this statutory scheme, articulated time and again by its architects and embedded in the statutory language, is that it is technology-forcing….* The essential purpose of this series of progressively more demanding technology-based standards was not only to stimulate but to press development of new, more efficient and effective technologies. *This policy is expressed as a statutory mandate, not simply as a goal.*[174]

Moreover, as the Supreme Court has recognized, the potential for economic consequences does not obviate the mandate for technology based standards:

> Prior to the passage of the Act, Congress had before it a report … [that] estimated that there would be 200 to 300 plant closings caused by the first set of pollution limitations. Comments in the Senate debate were explicit: 'There is no doubt that we will suffer some disruptions in our economy because of these efforts; many marginal plants may be forced to close.'[175]

Much more recently, the Second Circuit recognized that technology standards are economically achievable even if they could result in the closure of certain facilities.[176] Referring to an 11 percent industry-wide risk of closure, the Court stated that "the EPA – and courts – have treated more substantial risks of closure as nonetheless supporting a finding of economic achievability."[177] In *Chemical Manufacturers*, for example, the Fifth Circuit upheld a BAT standard where 14 percent of facilities would be forced to close.[178]

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[172] *American Iron & Steel Inst. v. EPA*, 526 F.2d 1027, 1058 (3d Cir. 1975), quoting legislative history.

[173] *NRDC v. EPA*, 863 F.2d 1420, 1431 (9th Cir. 1988). See also *Texas Oil & Gas Ass'n v. United States EPA*, 161 F.3d 923, 928 (5th Cir. 1998) (BAT limitations to be based on the performance of "the single best-performing plant.") *American Iron & Steel*, 526 F.2d at 1061; *National Ass'n of Metal Finishers v. EPA*, 719 F.2d 624, 657, n. 51 (3d Cir. 1983); *FMC Corp. v. Train*, 539 F.2d 973, 983 (4th Cir. 1976); *American Frozen Food Inst. v. EPA*, 539 F.2d 107, 117 (D.C. Cir. 1976).

[174] *NRDC v. EPA*, 822 F.2d 104, 123 (D.C. Cir. 1987) (emphasis added).

[175] *EPA v. National Crushed Stone*, 449 U.S. 64, 80 (1980).

[176] *Waterkeeper*, 399 F.3d at 518.

[177] *Id.*

[178] *Chem. Mfrs.*, 870 F.2d at 202.

3. As Part of the CWA's Technology-Based Regime, Section 316(b) Requires EPA to Adopt Uniform, National, Categorical, Technology-Based and Technology-Forcing BTA Standards for Cooling Water Intake Structures.

CWA Section 316(b) represents the convergence of two important Congressional objectives: to minimize the massive water withdrawals and fish kills caused by once-through cooling at power plants, and to do so through the imposition of national, categorical, technology-based standards that can be made stricter, but not weaker, as a result of site-specific water quality assessments. As noted above, Section 316(b) was enacted as part of the sweeping 1972 amendments to the Clean Water Act. The plain language of this provision and an examination of the relevant statutory structure compels the conclusion that EPA is required to adopt uniform, national, categorical, technology-based and technology-forcing BTA standards for cooling water intake structures.

a. Section 316(b) Requires EPA to Establish National Standards.

With its use of a clear command – "shall" – Section 316(b) affords the Administrator of EPA no discretion to decline to establish standards for the intake of cooling water.[179] Indeed, EPA recognizes that Section 316(b) "*requires EPA to establish standards* for cooling water intake structures that reflect the 'best technology available for minimizing adverse environmental impact.'"[180] Significantly, the term "standard" is used in the CWA only to refer to *national* standards, such as the "standards of performance" EPA issues as national categorical regulations for new facilities,[181] the "pretreatment standards" EPA issues as national categorical regulations for industrial facilities discharging toxic pollutants to sewer systems,[182] and the "standards of performance" EPA issues as national categorical regulations for marine sanitation devices.[183] Significantly, in the seminal 1977 case of *E. I. du Pont de Nemours v. Train* the Supreme Court relied, in part, on the fact that "§ 316(b) refers to '[any] *standard* established pursuant to section 301'" in holding that Congress intended EPA to promulgate effluent limitations for existing sources by regulation (and not case-by-case) under section 301.[184] As the Second Circuit confirmed in its review of EPA's Phase II cooling water intake rule, Section 316(b) constitutes a "statutory directive to set national standards."[185]

b. The National Standards Section 316(b) Requires Are a Form of Limitation Required by Sections 301 and 306.

Significantly, Congress has in Section 316(b) also directed EPA to utilize a *particular* Clean Water Act standard for implementing the BTA mandate: a "standard established pursuant

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[179] "'Shall' ... is the language of command." *Escoe v. Zerbst*, 295 U.S. 490, 493 (1935).

[180] 76 Fed. Reg. at 22,196 (col. 2) (emphasis added).

[181] CWA § 306; 33 U.S.C. § 1316.

[182] CWA § 307(b); 33 U.S.C. § 1317(b). As the Courts have noted, these standards are to be uniform within an industrial category. *See Chemical Mfrs.*, 870 F.2d at 244, 253.

[183] CWA § 312(b); 33 U.S.C. § 1322(b).

[184] *E. I. du Pont de Nemours v. Train*, 430 U.S. 112, 133 n.24 (1977) (emphasis added).

[185] *Riverkeeper II*, 475 F.3d at 126.

to [CWA sections 301 or 306] and applicable to a point source."[186] Any argument that EPA may choose to regulate on an individual, plant-by-plant basis thus is foreclosed not simply by Congress's use of the term "standard" in Section 316(b), but also by that section's requirement that intake structures be regulated *as part of* the categorical "standards established pursuant to" sections 301 and 306.[187]

Further, the legislative history provides that "[s]ection 316 must be read with other sections in the bill including section 301 effluent limitations . . . and section 306, new sources."[188] Looking to the cross-referenced sections 301 and 306, and consistent with the Supreme Court's conclusion in *du Pont* that the reference to "standards" in Section 316(b) means national categorical regulations, the courts have found that Section 316(b) requires EPA to establish BTA requirements as part of the standards required by sections 301 and 306 and subject to the deadlines set forth in those sections. For example, before remanding EPA's first BTA regulations in 1977, the Fourth Circuit concluded that:

> [t]he regulations issued under § 316(b) are...closely related to the effluent limitations and new source performance standards of §§ 301 and 306... It bears emphasis that § 316(b)... *requires § 301 and § 306 standards to deal with cooling water intake structures*....[The] regulations [are] issued at least in part under the same statutory sections, some of which limit intake structures, others, effluent discharges.[189]

Significantly, that court noted the fundamental differences in the statutory scheme for effluent limitations and Section 316(b) standards, as compared to water quality standards.[190] In that opinion, the Fourth Circuit also took note of "the aim of Congress to achieve nationally uniform standards."[191]

Likewise, in rejecting a challenge to EPA's authority to regulate cooling water structures in NPDES permits, the Seventh Circuit held that the requirements of Section 316(b) "are to be implemented through standards established pursuant to §§ 301 and 306."[192] In entering the consent decree requiring EPA's three-phase BTA rulemaking, the Southern District of New York held that "a Section 316(b) limitation should be considered a form of limitation under sections 301 and 306" and "the time limits in section 301 and 306 govern EPA's duty to take action under Section 316(b)."[193] And in reviewing EPA's Phase I Rule, the Second Circuit observed that Section 316(b)'s text:

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[186] CWA § 316(b).

[187] Also telling is the fact that BTA requirements must be issued for the same facilities, *i.e.*, "point sources" to which categorical discharge limitations apply.

[188] *Riverkeeper I*, 358 F.3d at 186, quoting statement of Rep. Clark.

[189] *Virginia Electric and Power Company v. Costle ("VEPCO"),* 566 F.2d 446, 450 (4th Cir. 1977); see also *Cronin v. Browner*, 898 F.Supp. 1052, 1059 (S.D.N.Y. 1995).

[190] *VEPCO,* 566 F.2d at 450, n.17 citing *Bethlehem*, 538 F.2d 513, and noting that unlike water quality standards, Section 316(b) regulators are "closely tied to § 301 or § 306." *Id.*

[191] *Id.* at 450, citing *American Frozen Food Inst. v. EPA*, 539 F.2d 107, 118 (D.C. Cir. 1976).

[192] *United States Steel Corp. v. Train*, 556 F.2d 822, 850 (7th Cir. 1977).

[193] *Cronin*, 898 F.Supp. at 1059.

> makes clear that administrative regulations under this section are promulgated "pursuant to" both sections 301 and 306 as well as Section 316(b). When the EPA "established" new source performance discharge "standard[s]" "pursuant to section … 306," it ought *then* to have regulated new intake structures, because, by virtue of Section 316(b), section 306's standards "shall require that … cooling water intake structures reflect the best technology available."[194]

Accordingly, EPA not only should have promulgated requirements for cooling water intake structures at the same time as it promulgated discharge requirements for the point sources using the intakes, in accordance with the specific deadlines set forth in sections 301 and 306,[195] — i.e., by 1989, at the latest — but EPA was also required to promulgate those requirements as a form of section 301 and 306 limitations as part of the same standards.

c. The National Standards Section 316(b) Requires Must Be Uniform and Categorical.

The fact that Section 316(b) standards are a form of limitation under CWA sections 301 and 306 also reveals an essential feature about them: like the Act's other technology-based standards, Section 316(b) standards are to be implemented on a nationwide, uniform basis whenever it is feasible to do so.[196] The industrial point source standards promulgated under sections 301 and 306 are "categorical" in nature. That is, each standard applies to a particular industrial category and, except in those limited circumstances where an individualized waiver or variance may be available, applies uniformly to all facilities in the United States in that category.[197] Since the requirements for cooling water intakes are required to be issued as part of these categorical standards, and are to be applicable to the same facilities to which categorical discharge limitations apply, it is therefore inescapable that these requirements are also to be categorical.

The integration of Section 316(b)'s "best technology available" (BTA) requirement to minimize adverse environmental impacts with the effluent limitations under sections 301 and 306 indicates Congress's intent for national technology-based standards to control entrainment and impingement.

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[194] *Riverkeeper I*, 358 F.3d at 185-86 (emphasis in original).

[195] For existing sources those deadlines were July 1, 1977 (33 U.S.C. § 1311(b)(1)(A)) and March 31, 1989 (33 U.S.C. § 1311(b)(2)(C) – (F)). For new sources, EPA was required to publish a list of at least 27 specified industry categories by January 17, 1973 (33 U.S.C. § 1316(b)(1)(A)), and to promulgate standards for each category within one year thereafter (33 U.S.C. § 1316(b)(1)(B)).

[196] This does not mean, of course, that the substance of the Section 316(b) regulations is to be based on the substantive factors applicable to the section 306 standards or any of the various section 301 standards. The substance of the Section 316(b) standards is to be determined with reference to the language of Section 316(b) itself.

[197] *See* 33 U.S.C. § 1311(b)(2)(A) (directing EPA to promulgate "effluent limitations for *categories and classes* of [existing] point sources"); 33 U.S.C. § 1316(b)(1)(B) (specifying that "after a *category* of sources is included in a list" as required by this section, EPA "shall propose and publish regulations establishing Federal standards of performance for new sources *within such category*") (emphases added). *See generally E.I. du Pont de Nemours & Co. v. Train*, 430 U.S. 112, 126-29 (1977).

Clearly, had it chosen to do so, Congress *could* have drafted Section 316(b) as solely a substantive requirement to be determined case-by-case by individual permit writers. For instance, Congress could simply have required that cooling water intake structures meet BTA, with no reference to "standards" or to sections 301 and 306. Or Congress could have written Section 316(b) to refer instead to CWA section 402,[198] since permit conditions are established pursuant to *that* section, not section 301 or 306. The fact that Congress added these additional mandates reflects a clear intent that the BTA requirements be issued as categorical standards.[199]

C. Regulatory Background: For Forty Years, Regulation on a Case-by-Case Site-Specific Basis Has Caused Bureaucratic Paralysis, Litigation Quagmires, and the Perpetuation of the Unacceptable Status Quo, Contrary to Congress's Intent.

Since 1972, in the absence of national regulations, cooling water intake structures have been relegated on an *ad hoc,* case-by-case, site-specific basis by individual permit writers, typically State agencies, exercising their "best professional judgment."[200] Permit proceedings have typically extended over many years – in some cases, more than a decade – despite the CWA's requirements that NPDES permits be limited to five years duration[201] and that BAT regulations be reviewed and, if appropriate, revised every five years.[202] Permit renewals are backlogged in virtually every state and hundreds of facilities operate on long-expired permits. When BTA decisions have been made, these site-specific proceedings have resulted in uneven and conflicting rulings, the widespread use of inferior technology, little change in the status quo, and enormous, unnecessary aquatic mortality, all of which run contrary to the goals of the Clean Water Act and the direct mandate of Section 316(b).

Industry, which has a critical strategic advantage in these complex proceedings because of its superior resources, has taken advantage of biological and economic complexity and used litigation and delay tactics to avoid technology upgrades. In particular, industry will inundate regulators with an overabundance of information, which is highly time-consuming to evaluate, if it can be evaluated at all. As just one example of which EPA is aware, in New Jersey, one plant's permit renewal application comprised 36 volumes, supported by 137 volumes of technical and reference materials, which took the state agency seven years to review and finally act upon.[203]

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[198] 33 U.S.C. § 1342.

[199] Of course, there will be some circumstances in which uniform regulation is simply impracticable for a particular aspect of certain facilities' operation. There may be technical or administrative impediments to uniform regulation, a lack of available data, or site-specific conditions preventing any one set of technologies from being deemed the "best available." Under *those* circumstances, plant-by-plant permitting may be appropriate; otherwise, there would be no regulation at all. *See generally NRDC v. Train*, 510 F.2d 692, 710 (D.C. Cir. 1974); *NRDC v. Costle*, 568 F.2d 1369, 1379-80 (D.C. Cir. 1977). But the fact that EPA's attempts to establish nationwide uniform standards may be thwarted on occasion by practical considerations does not give the agency *carte blanche* to refuse to set such standards for an entire category whenever it prefers another approach. It certainly does not allow EPA to countermand the congressional preference for uniform standards based on the agency's own policy judgments.

[200] *See* CWA § 402(a)(1)(B), 33 U.S.C. § 1342(a)(1)(B) (prior to national regulations, permits are case-by-case); *NRDC v. EPA*, 863 F.2d 1420, 1424 (9th Cir. 1988).

[201] CWA § 402(b)(1)(B), 33 U.S.C. § 1342(b)(1)(B).

[202] CWA § 301(d), 33 U.S.C. § 1311(d)

[203] 67 Fed. Reg. at 17,153 (col.1).

Industry then uses the enormous volumes of technical information in purported justification of a laundry list of baseless excuses and unsupported arguments, such as the following:

1. Industry incorrectly contends that adverse environmental impact (AEI) must be established at each facility before Section 316(b) applies or BTA requirements can be imposed.[204]
2. Industry further incorrectly contends that permitting agencies must define AEI at some threshhold level of ecological damage for each individual facility's permit application.[205]
3. Industry often contends, contrary to the obvious facts, that a particular power plant is not causing AEI despite entraining and impinging large numbers of organisms.[206]
4. Industry often incorrectly contends that AEI must be or should be measured at the population level.[207]
5. Industry incorrectly argues that the methods used by fisheries scientists to evaluate the inpacts of proposed harvesting regimes should be used to evaluate the harms of impingment and entrainment.[208]
6. Industry often incorrectly contends that populations will not be affected by intake structures, despite the loss of large numbers of early life stages of fish, based on the misapplication of the ecologically baseless concept of "surplus production."[209]

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[204] In New York, facility operators contest the existence of an adverse environmental impact as the first step in the state's BTA case analysis process. *See In the Matter of Athens Generating Company, LP*, Interim Decision of the Commissioner of the N.Y. State Dep't of Envtl. Conservation at 4, (June 2, 2000), available at http://www.dec.ny.gov/hearings/10976.html ("Pursuant to CWA §316(b), a four step analysis determines whether 'best technology available' is being utilized by any particular facility" and the first step is determining "whether the facility's cooling water intake structure may result in adverse environmental impact.")..

[205] *See, e.g.*, July 11, 2000, letter from Utility Water Action Group Cooling Systems Committee Chair David Bailey to OMB Office of Information and Regulatory Affairs Deputy Administrator Don Arbuckle, at 2, attached to July 11, 2000 letter from Kristy A.N. Bulleit to EPA Office of Science and Technology Director Geoffrey Grubbs. See also Comments of the Utility Water Action Group on EPA's Proposed Section § 316(b) Rule for New Facilities and ICR No. 1973.01, November 9, 2000 ("UWAG Phase I Comment") at 53-72.

[206] *See, e.g.*, *In the Matter of Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC*, Interim Decision of the Assistant Commissioner of the N.Y. State Dep't of Envtl. Conservation at 16 (Aug. 13, 2008), available at http://www.dec.ny.gov/docs/legal_protection_pdf/indianpointid.pdf (Exh. 59) ("Entergy maintains that staff may not presume adverse impacts exist, but rather must 'affirmatively establish' the existence of such impacts.").

[207] In pre-filed testimony, dated July 22, 2011, filed with the New York State DEC in regard to the NPDES permit for the Indian Point power plant, Entergy Nuclear argued that the plant's adverse environmental impact, and the efficacy of Entergy's proposed cylindrical wedgewire screens, should be considered at the population level and applied age-one equivalent conversions to represent the adverse impacts of Indian Point on all life stages of fish as part of a single metric; *see also* UWAG Phase I Comment at 58-68.

[208] UWAG Phase I Comment at 66.

[209] For example, FirstEnergy has claimed that the massive fish kills at its Bayshore power plant in Ohio are not significant to the fish population as a whole. *See* Letter from Michael Jirousek, FirstEnergy Generation Corp. to Naajy S. Abdullah, Ohio EPA re FirstEnergy's Comments on Renewal of NPDES Permit for Bay Shore Plant (May 26, 2010) (arguing that overall fish populations are not affected even though, "at face value" the fish kill data from

7. Industry incorrectly argues that only certain fish and shellfish species matter.[210]
8. Industry often has the temerity to argue, incorrectly, that massive fish kills and thermal discharges have a beneficial impact, for example because some of the dead fish are nuisance species or some species prefer warmer water.[211]
9. Industry makes the irrelevant argument that some of the fish they entrained or impinged were dead before they were trapped by the intake structure.[212]
10. Industry incorrectly argues that the percentage of fish being impinged and entrained is small when compared to overall stock size or what indsustry sometimes refers to as the "exploitable population."[213]
11. Industry incorrectly argues or suggests that other causes, for example, fishing or natural conditions, have a more significant impact on fish than intake structures.[214]
12. Industry incorrectly argues that documented fish or shellfish population declines in the vicnity of the plant are unrelated to the operation of their intake structures.[215]
13. Industry incorrectly argues that large numbers of fish survive impingement and/or entrainment unharmed.[216]
14. Industry contends, contrary to legal precedent, that it should get credit for restoration or

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Bayshore suggest "that the number of organisms impacted in the cooling water intake is large.") (Exh. 60); *See also* discussion of "surplus production" arguments in John Boreman, "Surplus Production, Compensation, and Impact Assessments of Power Plants," 3 *Envtl. Sci. & Pol'y* 8445 (2000) [DCN 2-018A] (Exh. 61) and Super and Gordon, "Minimizing Adverse Environmental Impact: How Murky the Waters," *The Scientific World* 229 (2002) (Exh. 62).

[210] FirstEnergy has used this argument to attempt to publicly diminish the significance of its massive fish kills at the Bayshore power plant. *See, e.g.,* Letter from Michael Jirousek, FirstEnergy Generation Corp. to Naajy S. Abdullah, Ohio EPA (May 26, 2010) (killing massive numbers of emerald shiners, sheephead and gizzard shad is less important because there are large populations of these species in Lake Erie) (Exh. 60).

[211] This argument has been made by Midwest Generation with regard to the Crawford and Fisk plants in the Chicago waterway system in Illinois. Similarly, Dayton Power & Light has argued that once-through cooling at its Stuart plant in Ohio is beneficial to the environment because it supports fishing opportunities during the winter. *See* Letter from JoAnne Rau, Director, Environmental Safety and Management, Dayton Power and Light Company to Sean Ramach, US EPA Region 5 (Apr. 28, 2011) (providing DP&L's comments on EPA's rejection of the draft NPDES permit renewal for the J.M. Stuart Electric Generating Station) (Exh. 63). Recently, EPA proposed to object to Ohio EPA's renewal of Stuart's NPDES permit because Ohio EPA does not require compliance with thermal water quality standards and Dayton Power & Light has not provided support for a thermal variance. *See id.*

[212] FirstEnergy has emphasized such deaths in an attempt to diminish the significance of the massive fish kills at its Bayshore power plant.

[213] *See, e.g.*, *In the Matter of Millstone Power Station*, Before the Connecticut Department of Environmental Protection, Office of Adjudications, Application No. 199701876, Applicant's Post Hearing Submittal (May 8, 2009) (Exh. 64).

[214] *Id.* FirstEnergy has also tried to distract the public from the massive fish kills at its Bayshore power plant by pointing to other sources of stress on the aquatic ecosystem in the surrounding area.

[215] *See, e.g.*, *In the Matter of Millstone Power Station*, Before the Connecticut Department of Environmental Protection, Office of Adjusications, Application No. 199701876, Applicant's Post Hearing Submittal (May 8, 2009) (Exh. 64).

[216] *See, In the Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer LLC (Danskammer Generating Station)*, DEC No.: 3-3346-00011/00002, SPDES No.: NY-0006262, Decision of the Deputy Commissioner of the N.Y. State Dep't of Envtl. Conservation at 17 – 18 (May 24, 2006) (Exh. 65) (Dynegy sought to have entrainment mortality figures for Danskammer adjusted for claimed entrainment survival).

mitigation measures.[217]

15. Industry often incorrectly argues that the operational baseline for comparing the performance of technologies should be calculated based on the wholly artificial concept that the plant operates at full capacity 24 hours a day, seven days a week, 365 days a year, and should receive "credit" for the difference between fictional baseline and its normal operation, even in instances where the gap between the fictional baseline and actual operation is 90 percent or more.[218]
16. Industry incorrectly argues that the burden of proof is on state regulators or intervenors to prove that certain technologies are BTA, when, in fact, permittees must prove that they are entitled to a NPDES permit to discharge and to withdraw cooling water from waters of the U.S.[219]
17. Industry often incorrectly argues that their excessive thermal discharges should be ignored because of "mixing zones."[220]
18. Industry invariably argues that they are entitled to a variance under Clean Water Act Section 316(a) from technology-based standards for thermal discharges.[221]
19. Industry incorrectly argues that states cannot or should not require closed-cycle cooling

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[217] *See, e.g., Voices of the Wetlands v. State Water Resources Control Board*, No. S160211, 2011 WL 3558007 (Cal. Supreme Ct. August 15, 2011) at * 7 (state approved $7 million Elkhorn Slough habitat restoration plan as mitigation for entrainment and impingement; parties disputed restoration was a "substitute" for BTA and whether the BTA determination rested on the resoration plan as the basis for its BTA finding). For many years, restoration measures have been the centerpiece of Section 316(b) compliance for PSEG's Salem nuclear plant in New Jersey, despite dubious claims that restoration is not linked to the BTA determination.

[218] Mirant Bowline LLC has sought a full-flow baseline for its Bowline Point Generating Station in recent permit proceedings, despite the fact that, in 2010, the plant generated energy equal to less than 5% of its capacity. *See In the Matter of the Application of Mirant Bowline LLC (Mirant) For a State Pollution Discharge Elimination System Permit Renewal for the Bowline Point Generating Station (Units 1 and 2), DEC # 3-3922-00003/00003, SPDES # NY-0008010*, Post-Issues Conference Brief by the Staff of the New York State Department of Environmental Conservation at 12 (June 29, 2006) (accepting the applicant's argument that the Mirant Bowline plant should be entitled to a full-flow baseline) (Exh. 66); *see also, In the Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer LLC (Danskammer Generating Station)*, DEC No.: 3-3346-00011/00002, SPDES No.: NY-0006262, Decision of the Deputy Commissioner of the N.Y. State Dep't of Envtl. Conservation at 1 (May 24, 2006) (Exh. 65) ("[T]he baseline should be calculated using full-flow"). *But see* New York Independent System Operator, *Gold Book; 2010 Load & Capacity Data* at 42 (April 2010), available at: http://www.nyiso.com /public/webdocs /services/planning/planning_data_reference_documents/2010_GoldBo_ok_Public_Final_033110.pdf (Mirant Bowline's two generating units generated less than 150 GWh of energy in 2010, despite having a combined nameplate capacity of over 1 GW).

[219] Dynegy has sought to reverse the burden of proof with respect to its Danskammer plant, while Entergy has sought to do the same in permit proceedings related to the Indian Point facility.

[220] In the commenters' experience, every power company attempts to make this argument, often by defining the mixing zone in a way that encompasses the entire thermal plume and failing to take an adequate look at the thermal discharges' impacts on aquatic life. *See, e.g.*, Letter from Mark Sanza, Assistant Counsel, NY DEC to the Hon. Maria E. Villa and the Hon. Daniel P. O'Connell, Administrative Law Judges, NY DEC (May 16, 2011) (Exh. 67) (NYS DEC stating letter stating that the Indian Point plant may use a "mixing zone" and that mixing zone will provide reasonable assurances of compliance with the water quality standards – without analyzing impacts on the record of permitting proceeding); Letter from Elise N. Zoli, Attorney for Entergy, to the Hon. Maria E. Villa, Administrative Law Judge, NY DEC (May 17, 2011) (Exh. 68) (power plant operator points to temperature measures in the thermal plume, rather than analyzing impacts to fish, in support of modified mixing zone).

[221] This argument is made by virtually every plant.

under Section 316(b) if closed-cycle cooling is not required under Section 316(a), even though those two subsections operate independently.[222]

20. Industry often incorrectly contends that compliance with BTA standards is too expensive for the company.[223]
21. Industry often incorrectly contends that compliance with BTA standards is too expensive for ratepayers.[224]
22. Industry often includes vague and absurdly excessive expenses in their estimates of compliance costs, such as overhead and indirect expenses.[225]
23. Industry incorrectly argues that it is entitled to special treatment because electricity is an "essential service."[226]
24. Industry incorrectly argues that it provides significant societal benefits that entitle it to special treatment.[227]
25. Industry incorrectly argues that states lack the authority to require plants to curtail operations to meet BTA requirements or to shut down plants that are not complying with such requirements.[228]
26. Industry incorrectly argues that technology retrofits will cause long outages.[229]
27. Industry incorrectly argues that under Section 316(b) all issues have to be "balanced" against one another to arrive at a pareto optimal result.[230]

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[222] *See, e.g.*, UWAG Phase I Comment at 16-20.

[223] Companies (facilities) that have argued that compliance is too expensive include FirstEnergy (Bayshore) and Dayton Power & Light (J.M. Stuart Generating Station). *See* Letter from Joseph M. Reidy, Attorney for Dayton Power & Light to John Sadzewicz, Ohio EPA (July 11, 1989) (comparing costs of cooling towers with other alternatives) (Exh. 69); *see also* Letter from William L. Patberg, Attorney for Dayton Power & Light to Paul Novak, Ohio EPA (Apr. 9, 2003) (arguing that cooling towers would cost a quarter of a billion dollars) (Exh. 70).

[224] Companies (facilities) that have argued that compliance is too expensive include: FirstEnergy (Bayshore) and Dayton Power & Light (Stuart).

[225] For example, in estimating the costs of retrofittng closed-cycle cooling at its E.F. Barrett plant in the South Shore Estuary on Long Island, New York, National Grid included a whopping $30 million for what it vaguely described as "management, "indirects," "indeterminates," and "contingencies." Alden Research Laboratory and Burns Engineering Services, *An Engineering & Cost Assessment of Retrofitting Closed-Cycle Cooling Technologies and E.F. Barrett Power Station* (September 2007) (Exh. 71).

[226] Companies (facilities) claiming they should not be required to retrofit to closed-cycle cooling because they provide an "essential service" include FirstEnergy (Bayshore) and Dayton Power & Light (Stuart).

[227] Companies (facilities) claiming they they are entitled to special treatment because they provide social benefits and therefore should not be required to retrofit to closed-cycle cooling include FirstEnergy (Bayshore) and Dayton Power & Light (Stuart).

[228] Companies (facilities) claiming that the regulator cannot require them to curtail operations to meet BTA requirements include FirstEnergy (Bayshore) and Dayton Power & Light (Stuart).

[229] Companies (facilities) claiming that a retrofit would cause an overly long outage include: FirstEnergy (Bayshore); Dayton Power & Light (Stuart); and Entergy Nuclear (Indian Point).

[230] In the case of Indian Point, Entergy Nuclear has phrased this argument as a need to condition a 316(b) decision on other permitting issues such as adverse air impacts, unacceptable visual impacts, and SEQRA analysis

28. Industry incorrectly argues that cooling system retrofits raise nuclear safety concerns.[231]
29. Industry incorrectly argues there are insurmountable energy concerns from outages, energy penalties, or potential plant retirements.[232]
30. Industry incorrectly argues there are insurmountable concerns relating to fogging, steam plumes or mineral drift from closed-cycle cooling.[233]
31. Industry incorrectly argues that closed-cycle cooling is noisy.[234]
32. Industry incorrectly argues that closed-cycle cooling is unsightly.[235]
33. Industry often incorrectly argues that there is insufficient space for closed-cycle cooling on a given site.[236]
34. Industry often incorrectly contends that closed-cycle cooling at a given site would have to be built to certain oversized specification (based on an overly conservative "approach temperature"), thereby consuming more space and costing more than is reasonably necessary.[237]
35. Industry often vastly overstates the amount of time necessary to install closed-cycle cooling.[238]

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[231] Dominion Nuclear Connecticut has even vigorously opposed conducting biological monitoring near the intake structure at the Millstone Power Station on the dubious grounds that it would raise nuclear safety and security concerns.

[232] Companies (facilities) claiming insurmountable energy concerns include FirstEnergy (Bayshore) and Dayton Power & Light (Stuart). *See, e.g.*, Ohio EPA, Response to comments document relating to FirstEnergy Bayshore plant, National Pollutant Discharge Elimination System (NPDES) permit (Oct. 2010) (Exh. 72) (FirstEnergy claims that it cannot shut down its own facility if a regulator requests it).

[233] *See, e.g.*, UWAG's Brief Challenging EPA's § 316(b) Rule for New Facilities, *Riverkeeper, Inc. v. U.S. Environmental Protection Agency*, No. 02-4005(L) (2d Cir.), July 2, 2003, at 22 (contending that "[w]et cooling towers also make fog, which can affect visibility and an some sites can deposit salt on trees, shrubs, and farmers' fields").

[234] For example, ignoring the availability of ultra low noise fan options, National Grid has incorrectly contended that operation of closed-cycle cooling at its Glenwood power station in Hempstead Harbor in New York might violate a town noise ordinance.

[235] For example, Entergy Nuclear has submitted a visual assessment study concluding that the installation of cooling towers at Indian Point "would present a significant aesthetic impact." Saratoga Associates, *Indian Point Energy Center Closed Cycle Cooling Conversion Feasibility Study Visual Assessment* at 1 (June 1, 2009), available at http://www.dec.ny.gov/docs/permits_ej_operations_pdf/indptvisual_1.pdf (Exh. 73).

[236] *See, eg.*, *In the Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer LLC (Danskammer Generating Station)*, DEC No.: 3-3346-00011/00002, SPDES No.: NY-0006262, Decision of the Deputy Commissioner of the N.Y. State Dep't of Envtl. Conservation at 1 (May 24, 2006) (Exh. 65) ("[T]he proposed closed-cycle cooling system retrofit configurations will not fit on the site.").

[237] See the discussion of approach temperatures in the report of Powers Engineering, attached as Appendix D. This position has been taken, for example, by National Grid in their evaluation of closed-cycle cooling at the E.F. Barrett. *See, e.g.*, *An Engineering & Cost Assessment of Retrofitting Closed-Cycle Cooling Technologies and E.F. Barrett Power Station*, Alden Research Laboratory and Burns Engineering Services, September 2007 (Exh. 71)

[238] *See, e.g.*, Enercon Services, Inc., *Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a closed-Loop Condenser Cooling Water Configuration, prepared for Entergy Nuclear Indian Point2, LLC, and Entergy Nuclear Indian Point 3, LLC* at *v*, 43 (Feb. 12, 2010) (Exh. 74), *available at* http://www.dec.ny.gov/ docs/permits_ej_operations_pdf/c onvclosloop.pdf. The over-estimate of the time necessary to install closed-cycle cooling is directly related to the tendency of many facilities to argue that technology retrofits

36. Industry often incorrectly contends that closed-cycle cooling does not pass a cost-benefit test.[239]
37. Industry often incorrectly argues that the benefits of closed-cycle cooling must exceed the costs before it can be required.[240]
38. Industry often incorrectly argues that only monetized benefits can be counted.[241]
39. Industry often incorrently argues that a host of so-called "social costs" should be considered as an integral part of the Section 316(b) determination.[242]
40. Industry often incorrectly argues that retrofits should not be required at plants that purportedly have too *little* useful life remaining.[243]
41. Industry often incorrectly argues that retrofits should not be required at plants that purportedly have too *much* useful life remaining (*i.e.*, plants that were recently repowered should be allowed to wait until the next repowering before retrofitting).[244]
42. Industry incorrectly argues that if a Section 316(b) determination was made a long time ago, it should not or cannot be revisited now.[245]

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will cause long outages.

[239] Companies (facilities) claiming that closed-cycle cooling cannot pass a cost-benefit test include FirstEnergy (Bayshore) and Dayton Power & Light (Stuart). *See, e.g.,* Letter from William L. Patberg, Attorney for Dayton Power & Light to Paul Novak, Ohio EPA (Apr. 9, 2003) (arguing that cooling towers would cost a quarter of a billion dollars but that "it is difficult to identify any environmental benefit at all" to their use) (Exh. 70).

[240] *Cf.* Brief of Petitioner Entergy Corp. in Support of Vacatur and Remand of Final Rule *Riverkeeper, Inc. v. United States Environmental Protection Agency*, No. 04-6692-ag(L) (2d Cir.), April 18, 2006, at 47 (arguing that Section 316(b) regulations – and, presumably, site-specific BTA determinations – "should not have net social costs").

[241] *See, e.g.,* Final Brief of Petitioners PSEG Fossil LLC and PSEG Nuclear LLC in Support of Vacatur and Remand of Portions of Final Rule, *Riverkeeper, Inc. v. United States Environmental Protection Agency*, No. 04-6692-ag(L) (2d Cir.), April 17, 2006, at 26-31 (arguing that "EPA improperly required evaluation of 'qualitative' non-use benefits in site-specific cost-benefit analyses").

[242] *See, e.g., In the Matter of Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations Inc.'s CWA § 401 Application for Water Quality Certification, DEC Application Numbers: 3-5522-00011/00030 (IP2) and 3-5522-00105/00031 (IP3)*, Town of Cortlandt Petition for Party Status in Joint Adjudicatory Hearing for Water Quality Certification (July 9, 2010) at 18 (Exh. 75); *In the Matter of Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations Inc.'s Joint Application for Water Quality Certification*, DEC Application Numbers: 3-5522-00011/00030 (IP2) and 3-5522-00105/00031 (IP3), Town of Cortlandt Memorandum of Law in Support of Cortlandt's Petition for Party Status (Sept. 23, 2010) (Exh. 76) at 7-8, 14 (in support of power plant, town argued that for consideration of "non-monetary costs" including alleged aesthetic, noise and traffic impacts and alleged impacts to "social fabric and community character").

[243] In the case of Indian Point, Entergy has framed this objection as a claim that closed cycle cooling could not be installed until near the end of its current Nuclear Regulatory Commission license period.

[244] *See, e.g.*, Dynegy Moss Landing, LLC, *State Water Resources Control Board Once-Through Cooling Water Policy Implementation Plan for the Moss Landing Power Plant* at 13-14 (Apr. 1, 2011) (Exh. 77) (arguing that changes to the cooling system are unwarranted in light of recent, large capital investments); *see also* e-mail from John Dennis, LADWP to Jonathan Bishop, California State Water Resources Control Board (Jul. 22, 2010) (Exh. 78) (arguing that LADWP should be allowed additional time for compliance with California's once-through cooling water policy in light of recent investments totaling over $600 million).

[245] In some cases, the claim that 316b decisions were made decades ago and cannot be disturbed now is supported

43. Industry often argues, contrary to the facts, that there is a cheaper alternative to closed-cycle cooling that is almost as protective.[246]
44. Industry often argues, contrary to the facts, there is an alternative to closed-cycle cooling that can be implemented more quickly and will therefore be more protective when time is factored in.[247]
45. Industry incorrectly argues that the receiving water into which the plant discharges is not entitled to Clean Water Act protection.[248]
46. Industry incorrectly argues that the receiving water into which the plant discharges is a commercial/industrial waterway such that water quality standards need not be as stringent as in other waterways.[249]

Given the inability of under-funded, under-staffed regulators at state agencies (or at EPA regional offices) – not to mention interested members of the public – to engage with and respond to the panoply of largely spurious issues raised at every opportunity and supported with opaque technical submittals, it is no wonder that power plants have successfully resisted upgrading their intake structures for decades. This applies to power plants regulated on a case-by-case basis by state agencies as well as those regulated directly by EPA.

For example, in the early 1970s the Atomic Energy Commission (AEC) determined that a

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by state regulators. Both Illinois and Michigan have adopted this unlawful interpretation of the Clean Water Act in multiple proceedings. *See, e.g.*, *In the Matter of the Natural Resources Defense Council (NRDC), the Sierra Club, and the Great Lakes Environmental Law Center (GLELC) on the permit issued DTE Energy, Detroit Edison Company Harbor Beach Power Plant (DTE Energy)*, Respondent Michigan Dep't of Envtl. Quality's Pre-Hearing Statement at 2-3 (Aug. 2, 2011) (a BTA permitting decision made in 1976 need not be revisited) (Exh. 79).

[246] For example, FirstEnergy claims that installing reverse louvers and fine mesh screens at its Bayshore plant would represent a move to the best technology available. At Indian Point, Entergy claims that cylindrical wedgewire screens are an acceptable alternative to closed cycle cooling (despite EPA's finding, in this proceeding, that wedgewire screens are not as effective as closed cycle cooling). And at the Danskammer Generating Station, Dynegy Generation has argued that variable speed pumps and sonic deterrents are effective, at least when viewed against the backdrop calculations of a full-flow baseline. *See In the Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer LLC (Danskammer Generating Station)*, DEC No.: 3-3346-00011/00002, SPDES No.: NY-0006262, Decision of the Deputy Commissioner of the N.Y. State Dep't of Envtl. Conservation at 3 (May 24, 2006) (Exh. 65).

[247] *See* Enercon Services, Inc., *Evaluation of Alternative Intake Technologies at Indian Point Units 2 & 3, prepared for Entergy Nuclear Indian Point2, LLC, and Entergy Nuclear Indian Point 3, LLC* at *v* (Feb. 12, 2010) (Exh. 80), available at: http://www.dec.ny.gov/docs/ permits_ej_operations_pdf/alttechrep.pdf *; see also id. at* n.4 and Attachment 6 (arguing that cylindrical wedgewire screens should be preferred to closed-cycle cooling at Indian Point because they can be implemented more quickly).

[248] Dayton Power & Light, the owner of the Stuart plant in Ohio, claims that Three Mile Creek, into which the Stuart plant discharges, is a "discharge canal" and thus that water quality standards do not apply until the point at which the creek meets the Ohio River, several miles downstream of the discharge point. *See, e.g.*, Public Fact Sheet, Dayton Power & Light, "J.M. Stuart Station NPDES Permit Renewal, Sprigg Township, Ohio" (Spring 2011) (Exh. 81); *see also* Letter from JoAnne Rau, Director, Environmental Safety and Management, Dayton Power and Light Company to Sean Ramach, US EPA Region 5 (Apr. 28, 2011) (providing DP&L's comments on EPA's rejection of the draft NPDES permit renewal for the J.M. Stuart Electric Generating Station) (Exh. 63).

[249] In Clean Water Act proceedings related to setting water quality standards, Midwest Generation has argued that Chicago's waters are less worthy of protection because they are used in commerce and by industry. *See* Midwest Generation, *Appropriate Thermal Water Quality Standards for the Chicago Sanitary and Ship Canal and Lower Des Plaines River* (Mar. 22, 2007) (Exhibit 82).

closed-cycle cooling system would be necessary at the Brunswick power plant in North Carolina to avoid significant environmental damage.[250] After years of battling, in 1980 EPA relented and settled for lesser controls.[251] With only these lesser controls in place, the plant currently kills three to four billion fish annually.[252]

Similarly, in the early 1970s, EPA ordered three Hudson River power plants to retrofit with closed-cycle cooling.[253] In the nearly 30 years since, the cooling water withdrawals at these plants have engendered endless lawsuits, negotiations, settlements and two environmental impact statements. Yet the plants still operate on long-expired permits, and the plants' once through cooling systems continue to kill fish at levels deemed "wholly unacceptable" by the state environmental agency.[254] The NPDES permit renewal for one of these plants, Indian Point, has been in adjudication since 2004 – only now scheduled for hearing dates to commence in the fall of 2011, and expected to take place over a year or more (with appeals likely).[255] Just as with the Brunswick plant, in the 1970s the AEC had determined that due to the potential for long-term impact, closed-cycle cooling was necessary for Indian Point – yet delay tactics, bureaucratic processing failures, and litigation have resulted in decades of operation of once-through cooling, allowing the plant to kill over a billion fish of all life stages each year.[256]

Notably, many of the plants whose negative environmental impacts spurred passage of the Clean Water Act 39 years ago are still operating today, their cooling water intake structures in much the same condition now as then. Incredibly enough, some of the oldest and most environmentally damaging plants in the country predate not just the 1972 Clean Water Act, but the Federal Water Pollution Control Act of 1948 as well.

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[250] *In the Matter of: Carolina Power & Light Company (Brunswick Steam Electric Plant)*, USEPA Environmental Appeals Board, 1978 EPA App. LEXIS 4 (February 20, 1978) at p. 2 (Exh. 83).

[251] James R. May & Maya K. van Rossum, *The Quick and the Dead: Fish Entrainment, Entrapment, and the Implementation and Application of Section 316(b) of the Clean Water Act*, 20 Vt. L. Rev. 373, 413 (1995). Internal EPA memoranda indicate that the decision not to require closed-cycle cooling was driven by agency resource and political concerns. *The Quick and the Dead*, 20 Vt. L. Rev. at 414, fn. 280 (Exh. 18).

[252] 66 Fed. Reg. at 65,264 (col. 1).

[253] *Consolidated Edison Co. of New York v. New York State Dept. of Environmental Conservation*, 726 F. Supp. 1404, 1407 (S.D.N.Y. 1989).

[254] 66 Fed. Reg. at 65,264 (cols. 1-2).

[255] In the Matter of Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC For a State Pollution Discharge Elimination System Permit Renewal and Modification, DEC No. 3-5522-00011/00004, SPDES No,: NY-0004472.

[256] See Letter from William R. Adriance, Chief Permit Administrator, New York State Department of Environmental Conservation, to Dara F. Gray, Entergy Nuclear Operations, (April 2, 2010) at 3 (available at http://www.dec.ny.gov/docs/permits_ej_operations_pdf/ipdenial4210.pdf).

II.

SUMMARY OF THE PROPOSED RULE

A. The Proposed Rule

The Proposed Rule applies to "existing" point sources that have a "Design Intake Flow" (DIF) of over 2 Million Gallons per day (MGD) with the capacity to withdraw more than 2 MGD of water from waters of the U.S. and use at least 25 percent of the water they withdraw exclusively for cooling.[257] However, under the proposal, "water obtained from a public water system, reclaimed water from wastewater treatment facilities or desalination plants, treated effluent from a manufacturing facility, or cooling water that is used in a manufacturing process either before or after it is used for cooling as process water, is not considered cooling water."[258]

Facilities below the thresholds are subject to permitting on a best professional judgment (BPJ) basis.[259] The three main components of the rule are the entrainment provisions, the impingement standards, and standards applicable to what EPA calls "new units at existing facilities."[260] Under the Proposed Rule, a new unit at an existing facility must reduce entrainment mortality to a level commensurate with the performance of a closed-cycle cooling system. Existing units are far less strictly controlled.[261] Each of these components and other key provisions are summarized below.

1. Entrainment Provisions for Existing Facilities (Existing Units)

The proposed rule does not set any specific criteria (numeric or otherwise) for the degree of entrainment reduction that is reflective of the Best Technology Available at any class or classes of existing units. Instead, permitting authorities are to determine BTA on a case-by-case basis.[262] Alternatively, existing facilities can choose to skip the case-by-case BTA analysis process and comply with the entrainment mortality standard that applies to new units at existing facilities.[263]

With respect to entrainment reduction, the only hard and fast "requirements" imposed on existing facilities are information provision requirements. These vary according to the size of

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[257] *See* proposed 40 C.F.R. § 125.91(a), 76 Fed. Reg. at 22,280 (col. 3). Although the rule specifies that an intake pipe is only regulated if at least 25% of its flow is cooling water, EPA leaves permit writers discretion to determine that an intake from which less than 25% of the flow is used for cooling should nonetheless be subject to permitting. *See* 76 Fed. Reg. at 22,193 (col. 2).

[258] Proposed 40 C.F.R. § 125.92, 76 Fed. Reg. at 22,281 (col. 2).

[259] *See* 76 Fed. Reg. at 22,174 (col. 3).

[260] In the proposed rule, EPA draws a critical distinction between what it terms "existing facilities" and "new units at existing facilities." But since every site addressed by this rule is an existing facility, and since a facility can contain multiple electric generating units, some new and some not, it may be more accurate to restate EPA's distinction in terms of existing and new *units*.

[261] *See* 76 Fed. Reg. at 22,196 (col. 1).

[262] *See* proposed 40 C.F.R. § 125.94(c), 76 Fed. Reg. at 22,283 (col. 2).

[263] *See* proposed 40 C.F.R. § 125.94(a)(2), 76 Fed. Reg. at 22,282 (col. 3).

the facility.[264] Applicants are not required to reduce the number of fish and other organisms entrained unless, after reviewing the information provided, the Director determines that efforts to reduce entrainment are warranted.

Facilities with an Actual Intake Flow (AIF) over 125 MGD, must conduct several entrainment-related studies and provide the results to the Director.[265] The Director's BPJ-based permitting review for such facilities relies on these studies.[266] The primary studies are:

- *Entrainment Characterization Study* – a large facility must collect data on entrainment mortality for all species and life stages that it has identified through a 'source water baseline biological characterization study.'[267] But note that as the Proposed Rule is written, the Director may exclude any species from the baseline study or from entrainment monitoring.[268] Thus, the study may not in fact report on all of the fish entrained. The study must be peer reviewed, with reviewers selected in consultation with the Director (who may also appoint additional reviewers). If any significant comments from the peer review process are not accepted, the facility owner must explain why. "Peer reviewers must have appropriate qualifications in biology, engineering, hydrology, or other fields and their names and credentials must be included in the peer review report."[269]

- *Comprehensive Technical Feasibility and Cost Evaluation Study* – "an engineering study of the technical feasibility and incremental costs of candidate entrainment mortality control technologies."[270] This study must be peer reviewed under the same terms as the entrainment characterization study.

- *Benefits Valuation Study* – "an evaluation of the magnitude of water quality benefits, *both monetized and non-monetized*, of the candidate entrainment mortality reduction technologies and operational measures evaluated" in the technical feasibility study.[271] The study must include hard numbers for fish and shellfish mortality and must explain how these averted losses and other water quality benefits are assigned a monetary value.[272] The study must be peer reviewed under the same terms as the other studies, but although the rule requires a monetary valuation of benefits, it does not require that the peer reviewers have expertise in environmental economics.[273]

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[264] *See* proposed 40 C.F.R. § 122.21(r)(1)(ii), 76 Fed. Reg. 22,275 (col. 3).

[265] *See* proposed 40 C.F.R. § 122.21(r)(1)(ii)(B), 76 Fed. Reg. at 22,276 (col. 1)..

[266] *See* proposed 40 C.F.R. § 125.94(a)(2), 76 Fed. Reg. at 22,282 (col. 3).

[267] *See* proposed 40 C.F.R. § 122.21(r)(9), 76 Fed. Reg. at 22,277 (col. 3) (requiring that the plan address "all species and life stages identified under the requirements of paragraph (r)(4) [the source water baseline biological characterization study]").

[268] *See* 40 C.F.R. § 125.98(c)(6), 76 Fed. Reg. at 22,287 (col. 3) (discussed below).

[269] Proposed 40 C.F.R. § 122.21(r)(9)(ii), 76 Fed. Reg. at 22,278 (col. 1).

[270] Proposed 40 C.F.R. § 122.21(r)(10), 76 Fed. Reg. at 22,278 (col. 2).

[271] *See* proposed 40 C.F.R. § 122.21(r)(11), 76 Fed. Reg. at 22,279 (col. 1) (emphasis added).

[272] *See* proposed 40 C.F.R. § 122.21(r)(11)(i),(ii), 76 Fed. Reg. at 22,279 (col. 1).

[273] *See* proposed 40 C.F.R. § 122.21(r)(11)(v), 76 Fed. Reg. at 22,279 (col. 1).

- *Non-water Quality and Other Environmental Impacts Study* – a "discussion of the changes in non-water quality factors and other environmental impacts attributed to each technology and operational measure considered."[274] As with the other entrainment-related studies, it also must be peer reviewed.[275]

Unlike larger plants, the owners and operators of existing facilities with an AIF less than 125 MGD need only provide a subset of the information that larger facilities must provide, i.e., baseline information to the Director about the cooling water intake system, the physical and biological characteristics of the waterbody, and their plans to reduce impingement mortality.[276]

After receiving the information listed above, the Director must determine "the maximum reduction in entrainment mortality warranted"[277] at a particular facility. In setting this so-called BTA standard at an individual facility, the Director must consider at least nine factors:

(1) Numbers and types of organisms entrained;
(2) Entrainment impacts on the waterbody;
(3) Quantified and qualitative social benefits and costs, including ecological benefits and benefits to any threatened or endangered species;
(4) Thermal discharge impacts;
(5) Impacts on the reliability of energy delivery within the immediate area;
(6) Impact of changes in particulate emissions or other pollutants associated with entrainment technologies;
(7) Land availability, inasmuch as it relates to the feasibility of entrainment technology;
(8) Remaining useful plant life; and
(9) Impacts on water consumption.

Based on these nine factors, the Director may reject an otherwise available technology "*if the social costs of compliance are not justified by the social benefits*, or if there are adverse impacts that cannot be mitigated that the Director deems to be unacceptable."[278] The Director must provide a written explanation of the decision. In that explanation, the Director must explain why any measures that perform better than the chosen option were rejected.[279]

It is unclear when (if ever) the analysis process will result in an entrainment reduction determination by the Director or implementation of entrainment controls by the facilities. While the rule sets deadlines for the owners and operators of existing units to provide the various

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[274] Proposed 40 C.F.R. § 122.21(r)(12), 76 Fed. Reg. at 22,279 (col. 1).

[275] *See* proposed 40 C.F.R. § 122.21(r)(12)(x), 76 Fed. Reg. at 22,279 (col. 2).

[276] *See* proposed 40 C.F.R. § 122.21(r)(2)(ii)(A),(B), 76 Fed. Reg. at 22,276 (col. 1) (all existing facilities must submit the basic information required in parts (r)(2)-r(8), but only the largest facilities must comply with the entrainment information requirements in parts (r)(9)-(r)(12)).

[277] Proposed 40 C.F.R. § 125.94(c), 76 Fed. Reg. at 22,283 (col. 2).

[278] Proposed 40 C.F.R. § 125.98(e), 76 Fed. Reg. at 22,288 (col. 1) (emphasis added).

[279] *See* proposed 40 C.F.R. § 125.98(e), 76 Fed. Reg. 22,288 (col. 1).

categories of information demanded to the Director,[280] it does not set an ultimate deadline for entrainment compliance.[281]

2. Entrainment Standards for "New Units at Existing Facilities."

New units at existing facilities must meet entrainment standards based on the use of a closed-cycle cooling system.[282] The entrainment standard for *new units* at existing facilities parallels the two track standard for *new facilities* that EPA developed in the Phase I rule. Thus, the operator of a new unit can choose to reduce the new unit's intake of cooling water to equal that of a closed-cycle cooling system under the same circumstances.[283] Alternatively, under the second compliance track, a higher intake flow is permissible but the facility operator must reduce entrainment mortality at the new unit to at least 90 percent of what would have been achieved had the new unit cut its AIF under the first track.[284] If a new unit opts to maintain a higher flow and plans to reduce mortality sufficiently to compensate, the Director must review the data the owner/operator submits to determine whether it will reduce impingement and entrainment mortality to 90 percent or greater of the reduction that could be achieved through closed-cycle cooling.[285] Finally, the Director also may exempt a new unit from compliance with either track and establish "alternative requirements" if the cost of compliance is "wholly out of proportion" to the costs considered by EPA during the rulemaking process.[286]

3. Impingement Standards for Existing Facilities (Existing Units) and "New Units at Existing Facilities."

The impingement standard offers covered facilities a choice.[287] One option allows the facility operator to choose to ensure that "for all life stages of fish that are collected or retained in a 3/8 inch sieve and held for a period of 24 to 48 hours to assess latent mortality," the mortality rate does not exceed 12 percent on an annual average basis, or 31 percent on a monthly basis.[288] This option is based on "the use of modified traveling screens with a fish handling and return system."[289] EPA concluded that this 12 percent/31 percent level of mortality reduction is almost

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[280] *See* proposed 40 C.F.R. § 125.95(b), 76 Fed. Reg. at 22,284 (col. 1).

[281] *See* proposed 40 C.F.R. § 125.93(b) (requiring compliance "with the applicable BTA standards for entrainment mortality in § 125.94(c) as soon as possible"), 76 Fed. Reg. at 22,282 (col. 2).

[282] *See* proposed 40 C.F.R. §§ 125.93(c), 76 Fed. Reg. at 22,282 (col. 2); 125.94(a)(3), 76 Fed. Reg. at 22,282 (col. 3).

[283] *See* proposed 40 C.F.R. § 125.94(d)(1), 76 Fed. Reg. at 22,283 (col. 2). In quantitative terms, this means demonstrating "total flow reductions approximating 97.5% for freshwater withdrawals and 94.9% for saltwater withdrawals." 76 Fed. Reg. at 22,253 (col. 3). See also proposed 40 C.F.R. § 125.92, 76 Fed. Reg. at 22,281 (col. 2) (defining a closed-cycle recirculating system with reference to these values).

[284] *See* proposed 40 C.F.R. § 125.94(d)(2), 76 Fed. Reg. at 22,283 (col. 3).

[285] *See id.*

[286] *See* proposed 40 C.F.R. § 125.94(d)(4), 76 Fed. Reg. at 22,283 (col. 3).

[287] *See* proposed 40 C.F.R. § 125.94(b), 76 Fed. Reg. at 22,282 (col. 3).

[288] *See* proposed 40 C.F.R. § 125.94(b)(1)(i), 76 Fed. Reg. at 22,282 (col. 3).

[289] *See* 76 Fed. Reg. at 22,197 (col. 2).

always achievable (i.e., 95 percent of the time)[290] through the use of modified traveling screens.[291]

Alternatively, the operator can choose to reduce the intake system's maximum velocity to 0.5 feet/second, which allows organisms to swim away from the intake.[292] EPA acknowledges this velocity reduction can reduce impingement (and thus impingement mortality) to below four percent, which is more effective than the 12 percent mortality level achievable by traveling screen systems option.[293] But EPA chose to identify two different levels of impingement reduction as the BTA level because "EPA's record shows modified traveling screens are available for all facilities, whereas reduced intake velocity may not be available at all locations."[294]

Under both alternatives, operators must also meet ancillary protective requirements. First, any facility that does employ travelling screens or equivalent active screens must incorporate certain protective measures that raise the odds that impinged fish can be safely returned to the source water.[295] Second, all facilities must ensure that there is a means of escape for fish that may get "entrapped" (for example in a forebay) to be returned to the waterbody.[296] Third, in the case of facilities withdrawing from oceans or tidal waters, their performance in reducing shellfish impingement mortality must be at least as good as would be achieved through properly deployed and maintained barrier nets.[297]

All covered facilities must meet the rule's impingement mortality standard on a schedule set by the Director.[298] In all cases, the standard must be met within 8 years of the rule taking

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[290] EPA used "performance corresponding to the 95th percentile of the beta distribution" as the statistical measure to determine the effectiveness of modified travelling screens. *See* 76 Fed. Reg. at 22,203 (col. 1).

[291] *See* 76 Fed. Reg. at 22,203 (col. 1).

[292] *See* proposed 40 C.F.R. § 125.94(b)(2), 76 Fed. Reg. at 22,283 (col. 1).

[293] *See* 76 Fed. Reg. at 22,204 (col. 3) ("the performance of 0.5 feet per second intake velocity is slightly better than the selected technology. . . a design through-screen velocity of 0.5 feet per second would be protective of 96% of motile organisms.").

[294] *See* 76 Fed. Reg. at 22,197 (col. 2).

[295] *See* proposed 40 C.F.R. § 125.94(b)(1)(iii)(B) (for those facilities choosing the 12/31 percent standard), 76 Fed. Reg. at 22,282 (col. 3); 40 C.F.R. § 125.94(b)(2)(v)(B) (for those facilities choosing the velocity limitation), 76 Fed. Reg. at 22,283 (col. 2).

[296] *See* proposed 40 C.F.R. § 125.94(b)(1)(iv)(B) (for those facilities choosing the 12/31 percent standard), 76 Fed. Reg. at 22,283 (col. 1); 40 C.F.R. § 125.94(b)(2)(vi) (for those facilities choosing the velocity limitation), 76 Fed. Reg. at 22,283 (col. 2). EPA has informed us that the term "through-flow" in these sections is a typographical error and should read "dual-flow." *See also* 76 Fed. Reg. at 22,251 (col. 2); 76 Fed. Reg. at 22,275 (col. 1) (discussing "entrapment" provision).

[297] *See* proposed 40 C.F.R. § 125.94(b)(1)(ii) (for those facilities choosing the 12/31 percent standard), 76 Fed. Reg. at 22,282 (col. 1); 40 C.F.R. § 125.94(b)(2)(iv) (for those facilities choosing the velocity limitation), 76 Fed. Reg. at 22,283 (col. 1).

[298] *See* proposed 40 C.F.R. § 125.93(a),(c), 76 Fed. Reg. at 22,282 (col. 2); *see also* proposed 40 C.F.R. § 125.94(a)(1), 76 Fed. Reg. at 22,282 (col. 3).

effect.[299] A facility's owner or operator must submit an Impingement Mortality Reduction Plan to the Director that identifies the approach they will use to meet the BTA standards.[300]

4. Other Provisions

a. Exclusion of Species/"Species of Concern"

On first reading, the language used to describe organisms protected by the rule appears comprehensive. For example, to be in compliance with the entrainment and impingement provisions means to achieve any applicable limitations "for all life stages of fish."[301] Although the definition of "all life stages" allows the Director to exclude moribund and invasive species,[302] it still embraces virtually all fish and shellfish that are actually entrained or impinged.

However, the rule also repeatedly refers to studying and monitoring impingement and entrainment of "species of concern" without defining the term.[303] One possibility is that EPA intends the "species of concern" category to function as it does under the Phase I rule: offering stronger protection to endangered, threatened, or otherwise uniquely valuable species that the rule's uniform standards would provide.[304] This elevated degree of protection is entirely consistent with the Clean Water Act's goals and purposes.

But if read in concert with proposed Part 125.98(c)(6), the phrase could be interpreted to unlawfully permit the Director to exclude various species of fish from protection under the Clean Water Act and lower the standards for a particular facility below the BTA standards that EPA has identified. Part 125.98(c) addresses the Director's responsibilities with respect to species of concern. Under sub-paragraph 6, "[t]he Director may determine invasive species, naturally moribund species, *and other specific species may be excluded from any monitoring, sampling, or study requirements* of 40 CFR 122.21 and § 125.94."[305] Read broadly, this would allow the Director to summarily exempt species from the source water baseline biological characterization

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[299] *See id.*

[300] *See* proposed 40 C.F.R. § 122.21(r)(1)(6), 76 Fed. Reg. at 22,277 (col. 1) (describing the plan). *See also* proposed 40 C.F.R. § 125.95(b), 76 Fed. Reg. at 22,284 (col. 1) (setting dates for submittal of the plan that vary by facility size).

[301] Proposed 40 C.F.R. § 125.94(b)(1)(i), 76 Fed. Reg. at 22,282 (col. 3) (achieve impingement standards for all life stages of fish). *See also* 40 C.F.R. §§ 125.94(b)(1)(iii)(A), 76 Fed. Reg. at 22,282 (col. 2-3) (the owner of a facility must count as impinged "any fish" carried over in screen); 40 C.F.R. § 125.94(d)(2), 76 Fed. Reg. at 22,283 (col. 3) (a new unit at an existing facility complying with the track II entrainment standard must demonstrate reduced entrainment of "all stages of fish and shellfish.").

[302] *See* proposed 40 C.F.R. § 125.92, 76 Fed. Reg. at 22,281 (col. 1).

[303] *See e.g.*, proposed 40 C.F.R. 125.97(a)(4), 76 Fed. Reg. at 22,287 (col. 1) (Entrainment monitoring reports must "describe . . . the species of concern, the counts and percentage mortality of organisms sampled, and other information specified in the permit."). *See also* 76 Fed. Reg. at 22,204 (col. 3) (EPA is considering, as an additional impingement requirement, that facilities opting to reduce intake velocity also show that "species of concern are adequately protected.").

[304] *See* 40 C.F.R. § 125.84(b)(4),(5) (requiring new facilities to take extra measures above and beyond implementation of closed-cycle cooling if necessary to protect "species of concern to the Director.").

[305] Proposed 40 C.F.R. § 125.98(c)(6), 76 Fed. Reg. at 22,287 (col. 3).

study, from the impingement and entrainment reduction studies and plans, and from all monitoring efforts.

b. Monitoring Provisions

Proposed section 125.96(a) would require impingement monitoring "over a 24-hour period and no less than once per month when the cooling water intake structure is in operation."[306] Yet, "EPA assumes the facility would monitor no less than once per week during primary periods of impingement as determined by the Director, and no less than biweekly during all other times."[307]

c. Nuclear Safety

Proposed section 125.94(e), entitled "Nuclear facilities" provides that "[i]f the owner or operator of a nuclear facility demonstrates to the Director, upon the Director's consultation with the Nuclear Regulatory Commission, that compliance with this subpart would result in a conflict with a safety requirement established by the Commission, the Director must make a site-specific determination of best technology available for minimizing adverse environmental impact that would not result in a conflict with the Commission's safety requirement."[308]

d. Exempted Offshore Facilities

The proposed rule exempts three categories of existing offshore point sources with cooling water intakes: offshore liquefied natural gas (LNG) plants, offshore seafood processing vessels, and offshore oil and gas facilities.[309] The preamble explains that EPA has studied these offshore facilities but is not aware of any technologies beyond screens that avoid unacceptably altering the envelope or seaworthiness of vessels and platforms in these categories.[310] Instead, these facilities are subject to case-by-case BPJ-based permitting.[311]

5. Revisions to Phase I Rule

The proposed rule also responds to the Second Circuit's decision in *Riverkeeper I* by removing from the Phase I new facility rule the restoration-based compliance alternative and the associated monitoring and demonstration requirements because EPA lacks the authority to allow compliance with Section 316(b) through restoration measures.[312] The proposed rule also proposes certain relatively minor corrections to the Phase I rule.[313]

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[306] Proposed 40 C.F.R. § 125.96(a)(2), 76 Fed. Reg. at 22,286 (col. 2).

[307] 76 Fed. Reg. at 22,256 (col. 3)–22,257 (col. 1).

[308] Proposed 40 C.F.R. § 125.94(3), 76 Fed. Reg. at 22,284 (col. 1).

[309] *See* proposed 40 C.F.R. § 125.91(d), 76 Fed. Reg. at 22,281 (col. 1).

[310] *See* 76 Fed. Reg. at 22,195 (col. 3).

[311] *See* proposed 40 C.F.R. § 125.91(d), 76 Fed. Reg. at 22,281 (col. 1).

[312] 76 Fed. Reg. at 22,174 (col. 1); Fed. Reg at 22,183 (col. 2). In *Riverkeeper I*, the Second Circuit held that EPA exceeded its authority by allowing new facilities to comply with section 316(b) through restoration measures, and remanded that aspect of the rule to EPA. 358 F.3d at 191.

[313] 76 Fed. Reg. at 22,183 (col. 3).

B. EPA's Option Selection

Section 316(b) of the Clean Water Act requires EPA to establish standards for cooling water intake structures that reflect the "best technology available" to minimize adverse environmental impacts.[314] In determining the best technology available, EPA considered how well various technologies reduced entrainment and impingement. But EPA also evaluated these technologies against a number of other criteria.[315] EPA ultimately set what it considers a BTA standard based on technology that is capable of being implemented universally. In so doing, EPA rejected the possibility of subcategorizing facilities according to the feasibility of control technologies, and rejected the possibility of setting a standard based on a more effective model technology but allowing variances where the model technology is infeasible.

1. In Considering Technological Options, EPA Set a "Universal Availability" Requirement for BTA Candidate Technologies, then Rejected Closed-Cycle Systems and Velocity Limits Because EPA Found that They Are Not Univerally Capable of Being Implemented.

EPA considered a number of flow-reducing technologies, including closed-cycle systems.[316] EPA also evaluated a number of exclusion technologies, including different screens and nets, fish collection systems that safely return excluded fish to a waterbody, and slowing the intake velocity sufficiently for fish to escape the zone of danger.[317] From this review, EPA selected three *best performing* technologies that merited further study: traveling screens, barrier nets, and wet closed-cycle cooling. EPA also determined that velocity reduction to 0.5 feet per second or less was a "candidate" best performing technology.[318]

Ultimately, however, EPA proposed a BTA performance standard based only on technologies that are capable of being implemented by every facility, even if better performing technologies are available and feasible at a subset of facilities.[319] For example, although EPA identified wet closed-cycle cooling "as a *candidate* best performing technology for both impingement mortality and entrainment mortality for new units at existing facilities,"[320] and although "EPA's record shows numerous instances of existing facility retrofits to closed-cycle,"[321] the agency did not propose closed-cycle cooling as the Best Technology Available because EPA asserts they are not capable of being implemented everywhere.[322] Instead, because

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[314] 33 U.S.C. § 1326(b).

[315] *See* 76 Fed. Reg. at 22,197 (col. 1) (EPA considered criteria including: technical availability and economic impacts on facilities of different size, age, type, and location; cost effectiveness; social costs and benefits; effects on energy production, availability, and reliability; and potential adverse environmental effects).

[316] *See* 76 Fed. Reg. at 22,198 (col. 1) - 22,200 (col. 2).

[317] *See* 76 Fed. Reg. at 22,200 (col. 2) - 22,202 (col. 3).

[318] 76 Fed. Reg. at 22,202 (col. 3) - 22,203 (col. 1).

[319] *See* 76 Fed. Reg. at 22,203 (col. 3). *See also* 22,204 (col. 3).

[320] 76 Fed. Reg. at 22,203 (col. 3).

[321] 76 Fed. Reg. at 22,204 (col. 1).

[322] *See* 76 Fed. Reg. at 22,203 (col. 3).

EPA claims "closed-cycle cooling is not practically feasible in a number of circumstances," and because these circumstances "are not isolated or insignificant," the agency decided "that it should not establish closed-cycle cooling as the presumptive BTA entrainment control."[323] Thus, after deciding that the BTA standard must be modeled on a technology capable of being implemented everywhere, EPA determined that closed-cycle cooling did not meet that standard and therefore could not be BTA.

Once it eliminated closed-cycle cooling and several other technologies from consideration, "EPA could identify no single technology that represented BTA [for entrainment] for all facilities" and opted for a case-by-case approach to regulating entrainment at existing units.[324] The agency concluded that closed-cycle technology could not be implemented everywhere for four reasons: local energy reliability; increased air pollution and the difficulty of obtaining air emissions permits for existing facilities in non-attainment areas; land availability; and remaining useful plant life.[325]

Uncertainty about the extent and likelihood of local reliability impacts caused by extended downtime was purportedly an important consideration for EPA.[326] In the preamble, EPA states that it considered establishing a uniform entrainment rule, while giving permitting authorities flexibility to establish extended compliance timelines for utilities to coordinate extended outages and account for reliability concerns. EPA states that it believes that this "would have been consistent with EPA's assessment that, at the national level (rather than local level), closed-cycle cooling would not pose material energy reliability consequences."[327] But EPA claims that it lacks adequate information to establish whether such a flexible approach would sufficiently address local reliability issues.[328]

Perceptions over increased air pollution also drove EPA's finding that closed-cycle cooling cannot be installed everywhere.[329] EPA believes that for new units this is a lesser concern, because their system can be optimized for closed-cycle cooling from the design stage. EPA also states that increased emissions could raise a permitting concern, particularly in non-attainment areas where a plant will need to identify offsets for its increased emissions.[330]

And, although "EPA's record indicated that the majority of facilities have adequate available land for placement of cooling towers . . . , as many as 25 percent of facilities may have one or more constraints on available space that would limit retrofit of cooling towers for the entire facility or would result in increased compliance costs."[331] Finally, EPA believes that

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[323] 76 Fed. Reg. at 22,207 (col. 1).

[324] 76 Fed. Reg. at 22,197 (col. 2).

[325] *See* 76 Fed. Reg. at 22,207 (col. 1).

[326] *See* 76 Fed. Reg. at 22,208 (col. 3).

[327] 76 Fed. Reg. 22,208 (col. 3).

[328] *Id.*

[329] 76 Fed. Reg. at 22,208 (col. 2).

[330] *See* 76 Fed. Reg. at 22,209 (col. 1).

[331] 76 Fed. Reg. at 22,209 (col. 2-3).

"many facilities are nearing the end of their useful life" and the costs of a retrofit to such a plant may not justify the benefits.[332]

Thus, EPA opted for a lowest common denominator strategy – setting no uniform entrainment standard, and basing the impingement standard on traveling screens because they are capable of being installed everywhere. EPA considered but rejected the possibility of subcategorizing "the industry" (actually, several industries) into groups of facilities for which more effective flow reduction technologies are feasible.[333] And moreover, EPA did not establish a presumptive hierarchy of technologies that must be applied if available.

Similarly, regarding impingement, while EPA acknowledges that velocity reduction to 0.5 feet per second is available at many facilities and is more effective at reducing mortality than traveling screens,[334] it proposed an impingement standard that allows a facility to choose between reducing velocity and installing traveling screens. And although EPA found that wedgewire screens "would perform equally as well or better than seasonal deployment of barrier nets" to reduce the impingement of shellfish, EPA did not conduct a full analysis of wedgewire screens in the rulemaking, nor did it require their use where feasible while allowing less effective technologies elsewhere.[335]

2. The Four Regulatory Options EPA Considered

Developing the proposed rule, EPA considered four regulatory options. The proposed rule is EPA's "Option 1": a numerical impingement standard based on the use of modified traveling screens or velocity reductions that applies to all units; flow reduction commensurate with closed-cycle cooling only for new units at existing facilities; and a case-by-case decision making approach to entrainment for all existing units.[336] The other end of the spectrum is EPA's Option 3, which calls for the same impingement standards as Option 1 and requires flow reduction commensurate with closed-cycle cooling by all facilities.[337]

Option 2 is a hybrid of Options 1 and 3. Like those options, it would set a uniform numerical impingement and entrainment standard based on the use of modified traveling screens or velocity reductions for all units, but the closed-cycle-cooling -based entrainment standard would only be required of larger units – those with an actual intake flow of more than 125 MGD. For units with a smaller flow, Option 2 allows the same case-by-case decision making as Option 1.[338]

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[332] *See* 76 Fed. Reg. at 22,210 (col. 1).

[333] *See* 76 Fed. Reg. 22,204 (col. 1).

[334] *See* 76 Fed. Reg. at 22,204 (col. 3) ("the performance of 0.5 feet per second intake velocity is slightly better than the selected technology. . . a design through-screen velocity of 0.5 feet per second would be protective of 96% of motile organisms.").

[335] *See* 76 Fed. Reg. at 22,203 (col. 3).

[336] *See* 76 Fed. Reg. at 22,204 (col. 1).

[337] *See* 76 Fed. Reg. at 22,206 (col. 2).

[338] *See* 76 Fed. Reg. at 22,206 (col. 1).

Finally, shortly before proposal, EPA considered a fourth possibility that is even less protective than Option 1. Option 4 would adopt a case-by-case approach to entrainment and apply the uniform impingement standard only to those facilities with a design intake flow greater than 50 MGD. Facilities with a lower intake capacity would be subject to case-by-case permitting for both impingement and entrainment.

C. The Regulatory Impact Analysis

EPA considered the social costs of the proposed rule and the distribution of those costs across different parts of society (i.e. the "economic impact" of the rule).[339] EPA also considered the social benefits – first by listing the physical impacts of the rule in terms of reduced mortality and other benefits, then by trying to monetize these benefits.

EPA estimates the total social costs of the proposed rule (Option 1) are $384 million.[340] If 100 percent of the rule's costs for electricity providers were borne by the ratepayers, this would amount to an average cost of $1.37 per year per household, or approximately 11.5 cents monthly.[341] By comparison, EPA estimates that the total social cost of the more environmentally protective Option 3 is $4,631 million,[342] or $1.47 monthly per household.[343] In the reverse, if 100 percent of the costs fell upon power companies "the majority of parent entities will incur annualized costs of less than one percent of revenues regardless of the option" that EPA selects.[344] Both of these 100-percent assumptions are highly conservative because, in reality, some (but not all) of the costs would be borne by power companies and some (but not all) would be borne by ratepayers.

EPA also estimated the rule's impact on manufacturers by modeling a manufacturer's after-tax cash flow, assuming, again highly conservatively, that the business had to absorb 100 percent of the rule's costs.[345] EPA found that no facilities would close and, even under Option 3, only 3.4 percent of facilities would experience even "moderate" cash flow impacts.[346]

Finally, EPA estimated the administrative costs that states and territories will incur in implementing the rule at existing facilities. "EPA estimates that the total annualized cost for these activities will be $5.31 million for Option 1, $2.19 million for Option 2, $1.28 million for Option 3, and $4.06 million for Option 4."[347] Thus, the highest administrative costs are imposed by the more site-specific, case-by-case options.

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[339] *See* 76 Fed. Reg. at 22,212 (col. 2)–22,237 (col. 1). EPA also conducted a variety of other analyses required by various acts of Congress, Executive Orders, and Agency initiatives.

[340] *See* 76 Fed. Reg. at 22,218 (col. 2) (in 2009 dollars, discounted at 3%).

[341] *See* 76 Fed. Reg. at 22,227 (col. 3).

[342] *See* 76 Fed. Reg. at 22,218 (col. 2).

[343] *See* 76 Fed. Reg. at 22,227 (col. 3) ($17.60 annually).

[344] *See* 76 Fed. Reg. at 22,226 (col. 3).

[345] *See* 76 Fed. Reg. at 22,220 (col. 2).

[346] *See* 76 Fed. Reg. at 22,221 (col. 2).

[347] *See* 76 Fed. Reg. at 22,270 (col. 3).

In terms of the rule's physical benefits (at least those that can be measured in direct fish and shellfish losses). Option 3 – uniform impingement and entrainment standards based on closed-cycle cooling – would save 1,000 times more fish than the proposed rule. While Option 1 may save 422 million fish, uniform standards would save 407,922 million fish (as well as sea turtles and other endangered and threatened species).[348]

Although the fish-protection benefits of Option 3 are 1000 times greater than Option 1, the agency could not perform a comparable and complete monetary analysis of the options. EPA found that "quantifying and monetizing reductions in I&E mortality losses due to the regulatory options is extremely challenging."[349] Since many benefit categories were not properly monetized, EPA concluded that the monetized values "likely underestimate total benefits, challenging the Agency's ability to base BTA decision making on the relationship of quantified costs and benefits alone."[350]

Still, EPA concluded that the sum of the proposed rule's benefits under Option 1 justified its costs. The agency explained that cost-benefit analysis should not ignore non-monetizable benefits:

> The assessment of benefits must take into account all benefits, including categories such as recreational, commercial and other use benefits, benefits associated with reduced thermal discharges, reduced losses to threatened and endangered species, altered food webs, nutrient cycling effects, and other nonuse benefits. Merely because there is no price tag on those benefits does not mean that they are not valuable.[351]

Thus, although EPA's estimate of the rule's monetized benefits (approximately $18 million per year at a 3 percent discount rate and $16 million per year at a 7 percent discount rate) is smaller than the agency's estimate of its monetized costs (approximately $384 million per year at a 3 percent discount rate and $458 million per year at a 7 percent discount rate),[352] EPA concluded that Option 1 is cost-justified.[353] In the proposed rule and preamble, EPA does not, however, state whether the benefits of Options 2, 3, and 4 that it considered justify the costs.

D. The Rulemaking Process: Changes Made at the Direction of OMB.

Shortly before proposal, EPA submitted a draft of the Proposed Rule to the Office of Information and Regulatory Affairs (OIRA) within the Office of Management and Budget (OMB).[354] Pursuant to Executive Order 12,866, EPA has also released a redlined version of its

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[348] *See* 76 Fed. Reg. at 22,239-40 (Table VIII-2-Baseline I&E Mortality Losses and Reductions for All In-Scope Facilities by Regulatory Option). Expressed in age-one equivalents (A1Es), Option 2 still saves three times as many fish as Option 1 (1982 million vs. 615 million A1Es).

[349] 76 Fed. Reg. at 22,246 (col. 3)-22,247 (col. 1).

[350] 76 Fed. Reg. at 22,247 (col. 2).

[351] 76 Fed. Reg. at 22,211 (col. 3).

[352] 2011 EBA at 12-3, Table 12-2.

[353] 76 Fed. Reg. at 22,206 (col. 3).

[354] *See Documentation of Changes Made During Executive Order 12866 OMB Review – Cooling Water Intakes*

proposed rule, revealing any amendments made to reflect OMB's suggestions and recommendations.[355] The key changes made at the suggestion or recommendation of OMB are as follows.[356]

1. Changes Relating to EPA's National Cost-Benefit Analysis

EPA strongly doubted that a meaningful national cost-benefit analysis is possible, but OMB removed EPA's reservations and expressions of doubt. EPA explained that it did not rely on "a nation-wide comparison of costs and benefits" in proposing a rule because it felt that its efforts to calculate the benefits of the rule were unsatisfactory.[357] Among other problems:

> EPA's calculation of reduced impingement and entrainment benefits of closed-cycle cooling does not account for 97 percent of the direct use A1E [age 1 equivalents[358]] of organisms entrained by coolin g water intakes. Moreover, the monetized benefit values do not include the majority of the indirect use and nonuse value of the reductions in I&E mortality, and completely exclude categories such as the non commercial portion of impacts to threatened and

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2040-AE95 NPRM, Document ID: EPA-HQ-OW-2008-0667-1295 (Exh. 84); *see also Document Submitted to Initiate EO 12866 Review - Cooling Water Intakes 2040-AE95 NPRM FRN* [DCN 10-6625A], Document ID: EPA-HQ-OW-2008-0667-1295.1 (first attachment to Document 1295, EPA draft of the Proposed Rule sent to OMB) (Exh. 85).

[355] EPA-HQ-OW-2008-0667-1295 2 with markup showing [DCN 10-6625B], EPA-HQ-OW-2008-0667-1407 [DCN 10-6625B], (Redline-strikeout documenting changes made during EO 12866 review, hereinafter "Redlined Version of Proposed Rule") (Exh. 86).

[356] On May 19, 2011, Riverkeeper submitted a request to OMB under the Freedom of Information Act ("FOIA") asking that OIRA make available for inspection and copying (1) all documents exchanged between OIRA and EPA during the Proposed Rule's interagency review period, and (2) all documents received by OMB from any member of the public regarding the rulemaking. Given the exigencies of the public comment period on the Proposed Rule, which at that time was to close on July 19, 2011, Riverkeeper asked OMB to make all responsive documents available as soon as possible. On May 20, 2011, OMB acknowledged Riverkeeper's request but did not make any documents available. On June 28, 2011, Riverkeeper wrote to OMB again, repeating its document request and again emphasizing that time was of the essence in obtaining documents from OMB because the window to review and use those documents during the public comment would soon close. OMB did not respond to Riverkeeper's second letter. Riverkeeper wrote a third time on July 18, 2011, reiterating its earlier requests and cautioning that unless OMB responded promptly, it would seek a court order compelling OMB to provide all records responsive to Riverkeeper's May 19, 2011 FOIA request. OMB again failed to respond and is therefore in blatant violation of FOIA's mandatory twenty-day response deadline set forth in 5 U.S.C. § 552(a)(6)(A)(i). Consequently, Riverkeeper sued OMB in federal court on July 25, 2011, seeking a court order compelling disclosure of the requested documents. To date, OMB has not responded to the complaint. Accordingly, the commenters reserve all rights with respect to this matter, including the right to submit comments and related documents to EPA after the close of the comment period in light of the failure of the United States to timely comply with the mandatory disclosure requirements under FOIA.

[357] Redlined Version of Proposed Rule at 140-41.

[358] EPA states that "The Equivalent Adult Model (EAM) is a method for converting organisms of different ages (life stages) into an equivalent number of individuals in any single age. For its 316(b) analyses, EPA standardized all I&E mortality losses into equivalent numbers of 1-year-old fish, a value termed age-1 equivalents (A1Es). This conversion allows losses to be compared among species, years, facilities, and regions." 2001 EEBA at 3-2 (internal citation omitted).

> endangered species, the thermal discharge impacts to water quality, and species composition.[359]

EPA thus concluded that, "[u]nder these circumstances, a complete national weighing of costs and benefits is not possible at this time."[360]

However, OMB deleted EPA's concerns and revised the preamble to read ". . . EPA has determined that the benefits of the proposed rule justify its costs. In addition, EPA has explained why consideration of costs and benefits is also appropriate in the site-specific permit setting when establishing entrainment controls."[361] OMB also toned down the language that EPA used to describe the failings of the cost-benefit analysis exercise, removing phrases like "thus, the universe of even ecosystem benefits that [the analysis] can quantify is small."[362]

2. Changes Relating to the Case-by-Case BTA Determination of Entrainment Standards

a. EPA Sought to Require All Facilities to Use the "Best Performing Technology" So Long As its Costs Were Not Wholly Disproportionate to its Benefits.

EPA strongly doubted the value and comprehensiveness of cost-benefit estimates where non-use, non-market values are so important. Therefore, the agency explained that a Director "may" take estimates of social costs and benefits into account when conducting a site-specific BTA analysis, but should keep in mind that these estimates are very uncertain and far from comprehensive.[363] In particular EPA stressed that:

> it is important that the Director recognize that even at [sic] when dealing with only a single site assessment the quantified and monetized estimates of benefits are more uncertain and less comprehensive than the estimates of costs. Important benefit effect categories will very likely not be able to be quantified and monetized . . . . As a result, benefit estimates are likely to underestimate the value that would accrue to society . . . ."[364]

EPA's strong doubts about the validity and meaning of a facility's cost-benefit analysis led the agency to restrict its use, even on a site-specific basis:

> The results of the social cost-benefit analysis should be interpreted in the following way: The Director may not reject an otherwise available technology as

[359] Redlined Version of Proposed Rule at 141.

[360] Redlined Version of Proposed Rule at 141.

[361] Redlined Version of Proposed Rule at 166; 76 Fed. Reg. at 22,211 (col. 3).

[362] Redlined Version of Proposed Rule at 141.

[363] Redlined Version of Proposed Rule at 343.

[364] Redlined Version of Proposed Rule at 343.

BTA for entrainment mortality requirements unless the social costs of compliance are wholly disproportionate to the social benefits.[365]

EPA called its approach to BTA the "wholly disproportionate" test."[366] Under the "wholly disproportionate" test, a BTA analysis begins with consideration of the best performing and available technology to reduce entrainment or impingement. Only if the Director rejects the best performing technology because its costs were "wholly disproportionate" to the benefits it provided could the Director consider the next most effective technology. And "the test should be applied to the next most costly entrainment technology until the social cost of the proposed entrainment technology no longer violates the wholly disproportionate rule."[367]

b. OMB Directed EPA to Abandon its "Wholly Disproportionate" Test and Let States Reject Any Technology After an Open-Ended, Multi-Factor Evaluation if its Costs "Are Not Justified" by its Benefits.

OMB rejected EPA's "wholly disproportionate" test, thereby fundamentally rewriting the approach that state permit writers must follow in making BTA determinations. OMB also deleted EPA's comment that it has used the wholly disproportionate test to interpret Section 316(b) since the 1970's, and has issued a general counsel opinion supporting its use.[368] Thus, instead of requiring the Director to impose "the best controls whose cost is not wholly disproportionate to their associated benefits,"[369] the proposed rule allows a Director to reject any technology if the costs "are not justified" by the benefits.[370]

EPA's initial draft emphasized performance and environmental protection: the rule text stated that closed-cycle cooling is the best performing technology and should be used unless infeasible or disproportionately costly. Additionally, EPA's "wholly disproportionate rule" ensured that site-specific cost-benefit analyses – analyses that the agency's staff cautioned would be uncertain and imprecise – were relegated to a secondary role of eliminating gross disparities between costs and benefits.

After OMB's revisions, the Director need only require the maximum reductions "warranted" by an open-ended consideration of costs and benefits,[371] and can reject any technology if he determines that its costs "are not justified" by its benefits.[372] Thus, OMB proposes to allow Directors to engage in open-ended consideration of multiple factors so long as the end result is "justified" in the agency's opinion. OMB has significantly altered the case-by-case analysis process, making it far more ambiguous, standardless and discretionary.

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[365] Redlined Version of Proposed Rule at 344.

[366] Redlined Version of Proposed Rule at 344.

[367] Redlined Version of Proposed Rule at 344.

[368] *See* Redlined Version of Proposed Rule at 168-69.

[369] Redlined Version of Proposed Rule at 169; *see also* p. 344, 450.

[370] Proposed 40 C.F.R. § 125.98(e), 72 Fed. Reg. at 22,288 (col. 1).

[371] Proposed 40 C.F.R. § 125.94(c), 76 Fed. Reg. at 22,283 (col. 2).

[372] Proposed 40 C.F.R § 125.98(e), 76 Fed. Reg. at 22,288 (col. 1).

c. EPA Determined that Closed-Cycle Cooling Is the "Best Performing Technology," but OMB Deleted this Conclusion.

EPA's original preamble and rule text stated that "closed-cycle cooling is the best performing technology for reducing entrainment mortality, but it may or may not be the BTA for individual facilities in light of site-specific considerations."[373] Under EPA's original case-by-case analysis as outlined above, because closed-cycle cooling is the best performing technology, a Director would be required to determine whether it is available without considering cost (i.e. "otherwise available") and, if so, the Director would require the use of closed-cycle cooling unless "the social costs of compliance are wholly disproportionate to the social benefits."[374] Thus, EPA intended for closed-cycle cooling to be the default compliance technology nationwide.

However, OMB deleted EPA's conclusion that closed-cycle cooling is the best performing technology,[375] and only left EPA's statement that it had evaluated closed-cycle cooling as a "*candidate* best performing technology."[376]

d. OMB Also Deleted EPA's Statement that Most Facilities Should Install Closed-Cycle Systems.

Having set the "wholly disproportionate" test and selected closed-cycle cooling as the "best performing technology," EPA believed that its case-by-case analysis procedure would lead to the same result as a national closed-cycle cooling standard with variances:

> In theory, EPA believes that site-specific determination of BTA entrainment mortality controls will result in the same reductions – will "minimize adverse environmental impact" – as a one-size-fit-all requirement that included the variances that would be necessary to address the site-specific limitations on installation of closed-cycle.[377]

OMB, once again, deleted this statement. OMB also deleted EPA's suggestion that many facilities would move to closed-cycle cooling:

> In EPA's view, entrainment mortality controls are appropriate in virtually all circumstances. The proposed decision not to establish uniform national entrainment controls was not a decision that no controls are required. The rejection of one-size-fits all does not mean that no-size-fits-all. Rather, the best way to determine entrainment controls is on a site-by-site basis. . . . Thus, EPA expects that, under the proposed approach, *there will be entrainment controls for*

[373] Redlined Version of Proposed Rule at 428, proposed 40 C.F.R. § 125.94(c).

[374] Redlined Version of Proposed Rule at 344.

[375] Redlined Version of Proposed Rule at 428, proposed 40 C.F.R. § 125.94(c).

[376] 76 Fed. Reg. at 22,203 (col. 3) (emphasis added).

[377] Redlined Version of Proposed Rule at 138.

most facilities and . . . Directors will require many facilities to install closed-cycle cooling to address entrainment.[378]

e. Although OMB Put Cost-Benefit Analysis at the Heart of the Decision Making Process, it Deleted EPA's Guidance on How to Perform Cost-Benefit Analysis.

After deleting EPA's statements about the very significant uncertainties involved in the cost-benefit analysis process, OMB made a highly ambiguous form of cost-benefit analysis the linchpin of the rule. OMB would require monetized cost-benefit analyses wherever possible.[379] But, at the same time, OMB deleted and weakened EPA's guidance statements about how cost-benefit analyses should be performed and reviewed.

For example, the rule calls for cost-benefit analyses that focus on the social costs of reducing impingement and entrainment, not the compliance costs to facilities. OMB deleted EPA's explanation of the difference between social and facility costs of installation downtime and energy penalties, and how these costs should be calculated to avoid overestimating the social costs.[380]

OMB also removed EPA's guidance on discount rates. EPA had called for facilities to use a "social discount rate . . . reflecting society's rate of time preference as opposed to a facility's cost of capital," and suggested 3%, as per existing OMB guidance.[381] OMB replaced this instruction with a general reference to "an appropriate discount rate."[382]

Finally, in the peer review process for the entrainment-related studies, EPA planned to require states to provide an explanation "for any reviewer comments not accepted."[383] OMB changed this, only requiring explanation for "significant" comments that are not accepted.[384]

3. Changes Relating to Definition of New Units

a. OMB Determined that Replacements/Repowerings Are Not New Units and Deleted EPA's Contrary Statements and Rationale.

EPA intended to treat replacements and repowerings as new units, but OMB excluded replacements and repowerings from the definition of new units.[385] Originally, EPA wrote that

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[378] Redlined Version of Proposed Rule at 159-160 (emphasis added).

[379] *See* Redlined Version of Proposed Rule at 310 (OMB suggests that the benefits valuation study should include monetization "to the extent appropriate.").

[380] *See* Redlined Version of Proposed Rule at 338-339.

[381] *See* Redlined Version of Proposed Rule at 340.

[382] *See* Redlined Version of Proposed Rule at 340, 76 Fed. Reg. 22,261 (col. 2).

[383] Redlined Version of Proposed Rule at 401, 406, 408.

[384] *See* proposed 40 C.F.R. §§ 122.21(r)(9),(1 0),(12), 76 Fed. Reg. at 22,277-79.

[385] *See* Redlined Version of Proposed Rule at 92, 423 (revising 40 C.F.R. 125.92(r) and deleting 125.92(t), which defined repowering).

> a replacement unit or repowered unit, as distinct from constructing an additional unit, would also be treated differently than existing units. Repowering, in contrast to simply constructing a new unit, is rebuilding and replacing the major components of an existing power plant. Repowering is done to improve efficiency, increase or optimize capacity, or minimize operating costs of the existing unit. For example, an electric generating facility may replace boilers, retrofit improved condenser designs, and utilize combined cycle or cogeneration in the repowered unit. The requirements for new units are modeled after the requirements for a new facility in the Phase I rule.
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> EPA has adopted this approach for the following reasons. Almost two-thirds of the coal fired units are at least 30 years of age, and more than 30 percent of coal units are at least 50 years of age. As these units are retired and replaced based on individual facility circumstances, facilities have the ideal opportunity to design and construct the new units without many of the additional expenses associated with retrofitting an existing unit to closed-cycle. Thus, for example, the timing of retirement and replacement is within the control of the facility and would be dictated strictly by the facility's internal requirements rather than linked to specific regulatory compliance deadlines. Further, the incremental downtime that may be associated with installing closed-cycle cooling may be avoided or minimized. In addition, the condensers can be configured for closed-cycle, reducing energy requirements, and high efficiency cooling towers can be designed as part of the unit replacement, allowing for installation of smaller cooling towers. These advantages may not always be available when retrofitting cooling towers at an existing unit. In consideration of the fact that these repowering, replacement, and additional unit construction decisions rest largely within the control of the individual facility, EPA decided that subjecting these operations to the same national BTA requirements as those applicable to new facilities is warranted.[386]

OMB also deleted EPA's extensive and reasoned explanation of why replacements and repowerings should be considered new units, and why a retrofit to closed-cycle cooling is available for all replacements and repowerings.[387] EPA's summary was trenchant:

> In summary, EPA proposes that, because repowering, replacement, and additional unit installation decisions can be accomplished feasibly and with lower costs than retrofitting an entire existing facility, it is appropriate to require the same entrainment mortality controls at new units as are applicable to new facilities per the Phase I rule. New units are similar to new facilities, regardless of whether that unit is a green field construction, an additional unit, a replacement unit, or a repowered unit. Further, EPA considered that new units would be similar to new facilities in terms of the useful expected plant life and therefore found in general this would mean that closed-cycle cooling would reduce entrainment mortality for

[386] Redlined Version of Proposed Rule at 92-93.

[387] *See* Redlined Version of Proposed Rule at 143-148.

a longer time than for existing facilities as a whole. Finally, since new units are more likely to be located in areas in attainment for national ambient air quality standards, EPA finds that air permit issues are also minimized for new units. Thus, EPA's analysis shows closed-cycle cooling would be available to such facilities for the reasons described above and are economically achievable (see Section VII).

In developing this proposed rule, EPA considered whether such requirements for new units would serve as a disincentive to replace older units and determined that this would not be the case given closed-cycle cooling's comparable cost relative to once through cooling and its small cost as a percentage of overall costs at the new unit. The capital costs of closed-cycle cooling are comparable to the capital costs of once through cooling with only a modest increase in O&M expenses of the cooling water system. Furthermore, the costs usually comprise less than 1 percent of the total costs of a new unit. Recent experience indicates that the Phase I requirements are not a disincentive for new facility construction, as demonstrated by numerous instances where recently constructed facilities are using closed-cycle; see 66 FR 28856; also see 66 FR 28865.

Further, EPA's analysis shows the generating units projected to close are most likely to do so because they are older, unreliable, less efficient, and therefore generally unprofitable. See Section VII for more information. In some instances, insufficient water exists to continue to operate a facility with once-through cooling, or thermal discharge limitations preclude operation of once-through cooling; these facilities have employed cooling towers, partial towers, and helper towers resulting in an increased reliability.[388]

4. Changes Relating to Regulatory Options

a. OMB Revised the Discussion of Options 2 and 3, and Added a New Option 4.

OMB added Option 4 to the rule.[389] OMB also rewrote EPA's analysis of Options 1, 2, and 3 to play up the benefits of Option 1 and delete any favorable comments about Options 2 and 3. Accordingly, OMB deleted EPA's statement that Option 3 is three times more effective than Option 1:

> A comparison of the baseline and Option 1 adverse environmental impacts as expressed in age-1 equivalents shows that Option 1 reduces AEI by 31 percent. A similar comparison of the baseline to Option 3 shows that Option 3 reduces AEI by 92 percent."[390]

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[388] Redlined Version of Proposed Rule at 147-148.

[389] *See* Redlined Version of Proposed Rule at 125 (removing references to three options and replacing with references to four options), *see also* Redlined Version p. 148-50 (adding a two page description of Option 4 to the preamble).

[390] Redlined Version of Proposed Rule at 163.

And in discussing EPA's cost estimates for Option 2, EPA noted that its decision to allow Directors discretion to give facilities several extra years to come into compliance with the rule may actually reduce compliance costs. OMB deleted this observation as well.[391]

Most importantly, EPA concluded that none of the options it evaluated would have significant effects on national generating capacity. OMB highlighted the fact that Option 1 would have insignificant effects but deleted EPA's very similar conclusion about Options 2 and 3. With respect to Option 1, OMB summarized EPA's electricity market impact analysis by stating that "the early retirements among in-scope facilities under the proposed regulatory option have little impact at the level of national and regional electricity markets."[392] But with respect to Option 2, OMB deleted EPA's conclusion that although more generating units would close, "a large share of the estimated closures occur in generating units that have very low capacity utilization in the baseline" and only "3 percent of closure capacity occurs in generating units that otherwise appear to be reasonable economic contributors to electric power generation."[393]

Finally, OMB directed the addition of a summary of economic impacts which states: "EPA has considered the totality of these measures of economic impacts in concluding that there are no significant economic impacts associated with Option 1 (the preferred option) or Option 4, while there are considerably greater economic impacts associated with Options 2 and 3."[394]

5. Changes to Other Provisions of the Rule

a. OMB Asked for Comment on the Possibility of Weaker Compliance Timelines.

EPA set a firm eight year deadline for impingement compliance, even at facilities where the Director recognized that a plan to install closed-cycle cooling for entrainment compliance would extend beyond the eight year window. EPA recognized that keeping to a firm window might require some facilities to install impingement controls that become redundant when the closed-cycle cooling retrofit comes online, but EPA stated firmly that it "does not intend for the facility to do nothing to reduce [impingement] until the technologies for [entrainment] have been implemented."[395] OMB inserted a specific request for comments on this firm deadline.

b. OMB Removed Firm Monitoring Requirements and Replaced Them with Suggestions.

In the draft sent to OMB, EPA set firm impingement monitoring requirements that included weekly monitoring during peak periods of impingement and bi-weekly monitoring at other times. OMB changed this, writing that monitoring frequencies would be specified on a

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[391] *See* Redlined Version of Proposed Rule at 134-35.

[392] Redlined Version of Proposed Rule at 240.

[393] Redlined Version of Proposed Rule at 242.

[394] Redlined Version of Proposed Rule at. 253.

[395] Redlined Version of Proposed Rule at 291.

case-by-case basis by the Director, but that EPA "assumes" that the weekly/bi-weekly schedule would be common.[396] Similarly, EPA required facilities to stratify collections so that they cover the entire daily cycle (and tidal cycles where appropriate). Again, OMB changed this from a hard requirement to an assumption.[397] OMB then added a request for comment "on whether EPA should specific [sic] minimum sampling frequencies or leave this determination to the Director."[398]

c. OMB Removed Extra Protection for Species of Concern.

EPA had originally required facility operators who reduce intake velocity to 0.5 feet/second or less to document that this measure adequately protected species of concern. OMB removed this requirement.[399]

d. OMB Altered the Nuclear Safety Exception.

EPA created an exception to the entrainment mortality requirements for nuclear facilities if compliance "would result in a conflict with a safety requirement established by the [Nuclear Regulatory] Commission."[400] However, OMB deleted EPA's clarifying statement that the exception was narrow and that "[t]echnical infeasibility, and not cost, is the only consideration in evaluation of a potential conflict with Commission safety requirements."[401] OMB also broadened the exception such that it applies to the determination of BTA requirements generally, not just entrainment mortality.[402]

e. OMB Created a New Exception for New Units at Existing Facilities with Costs "Wholly out of Proportion" to the Costs Considered by EPA.

OMB added the "compliance costs wholly out of proportion" exemption to the rule's entrainment requirements at § 125.94(d)(4).[403] EPA originally exempted only facilities that could show that installing closed-cycle cooling would result in significant adverse impacts on local air quality.[404]

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[396] *See* Redlined Version of Proposed Rule at 318, *see also* redlined version p. 442 (revisions to 40 C.F.R. §§ 125.96(b),(c)).

[397] Redlined Version of Proposed Rule at 320.

[398] Redlined Version of Proposed Rule at 322.

[399] *See* Redlined Version of Proposed Rule at 397.

[400] Redlined Version of Proposed Rule at 431, proposed 40 C.F.R. § 125.94(e), 72 Fed. Reg. at 22,284 (col. 1).

[401] Redlined Version of Proposed Rule at 431.

[402] *Id.*

[403] Redlined Version of Proposed Rule at 56.

[404] *See* Redlined Version of Proposed Rule at 430.

f. OMB Would Allow Facilities to Prove that, at Their Site, Entrainment Mortality Is Less Than 100 Percent.

OMB added a sentence to the preamble stating that the Proposed Rule allows facilities to demonstrate that entrainment mortality is less than 100 percent at their site.[405]

* * *

OMB thus took a weak and illegal rule and made it much weaker, more arbitrary and capricious, and much further from being compliant with the law.

[405] *See* Redlined Version of Proposed Rule at 62.

III.

THE PROPOSED RULE FALLS WELL SHORT OF THE CLEAN WATER ACT'S STATUTORY MANDATE, IS ARBITRARY, CAPRICIOUS, AN ABUSE OF DISCRETION, AND OTHERWISE NOT IN ACCORDANCE WITH LAW, IS SIGNIFICANTLY WEAKER THAN EPA'S PRIOR 316(b) RULES, AND WILL NOT PROTECT AQUATIC RESOURCES UNLESS IT IS SIGNIFICANTLY STRENGTHENED

In introducing the Proposed Rule's BTA determination, EPA stated that it "has decided not to re-propose requirements similar to those of the final Phase II rule, but would adopt, for the reasons explained in [the] preamble, *a new framework*."[406] Unfortunately, that "new" framework, while it differs from the Phase II rule in certain respects, is not new at all; instead, it largely codifies existing practice and thereby perpetuates the highly unfortunate vacuum of federal leadership on this issue that has persisted for four decades since Congress first directed EPA to take action. For the reasons explained below, the Proposed Rule is both illegal and poor policy, worse in many ways than the Phase II framework (which was itself impermissibly weak, but at least purported to establish national categorical standards), and will continue the longstanding bureaucratic paralysis that has left impingement and entrainment as one of the last remaining unaddressed problems that the 1972 CWA was designed to correct.[407]

A. EPA's Interpretation of Section 316(b) and its "Approach to BTA" Contradicts the Plain Meaning of the Act and Congress's Clearly Expressed Intent.

Section IV.A. of the Preamble is entitled "EPA's Approach to BTA" and sets forth EPA's interpretation of Section 316(b) and the court decisions that interpreted and applied that provision.[408] EPA's interpretation is, however, deeply flawed and plainly contradicts the statute in several important respects; many of the Proposed Rule's fundamental flaws spring directly from the Agency's misunderstanding of its own authority.

1. When Making BTA Determinations Under Section 316(b) and Setting Parameters for Permit Writers to Do So, EPA Does Not Have Authority to Eschew Congress's Fundamental Intent for the CWA's Technology-Based Regulatory Program.

EPA takes the mistaken view that the integration of Section 316(b) with sections 301 and 306 is no more than an invitation from Congress to look to the factors considered in those other sections when establishing standards for Section 316(b), leaving the agency free to ignore any and all of the Congressional mandates on which the CWA's technology-based program rests.

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[406] 76 Fed. Reg. at 22,196 (col. 2) (emphasis added).

[407] EPA states that "[f]ollowing promulgation of the 2004 Phase II rule," the agency "became aware of certain elements of the 2004 rule that were particularly challenging or time-consuming to implement." 76 Fed. Reg. 22, 185 (col. 2). Unfortunately, the Proposed Rule does not improve upon the Phase II framework, but instead moves in the opposite direction, perpetuating the case-by-case approach, which will be impossible to implement.

[408] 76 Fed. Reg. at 22,196 (col. 2)–22,197 (col. 2).

For example, referring to the Second Circuit's decisions in *Riverkeeper I* and *Riverkeeper II*, EPA states: "courts have held that, given Section 316(b)'s reference to sections 301 and 306 of the Act, EPA may look to the factors considered in those sections in establishing those standards for Section 316(b) standard setting."[409] And referring to the *Entergy* decision, EPA states that "[t]he Supreme Court noted that, given the absence of any factors language in Section 316(b), EPA has more discretion in its standard setting under Section 316(b) than under the effluent guidelines provisions."[410] In fact, while EPA may look to the factors set forth in sections 301 and 306 (and, by extension, section 304) in formulating the substantive content of BTA regulations, EPA is not free to disregard the fundamental regulatory principles inherent in the basic fabric which underlies all of the BAT, BPT, BCT, and BADT standards promulgated pursuant to those sections. Put slightly differently, while BTA requirements may impose a different substantive standard than the effluent limitations – indeed, *each* type of effluent limitation embodies a different substantive standard – BTA regulations must follow the same basic regulatory approach as Congress required for technology-based standards as a whole.[411]

This conclusion is made inescapably clear in the court decisions to which EPA refers, namely *Riverkeeper I* and *Riverkeeper II*, which, while finding that EPA need not follow certain directives that are particular to one or another of the effluent limitations (such as section 306's prohibition against variances), nevertheless held that BTA standards must adhere to Congress's intent for the entire technology-based program. For example, in *Riverkeeper I* the court began by explaining that "review [of] the entire statutory scheme … [and] its development assists in interpreting the narrow statutory provision [i.e., Section 316(b)] before us."[412] Similarly, in *Riverkeeper II*, the court began by noting that its "interpretation of Section 316(b) is informed by the two provisions it cross-references, CWA sections 301 and 306."[413]

The Second Circuit in both of those cases went on to remand the restoration measures provisions in Phase I and Phase II rules, in part, because "Congress rejected a regulatory approach that relies on water quality standards, [such as] … focusing on fish populations and consequential environmental harm,"[414] and restoration measures "are inconsistent with Congress's intent that the 'design' of intake structures be regulated directly, based on the best technology available, and without resort in the first instance to water quality measurements"[415] because they "resemble the pre-1972 approach to water pollution, which regulated point sources based on their effect on the surrounding water and allowed sources to discharge pollutants provided the discharge did not cause water quality to dip below an acceptable level."[416] In *Riverkeeper II* the court also relied on the CWA's "technology-forcing principle" in its rejection

[409] 76 Fed. Reg. at 22,196 (col. 3).

[410] 76 Fed. Reg. at 22,196 (col. 3).

[411] That regulatory approach is discussed above in Sections I.B.2 and I.B.3 of these comments.

[412] *Riverkeeper* I, 358 F.3d at 184. EPA itself has stated that "CWA § 316(b), like other provisions of the statute, should be construed with Congress' ambitious overarching statutory purposes in mind." EPA, *Clean Water Act NPDES Permitting Determinations for Thermal Discharge and Cooling Water Intake from Brayton Point Station in Somerset, MA*, NPDES Permit No. MA 0003654, at 7-2 (July 22, 2002) (Exh. 87).

[413] *Riverkeeper II*, 475 F.3d at 91.

[414] *Riverkeeper I,* 358 F.3d 196.

[415] *Riverkeeper I*, 358 F.3d at 190; *see also Riverkeeper II*, 475 F.3d at 108-09.

[416] *Riverkeeper I*, 358 F.3d at 189, citing *CPC Int'l, Inc. v. Train*, 515 F.2d 1032, 1034-35 (8th Cir. 1975).

of the Phase II restoration measures provision.[417] And that decision also remanded one of EPA's site-specific compliance options because, as the court explained, "Congress changed its approach in 1972, [and] … [t]he Act now regulates discharges from point sources rather than water quality."[418]

Nothing in the Supreme Court's *Entergy* decision affected those holdings, as that court merely considered whether Congress had prohibited cost-benefit analysis for BTA, despite requiring it for BPT.[419] Thus, that decision, which explicitly left undisturbed all of the Second Circuit's other holdings,[420] concerned the differences between the various technology-based standards rather than the regulatory approach common to all of them.

The fundamental precepts that apply to BTA requirements as well as all of the effluent limitations reflect the shift in regulatory approach embodied in the 1972 CWA amendments, including but not limited to (i) Congress's direction to EPA to establish uniform, national, categorical, technology-based and technology-forcing regulations, (ii) Congress's intent to avoid lengthy indeterminate studies in the context of permitting, (iii) the focus on readily applied, readily monitored and readily enforced "end-of-pipe" restrictions, and (iv) the assessment of consequential water quality effects only as a secondary task and only to make the requirements stricter than is dictated by technology considerations. As discussed herein, EPA has ignored all of those dictates in fashioning its current "approach to BTA" and "new framework."

2. EPA's Interpretation of the Statutory Term "Available" Is Unlawful.

In one instance of this derogation of Congress's intent and the plain language of the statute, EPA has applied an unlawful interpretation of the term "available" in Section 316(b). Specifically, EPA proposes to rule out several candidate "best performing technologies" because they cannot be implemented at every regulated facility in the United States. Thus, EPA rejected closed-cycle cooling as BTA and avoided setting a nationally uniform entrainment standard because it could not identify "a single technology that represented BTA for all facilities."[421] Likewise, EPA rejected a velocity limit of 0.5 feet/second as the basis for a national impingement standard "because it is not available at all facilities."[422]

However, it is impermissible for EPA to reject any technology "because it is not available at all facilities."[423] The language, structure, and legislative history of the Clean Water Act indicate that Congress did not intend for EPA to consider whether a candidate technology is capable of being implemented universally when setting technology-based standards.

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[417] *Riverkeeper II*, 475 F.3d at 110.

[418] *Riverkeeper II*, 475 F.3d at 114-15.

[419] *Entergy Corp. v. Riverkeeper, Inc.*, 129 S. Ct. 1498, 1510 (2009).

[420] *Id.* ("We of course express no view on the remaining bases for the Second Circuit's remand which did not depend on the permissibility of cost-benefit analysis").

[421] 76 Fed. Reg. at 22,197 (col. 2).

[422] 76 Fed. Reg. at 22,203 (col. 1).

[423] 76 Fed. Reg. at 22,203 (col. 1).

3. EPA's Understanding of its Cost-Benefit Authority is Incorrect.

As discussed above, the Clean Water Act also restricts (albeit does not deny entirely) the authority of EPA and delegated states to rely on cost-benefit considerations in establishing BTA standards under Section 316(b). Moreover, cost-benefit analysis is, at best, optional under Section 316(b). Indeed, EPA has not always employed cost-benefit analysis when regulating cooling water intake structures. The Phase I rule, the Phase III rule for oil rigs, and the "new units" provisions in the Proposed Rule each set Section 316(b) standards primarily based on technological and cost considerations, but not a strict cost-benefit approach, and none of them authorize permit writers to undertake cost-benefit analyses on a site-specific basis.[424] In *ConocoPhillips*, the Fifth Circuit upheld EPA's decision not to perform a cost-benefit analysis for the Phase III rule.[425] Because cost-benefit analysis is optional, and, in the circumstances presented here, frustrates, rather than promotes the intent of the statute, we urge EPA not to rely on cost-benefit considerations for this rule, and even more importantly, not to authorize permit writers to consider cost-benefit considerations on a site-specific basis.

Nevertheless, to the extent EPA chooses to engage in cost-benefit analysis for the final rule, as it did in developing the proposal, the agency's understanding of its authority in this regard is also mistaken. In explaining its approach to BTA, EPA states that:

> because the Supreme Court has concluded that EPA may permissibly consider costs and benefits in its BTA determination and E.O. 13563 directs EPA only to propose regulations based on a reasoned determination that the benefits justify the costs, EPA has taken costs and benefits into account in this proposal. EPA has concluded that the benefits of the proposed option justify its costs.[426]

That blithe statement, however, completely ignores the limitations that the CWA imposes, as Justice Breyer explained in *Entergy* and EPA has previously recognized. In particular, the statute restricts EPA's investigation of, and reliance upon, cost-benefit analysis in choosing a regulatory option, establishing nationwide performance standards and procedures for them to be applied in permits. Justice Breyer explained that EPA is required to "describe environmental benefits in non-monetized terms," "avoid lengthy formal cost-benefit proceedings and futile attempts at comprehensive monetization," and "take account of Congress' technology-forcing objectives," while merely using cost-benefit analysis to "prevent results that are absurd or unreasonable in light of extreme

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[424] *See e.g.,* 66 Fed. Reg. at 65,312 (cols. 2-3) (In responding to comment on why the agency did not rely on cost-benefit considerations for the Phase I rule, EPA stated that "it is neither required nor prudent for EPA to develop empirical estimates of benefits where data limitations or other critical constraints preclude doing so in a credible and reliable manner"); *ConocoPhillips Co. v. EPA,* 612 F.3d 822, 829 (5th Cir. 2010) ("For new Phase III facilities, the EPA concluded that it was impossible to compare the costs incurred by individual facilities to the benefits of those facilities because those facilities have not yet been built. Instead, the EPA calculated the expected costs of compliance under the national uniform standards and determined whether those costs would result in a barrier to entry for new operations and whether those costs could be reasonably borne by the industry.") (internal footnotes omitted); *see also* 71 Fed. Reg. at 35,025-29, 35,034; proposed 40 C.F.R. § 125.94(d); 76 Fed. Reg. at 22,283 (cols. 2-3).

[425] *See ConocoPhillips Co. v. EPA*, 612 F.3d at 842.

[426] 76 Fed. Reg. at 22,196 (col. 3).

disparities between costs and benefits."[427] This can be done through EPA's traditional wholly disproportionate test, so long as the analysis is a "limited" and "relatively subsidiary task" rather than a "primary" or "paramount" factor, in light of the "difficulty of quantifying all the benefits of minimizing the adverse impacts of cooling water intake structures" (to use the agency's own words), and so long as permit writers do not conduct a second cost-benefit analysis of any kind – whether the wholly disproportionate test or otherwise – in implementing the standards that EPA establishes.

For a much fuller description of the numerous fatal flaws in EPA's cost-benefit analysis please see Section III.F., below, and Appendix A.

B. EPA Should and Must Establish a National Categorical Entrainment Standard Based on Closed-Cycle Cooling.

EPA should completely jettison the case-by-case site-specific approach to setting entrainment standards and instead establish a national categorical entrainment standard based on closed-cycle cooling. EPA considered two such options: Option 3 which applies closed-cycle cooling to all facilities subject to the rule, and Option 2 which has a 125 MGD actual intake flow threshold. Because Option 3 is superior in all respects, and will protect aquatic resources with minimal difficulty, EPA should select that option for the final rule in place of the proposed option, Option 1.

1. Option 1's Entrainment Provisions Represent a Complete Abdication of EPA's Responsibility to Minimize Adverse Environmental Impact.

Despite the widespread availability of closed-cycle cooling, EPA plans to require states to set entrainment controls on a case-by-case basis. This violates a clear Congressional directive to adopt effective, national, and uniform standards. Further, it is arbitrary and capricious of EPA to claim that it will fulfill its statutory duty to minimize the adverse environmental impact of cooling water intakes by delegating BTA decisions to the states. Forty years of experience shows that states cannot make these permitting choices, and the states have told EPA as much. EPA's Proposed Rule will therefore continue a woefully inadequate permitting process that has, for decades, allowed power plants to operate across the country pursuant to long-expired or impermissibly weak permits.

Not only does the Proposed Rule unlawfully and arbitrarily create a case-by-case standard-setting regime, the particular case-by-case regime that EPA has designed is particularly egregious in its legal infirmity. It leaves state permitting authorities unfettered discretion in setting standards, effectively allowing industry to self-regulate by proposing controls that overburdened state regulators lack the oversight capacity to meaningfully review.

[427] *Entergy*, 129 S. Ct. at 1515; see also *Entergy Corp. v. Riverkeeper, Inc.*, 129 S. Ct. 1498, Transcript of Oral Argument (Dec. 2, 2008) (Exh. 88).

a. EPA's Failure to Set Uniform National Standards for Entrainment Violates the Plain Language of Section 316(b) and Congress's Clearly-Expressed Intent.

As explained above, the Clean Water Act requires EPA to adopt uniform, national, categorical, technology-based and technology-forcing BTA standards for cooling water intake structures. Beyond the explicit directive to establish "standards" in the text of Section 316(b), the fact that Section 316(b) standards are promulgated under CWA sections 301 and 306 also indicates that, like the Act's other technology-based standards, Section 316(b) standards must be implemented on a nationwide, uniform basis.

Further, national technology-based standards are consonant with several significant Congressional objectives that underpin the Clean Water Act: standardizing permitting procedures; limiting and revising the water-quality based approach to pollution control that rendered effective regulation impossible from 1948 to 1972; setting a federal floor for environmental protection in order to avoid a "race to the bottom" by state regulators; and promoting the Congressional interest in "horizontal equity," *i.e.*, that similar facilities be treated similarly under the CWA insofar as possible. Congress made it abundantly clear that, to meet these objectives, EPA must set uniform, national, technology-based standards to minimize the adverse environmental impact of cooling water intake structures.

The record shows that EPA can and should establish a uniform national standard based on the use of closed-cycle cooling technology: EPA determined that closed-cycle cooling is a best performing technology[428] and that numerous existing facilities had retrofitted to closed-cycle.[429] EPA is concerned that "closed-cycle cooling is not practically feasible in a number of circumstances" that "are not isolated or insignificant."[430] But it is unlawful for the agency to decide on this basis "that it should not establish closed-cycle cooling as the presumptive BTA entrainment control."[431] As noted above, Congress gave EPA the ability to subcategorize the regulated industry and/or to offer variances precisely to address such concerns.[432] And properly crafted variance provisions have been upheld under Section 316(b) before.[433]

It is feasible to set uniform national standards because closed-cycle cooling and other technologies are available to the industry as a whole and EPA has the ability to issue variances in the rare case where it is technically infeasible. And, as outlined above, a case-by-case approach directly contradicts Congress' general intent to end site-specific permitting under the Clean Water Act, and it contradicts Congress' specific intent to require uniform standards under Section 316(b).

Setting a uniform standard with a variance is also consistent with Congress's most

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[428] *See* 76 Fed. Reg. at 22,203 (col. 3).

[429] *See* 76 Fed. Reg. at 22,204 (col. 1).

[430] 76 Fed. Reg. at 22,207 (col. 1).

[431] *Id.*

[432] *See* 33 U.S.C. § 1311(n) (fundamentally different factors variance).

[433] *See Riverkeeper I*, 358 F.3d at 193-94.

fundamental objective in passing the Clean Water Act: "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[434] A uniform standard provides a strong baseline of environmental protection and helps maintain water quality by placing the burden of proof for any downward variance upon the polluter.

If EPA is concerned about setting a categorical standard for the more than 1,200 facilities with cooling water intake structures affected by this rule, it must nevertheless undertake a thorough effort to craft national standards by looking at various thresholds and options for subcategorizing. EPA cannot aggregate all industries using intake structures and then default to a case-by-case regulatory approach, merely because it cannot find one technology that it believes all 1,200 facilities can install.

b. EPA Is Unlawfully Requiring State Permit Writers to Set Entrainment Controls Based In Large Part on Water Quality Considerations Rather than Technological Considerations.

Under EPA's Proposed Rule, before a state may set entrainment controls at a particular site, the state permitting Director must consider the entrainment impacts on the waterbody, the ecological costs and benefits of the BTA candidate technologies (including to any threatened or endangered species), and the thermal discharge impacts of the candidate BTA technologies.[435] Additionally, to determine the environmental impacts of entrainment on the waterbody, the state permitting authority must also review "source water physical data" and "source water baseline biological characterization data."[436] Only once the state has adequately evaluated these water-quality based concerns may it make a BTA determination. To the extent that this requires, or merely allows, states to analyze the consequential impact of its decision on the quality of the affected waters in the first instance, it is illegal because it is diametrically opposed to the approach to BTA envisioned by Congress and required under the Clean Water Act. As noted above, "Congress [intended] that the 'design' of intake structures be regulated directly, based on the best technology available, and without resort in the first instance to water quality measurements."[437] It deliberately established the NPDES program to relieve permitting agencies of the need to conduct costly, lengthy, and indeterminate ecological studies to issue permits. Improving water quality is, of course, the goal of the Clean Water Act and its implementing regulations, but charactering on a site-specific basis the full extent of consequential damage caused to the waterbody by each intake structure's fish kills is not a prerequisite to the imposition of technological controls.

The principled use of technology-based standards and rejection of the pre-existing water-quality based analyses applies equally in the Section 316(b) context as it does to effluent

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[434] 33 U.S.C. § 1251(a).

[435] *See* proposed 40 C.F.R. § 125.98(e), 76 Fed. Reg. at 22,288 (col. 1).

[436] *See* proposed 40 C.F.R. § 125.98(e), 76 Fed. Reg. at 22,288 (col. 1) ("The Director must establish case-by-case BTA standards for entrainment mortality for any facility subject to such requirements after reviewing the information submitted under 40 CFR 122.21(r)"); *see also* proposed 40 C.F.R. §§ 122.21(r)(2), (r)(4), 76 Fed. Reg. at 22,276 (col. 1-2) (requiring facilities to submit source water physical data and source water biological characterization data).

[437] *Riverkeeper I,* 358 F.3d at 190.

limitations. The Second Circuit explained in *Riverkeeper I* and again in *Riverkeeper II* that "Congress rejected a regulatory approach that relies on water quality standards, [such as] … focusing on fish populations and consequential environmental harm."[438] Congress retained water quality standards in the Clean Water Act only as a supplementary mechanism that can be used to set limitations stricter, but not more lenient, than technology-based limitations.[439] EPA is permitted to give consideration to the environmental benefits of its regulations at the national level.[440] But Congress forbade EPA from using site-specific water quality considerations as the basis for case-by-case standard setting or as the basis to weaken requirements that are based on technology considerations; yet that is precisely what EPA demands of state permitting authorities today.

The Clean Water Act directs EPA to set categorical standards on the basis of the best technology available to minimize adverse environmental impact without respect to water quality (except that water quality can be considered where necessary to make the requirements stricter). And as the next section points out, it is precisely EPA's failure to set such categorical standards under Section 316(b) that, since the 1970's, has paralyzed state decision making. For EPA to abdicate its responsibility to set national technology-based standards and instead order states to set water quality-based standards not only violates the law but marks a return to the pre-1972 regulatory approach that Congress sought to eliminate.

c. EPA's Decision to Require State Permit Writers to Set Entrainment Controls on a Case-by-Case Basis Is Arbitrary and Capricious and Will Perpetuate Bureaucratic Paralysis.

EPA knows full well that the states will not meet the case-by-case decision making and cost-benefit analysis obligations that this Proposed Rule imposes. EPA thus abuses its discretion by claiming that this empty delegation of responsibility – which simply continues the current, failed site-specific permitting system – is adequate to meet the agency's obligation to set BTA standards that minimize adverse environmental impact. EPA's rule will not minimize adverse environmental impacts, and it will do little or nothing to change the status quo.

(1) States Cannot Complete Case-By-Case BTA Determinations.

EPA's conclusions that (1) requiring state permitting authorities to set entrainment controls on a site-specific basis "represents the best technology available for minimizing the adverse environmental impacts associated with intake structures"[441] and that (2) "[s]ite specific proceedings are the appropriate forum for weighing all relevant considerations in establishing

[438] *Riverkeeper I*, 358 F.3d at 196; *see Riverkeeper II*, 475 F.3d at 114 ("[I]n enacting the CWA, Congress rejected regulation by reference to water quality standards.").

[439] *EPA v. California,* 426 U.S. at 205 n. 12; *Riverkeeper*, 358 F.3d at 185 n. 10, 190; *Weyerhaeuser*, 590 F.2d at 1043.

[440] *Entergy*, 129 S.Ct. at 1505-1506 (in setting uniform, national standards under Section 316(b), EPA may consider the benefits that derive from a "reduction in adverse environmental impacts" and the costs of achieving that reduction).

[441] 76 Fed. Reg. at 22,210 (col. 2).

BTA entrainment mortality controls"[442] are arbitrary, capricious, and an abuse of the agency's discretion under the Clean Water Act. The Proposed Rule would require plant operators to submit, and permit writers to evaluate, at least the following studies:

- Source Water Physical Data;
- Cooling Water Intake Structure Data;
- Source Water Baseline Biological Characterization Data;
- Cooling Water System Data;
- Proposed Impingement Mortality Reduction Plan;
- Performance Studies;
- Operational Status;
- Entrainment Characterization Study;
- Comprehensive Technical Feasibility and Cost Evaluation Study;
- Benefits Valuation Study; and
- Non-Water Quality Impacts Assessment[443]

However, experience shows that state permitting authorities cannot meaningfully review studies of this sort and cannot make site specific BTA determinations at all, much less in the timely manner required under the Clean Water Act.

Since 1972, site-specific proceedings have resulted in uneven and conflicting rulings, the widespread use of inferior technology, as well as enormous, unnecessary aquatic mortality, all of which run contrary to the goals of the Clean Water Act and the direct mandate of Section 316(b). On December 13, 1976, EPA issued its first cooling water intake regulation to implement Section 316(b). Industry filed suit and, without reviewing its merits, the Fourth Circuit remanded the regulation because of procedural defects.[444] EPA subsequently withdrew the regulation, and for more than two decades failed to propose or adopt any new cooling water intake regulations.

In the absence of national regulations, cooling water intake standards have been relegated to *ad hoc* determinations by individual permit writers, typically state agencies, exercising "best professional judgment."[445] EPA's own assessment is that these case-by-case, site-specific Section 316(b) proceedings, which involve a complex assessment of the local marine ecosystem and fishery population dynamics to determine best technology available, impose a significant burden on permitting agencies:

> The historical case-by-case approach requires significant resources on the part of the regulatory authorities that must implement Section 316(b) requirements. …

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[442] 76 Fed. Reg. at 22,207 (col. 1).

[443] *See e.g.,* proposed amended 40 C.F.R. 122.21(r); 76 Fed. Reg. 22,275 (col. 1)-22,279 (col. 2).

[444] *Appalachian Power Co. v. Train,* 566 F.2d 451, 459 (4th Cir. 1977).

[445] 66 Fed. Reg. at 65,262 (cols. 1-2). Where EPA has not yet promulgated national technology-based standards for a category of point sources, the permit writer must use, on a case-by-case basis, his or her best professional judgment to impose such conditions as he or she determines are necessary to carry out the provisions of the Clean Water Act. 33 U.S.C. § 1342(a)(1)(B); *NRDC v. EPA*, 863 F.2d 1420, 1424 (9th Cir. 1988).

> [E]ach regulated facility must develop, submit, and refine [multi-year, multi-disciplinary] studies that characterize or estimate potential adverse environmental impact. … [G]iven the iterative nature of the assessment process, industry as well as EPA regional and State regulatory authorities must expend significant resources assessing study plans and methods for characterizing the environmental impact occurring at each facility and evaluating those data to determine what constitutes BTA for each specific facility.[446]

EPA also acknowledges that "site-specific options increase the likelihood that each significant cooling water intake permitting issue would become a point of contention between the applicant and permit writer, which EPA's experience indicates slows the permitting process, makes it more resource intensive, and makes it more costly."[447] And EPA has been clear that site-specific consideration of biological and ecological conditions is one of the key drivers of this complexity, controversy, imprecision and substantial delay:

> [B]ecause of the complexity of biological studies, it is very difficult to assess the cause and effect of cooling water intake structures on ecosystems or on important species within an ecosystem. An overwhelming majority of scientists have stated that biological studies can take multiple years because of the complex nature of biological systems. Moreover, unlike in the laboratory, where conditions are controlled, a multitude of confounding factors make biological studies very difficult to perform and make causation, in particular, difficult to determine.[448]

Biological complexity and the lack of categorical standards make industry's superior resources a critical strategic advantage. Many states, including New York, New Jersey, Texas, Louisiana, Michigan, Wisconsin, Minnesota, and Kansas, have complained to EPA of the extreme burdens of making these decisions on a case-by-case, site-specific basis. For example, the New York State Department of Environmental Conservation has informed EPA of the "potentially endless, expensive studies that usually yield ambiguous or debatable results … because it is impossible to identify, measure, and attribute the impact of each the [sic] many variables affecting populations on each of the impacted species."[449] New York thus asked EPA to promulgate "clear performance-based requirements" that set "nationally-applicable minimum standards" so that "companies and regulators could put their staff and monetary resources into reducing impacts instead of into studies and rebuttals."[450] Similarly, New Jersey has explained that:

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[446] 65 Fed. Reg. at 49,079 (col. 2). *See also* 66 Fed. Reg. at 65,262 (cols. 1-2) (EPA noting that site-specific determinations impose "significant resource demands on permitting agencies") and 66 Fed. Reg, 28,853, 28,865 (cols. 2-3) (May 25, 2001) (in some States' view, site-specific approach requires "burdensome expenditure of resources to develop section 316(b) requirements for each new facility.").

[447] 69 Fed. Reg. at 41,607-608 (footnote and citations omitted).

[448] 66 Fed. Reg. at 65,285 (col. 2)

[449] Statements of NYS Dept. of Env. Cons., Division of Fish, Wildlife, and Marine Resources, provided to U.S. EPA, re Public Meeting to Discuss Adverse Environmental Impacts resulting from Cooling Water Intake Structures, p.1 [DCN 1-5025-PR] (June 29, 1998) (Exh. 89).

[450] Phase II Comment Letter from Peter Duncan, Deputy Commissioner of the Office of Natural Resources, NYS DEC, to EPA Proposed Rule Comment Clerk, re the NPDES Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, August 7, 2002, Comment 1.38, p. 2 (Exh. 90).

> State agencies and permitting authorities could engage in a debate for years as to the population measure of a given fish species, let alone many fish species. The results of biological population studies and modeling can be very subjective because it is difficult to identify, measure, and attribute the impact of each of the many variables…affecting populations of each of the impacted species.[451]

More pointedly, Louisiana DEQ has stated: "In our opinion EPA vastly under estimated the resources necessary … to implement the 316(b) requirements.… Throughout the proposed regulations, reference is made to site-specific determination of best technology available.… Where will the states and/or EPA get the resources to review all the submittals…?"[452] Michigan's Department of Natural Resources has notified EPA that it has "experienced considerable inaction in the adoption of technology because of disagreement among power producers and agency biologists" regarding the minimization of cooling water intake structure impacts.[453] Likewise, the surface water permitting chief at the Michigan DEQ (which implements the NPDES program in that state) has complained of the:

> considerable burden on the NPDES permitting program in Michigan if the 316(b) regulations … require environmental effects studies at individual facilities. My experience indicates that studies of the effects of cooling water intake structures on the receiving water fisheries are extremely difficult to do and the results are difficult to interpret. The burden would be considerably reduced if the regulations require specific cooling water intake structure technology. Also, this approach would seem to me to be consistent with the intent of Section 316(b).[454]

As of July, 2011, several states had already taken the opportunity to reemphasize to EPA during the current comment period that a site-specific approach to BTA determinations imposes considerable and unrealistic administrative burdens on them. For example, the Texas Commission on Environmental Quality told EPA that it:

> is not aware of any other situation in the NPDES permitting scheme with such excessive resource expectations on the permitting authority. . . . At a minimum, TCEQ has significant concerns related to the level of expertise necessary to

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[451] Phase II Comment Letter from Dennis Hart, Assistant Commissioner, Environmental Regulation, New Jersey Department of Environmental Protection, to EPA Proposed Rule Comment Clerk, re Cooling Water Intake Structures (New Facilities), November 9, 2000, DCN Comment 1.54, p. 4 (Exh. 91); see also Phase II Comment Lettr from Bradley M. Campbell, Commissioner, New Jersey Department of Environmental Protection, to EPA Proposed Rule Comment Clerk, re Cooling Water Intake Structures (Existing Facilities), Aug. 8, 2002, Comment 2.002 (Exh. 92) (explaining that site-specific options are "likely to result in protracted dialogue between the permitee and the regulatory agency, undue and wasted effort, and delayed implementation of the required improvements.").

[452] Phase II Comment Letter from Gary Aydell, Technical Advisor, Office of the Secretary, Louisiana Department of Environmental Quality, to EPA Proposed Rule Comment Clerk, re Cooling Water Intake Structure (Existing Facilities: Phase II) Proposed Rule, August 8, 2002, DCN Comment 2.1, p. 1 (Exh. 93).

[453] November 7, 2000 letter from Michigan Dept. of Natural Resources to EPA.

[454] Phase II Comment Letter from Bill McCracken, Chief of Permits Section, Surface Water Quality Division, Michigan Department of Environmental Quality, re 316(b) Burden, January 24, 2002 [DCN 4-0049] (Exh. 94).

> review the required information in some of the studies and reports (such as noise, grid reliability, air emissions, social benefits). . . . TCEQ is also concerned that the inconsistency of reviews from state to state and region to region will allow for further inequities.[455]

Similarly, Kansas warns that "[r]educed state funding resources resulting from state budget restraints, expected reductions in EPA program funding, reduced program staffing because of funding restraints over the last several years, and increased workloads in the NPDES arena make simplification of the proposed 316(b) Rule provisions imperative."[456]

According to the Minnesota Pollution Control Agency (MPCA), EPA's rules force permitting agencies:

> to play a critical role in the preparation of these application materials, in addition to the final review of the application materials and peer review comments during the permit development process. The MPCA believes that this proposed regulation requires expenditure of agency resources on permits falling under Section 316(b) …. This approach effectively requires state permitting authorities to undertake a level of effort, *on par with a rulemaking*, with each and every permit action that requires entrainment mortality reductions instead of specifying reductions within these proposed regulations.[457]

Instead of onerous case-by-case decision making, "the MPCA is in support of establishing nation-wide performance standards for minimizing adverse environmental impacts resulting from cooling water intake structures."[458]

Similarly, Wisconsin stated that "[s]pecific performance standards … make BTA decisions easier. . . . For example, if cooling towers are the ideal, why not set this as the EM [entrainment mortality] standard but allow for permittees to demonstrate why this will not work for a given situation?"[459]

The lesson learned in these states and around the country in the nearly four decades since Section 316(b) was enacted is that state permit writers lack the resources and expertise to permit intake structures in the absence of national categorical requirements, while applicants can use site-specific standard setting procedures to bring permitting to a grinding halt. The electricity industry has long and vigorously urged site-specific approaches and cost-benefit tests for Section

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[455] Phase II Comment Letter from Mark Vickery, P.G., Executive Director, Texas Commission on Environmental Quality to EPA, July 19, 2011, at p. 4 (EPA-HQ-OW-2008-0667-1970).

[456] Phase II Comment Letter from Donald R. Carlson, P.E., Chief, Industrial Programs Section, Bureau of Water, Kansas Department of Health and Environment to EPA, July 1, 2011, p. 6 (EPA-HQ-OW-2008-0667-1598).

[457] Letter from Jeff Udd, Acting Supervisor, Industrial Water Quality Permits Unit, Minnesota Pollution Control Agency to EPA, June 30, 2011, at p. 1-2 (EPA-HQ-OW-2008-0667-1631) (emphasis added).

[458] *Id.* at p. 1.

[459] Letter from Susan R. Sylvester, Acting Director, Bureau of Watershed Management, Wisconsin Department of Natural Resources to EPA, July 13, 2011, p. 4-5 (EPA-HQ-OW-2008-0667-2063).

316(b) permitting.[460] Power plant owners have perfected the technique of inundating regulators with site-specific information and then contesting every aspect of the permitting process so as to avoid technological upgrades. (As just a few examples of the many power plants whose permitting proceedings have been confounded by the lack of national intake structure regulations and the resulting case-by-case approach, see Section I.C., above.)

Nationwide, there are more than 600 existing power plants subject to the Proposed Rule, and an enormous number of them are already significantly overdue for re-permitting. At coal-fired power plants alone, more than 87 million MWh of generation operates without an up-to-date permit, and nationwide, 255 existing power plants have expired permits. Many of these permits (at least 65) have been expired for more than an entire five-year permit cycle,[461] and at least seven plants that we are aware of are operating with permits that expired in 1995 or earlier.[462] States cannot even re-issue permits in a timely manner, therefore, it is clear that they are unable to complete the expensive and labor-intensive technology review required by the proposed rule.

This problem will only get worse as those state agencies are subject to ever-worsening budget cuts. In 2011 alone, state funding for environment and energy agencies in New York was cut by ten percent,[463] and state funding for the North Carolina Department of Environment and Natural Resources was cut by more than twelve percent.[464] In Arizona, the state funding for the Department of Environmental Quality has been cut in half in the last two years, dropping from $19.7 million in 2009 to $7 million for 2011, and the budget for the Arizona Department of Water Resources has been cut by almost two-thirds.[465]

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[460] *See Riverkeeper I*, 358 F.3d at 196 (utility industry arguing that "EPA should only have sought to regulate impingement and entrainment where they have deleterious effects on the overall fish and shellfish populations in the ecosystem, which can only be determined through a case-by-case, site-specific regulatory regime."); 67 Fed. Reg. at 17,162 (describing two wholly site-specific regulatory frameworks proposed by a utility association and a power company).

[461] *See* NPDES Permit Expiration Date spreadsheet (listing 47 coal plants with cooling water intakes operating on permits that expired in 2005 or earlier and had not been renewed by 2011; 18 of these were more than 10 years overdue) (Exh. 95).

[462] *See* NPDES Permit Expiration Date spreadsheet (lisitng four coal plants – Indian River, Cayuga, Schiller, and Valley – with pernits expired in 1995 or earlier). In addition, the Indian Point, Bowline and Roseton facilities on the Hudson River are operating under NPDES permits that were issued in 1987 and expired in 1992. *See also* Abt Associates, Inc., P2F Compliance Years, dated February 13, 2004 ("[2004] Compliance Years List") (listing 57 plants with cooling water intakes operating on permits that expired in the 1990s or earlier and had not been renewed by 2003; 15 of these were more than 10 years overdue) [DCN 6-4036-N] (Exh. 96); *See also* Attachment to EPA Memorandum re Implementation of Section 316(b) in NPDES Permits, Feb. 27, 2003 ("2003 NPDES Permit List") (listing 67 plants with cooling water intakes operating on permits that expired in the 1990s and had not been renewed by 2003; 13 of these were more than 10 years overdue) (Exh. 97).

[463] Mary Phillips-Sandy, "New York Budget: The 5 Most Painful Cuts," *AOL NEWS* (Feb. 1, 2011) (Exh. 98) *also available at* http://www.aolnews.com/2011/02/01/new-yo rk-budget-the-5-most-painful-cuts/.

[464] Gary Robertson and Martha Waggoner, "Final NC budget takes aim at environmental policy," *Bloomberg Business Week* (June 3, 2011) (Exh. 99) *also available at* http://www.businessweek.com/ap/financialnews /D9NKE8N80.htm.

[465] Shaun McKinnon, *Arizona budget cuts hurting water and air agencies*, THE ARIZONA REPUBLIC (May 4, 2010) (Exh. 100) *also available at* http://www.azcentral.com/arizonarepublic /news/articles/2010/05/04/20100504arizona-budget-cuts-hurting-water-and-agencies.html.

The federal funding for state environmental agencies has also been cut. The EPA's budget for the 2011 fiscal year was cut by 16 percent, and EPA passed that loss on to the states by cutting the federal funding given to state environmental agencies. Experts predict that the EPA's budget will be cut again during the next appropriations cycle, which will likely result in more cuts to state funding.[466] As a result of these drastic cuts, state officials have millions of dollars less to implement and enforce environmental laws than they did a few years ago.[467] These cuts have left state environmental agencies seriously shorthanded, making it even unreasonable to believe that they can complete the resource intensive review required by this permitting process.

EPA recognizes that Section 316(b) requires it "to establish standards for cooling water intake structures that reflect the 'best technology available for minimizing adverse environmental impact.'"[468] EPA also knows that state permitting authorities almost never complete site-specific determinations in a timely manner, and in many cases do not complete them at all. The simple reality is that most state permit writing agencies do not have sufficient financial or technical resources to meaningfully address cooling water impacts in the absence of national categorical requirements. Experience over the last four decades has shown that a case-by-case approach simply will not work. Instead, it is guaranteed to mire the NPDES permitting process in an endless cycle of paperwork and litigation that will leave waterbodies across the country unprotected. Any cooling water rule EPA promulgates cannot be effective unless it is simple and straightforward to implement, and does not require case-by-case determination of BTA requirements for each facility. Accordingly, the agency's conclusion that entrainment controls determined by state permitting authorities on a site-specific basis "represent[] the best technology available for minimizing the adverse environmental impacts associated with intake structures"[469] is irrational and illegal.

(2) States Cannot Conduct, or Meaningfully Review, Site-Specific Cost-Benefit Analyses.

Similarly, and more particularly, it is arbitrary, capricious, and an abuse of discretion for EPA to require states to perform the task that it knows, above all, they cannot possibly accomplish: evaluating the consequential, monetized and social benefits of entrainment controls on a site-specific basis.[470] Under the Proposed Rule, state permitting authorities must not only oversee the development of hundreds of case-by-case, cost-benefit analyses, they also must

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[466] *Id.*

[467] Juliet Eilperin, *EPA budget cuts put states in bind*, THE WASHINGTON POST (June 20, 2011) (Exh. 101) *also available at* http://www.washingtonpost.com/national/environment/epa-budget-cuts-put-states-in-bind/2011/06/08/AGbVpYdH_story.html.

[468] 76 Fed. Reg. at 22,196 (col. 2)

[469] 76 Fed. Reg. at 22,210 (col. 2).

[470] *See* 76 Fed. Reg. at 22,204 (col. 2) ("the facility would provide detailed information on the other factors relevant to the Director's site-specific BTA determination. These would include . . . both the monetized and non-monetized benefits of such controls."); *see also* 76 Fed. Reg. at 22,210 (col. 3) ("[T]he facility's permit application must include the following information: . . . a detailed discussion of the magnitude of water quality benefits, both monetized and non-monetized, of the candidate entrainment mortality reduction technologies evaluated.").

conduct a meaningful review of each applicant's studies that includes both quantitative and qualitative assessments of environmental benefits and, more problematic still, estimates of the monetized value of these benefits.[471] That task simply cannot be done by state permitting agencies – not under the relatively flush times of years past, and most certainly not in today's leaner times as state agency resources are stretched ever thinner – and EPA knows it. The rule's site-specific cost-benefit analysis requirements will thus only impede the permitting process, reduce environmental protection, and lead to ineffective and wildly inconsistent permitting decisions – exactly the opposite of what Congress expected when it ordered EPA to set standards under Section 316(b) and what Administrator Jackson promised in asserting the rule would provide "regulatory certainty."

It is clear that states cannot conduct cost-benefit analysis under section 316(b) because, even with the resources of the federal government at its disposal, EPA itself could not do it. EPA was incapable of making meaningful cost-benefit determinations for fundamental reasons: considerable uncertainty in quantifying the physical benefits of the rule, and beyond that, an inability to assign meaningful and accurate monetary values to those benefits. Tellingly, in the draft of this rule that EPA originally sent to OMB, EPA candidly admitted that it did not rely on the results of a cost-benefit analysis in setting standards because "a national *weighing of costs and benefits is not possible* at this time."[472] It is irrational to think that what EPA cannot complete once, the states can do hundreds of times.

The first problem that EPA encountered lay in quantifying the benefits of the rule within acceptable bounds of uncertainty. There are some categories of benefits that EPA admits it was entirely unable to quantify, although the agency acknowledges that they exist and are important. For example, "[w]hile EPA can identify and hypothesize regarding the direction and relative importance of impacts of CWISs on the totality of the aquatic ecosystem …, EPA is currently unable to connect these effects with quantifiable environmental benefits. Thus, it is highly likely that the total environmental and monetary impacts of CWISs are significantly underestimated…"[473]

EPA also believes that its calculations underestimate the environmental impacts of intake structures in other ways. For example, EPA confirmed that at least 15 threatened and endangered species are currently killed by cooling water intake structures.[474] But EPA states that 15 species "may be an underestimate" because it has documented cases of intakes killing non-endangered organisms from the same genus as a threatened and endangered species, and the range of the endangered species is sufficiently similar to that of the other member of its genus that it includes the zone of danger near a reporting facility's intake structure.[475] In all, EPA

[471] *See* 76 Fed. Reg. at 22,205 (col. 3) (the state permitting authority's "written explanation would provide a review of the social costs . . . of the various technologies; a review of the potential reductions in entrainment and entrainment mortality; and a review and analysis of monetized and non-monetized benefits.").

[472] Redlined Version of Proposed Rule, p. 166 (emphasis added).

[473] 2011 EEBA, p. 2-22.

[474] 76 Fed. Reg. at 22,244 (col. 1).

[475] 76 Fed. Reg. at 22,244 (col. 3).

identified 88 threatened and endangered species whose ranges overlap with cooling water intakes affected by this Rule.[476]

After grappling with the physical uncertainties, EPA was then faced with the even more difficult task of assigning meaningful and accurate dollar figures to the estimated 98 percent of the rule's benefits that have no established market value benefits to wildlife, ecosystem stability, and endangered species. Here, EPA admits a near-complete failure:

> EPA's analysis does not fully quantify or monetize certain potentially important categories of benefits, such as existence values for threatened and endangered species, secondary and tertiary ecosystem impacts, benthic community impacts, shellfish impacts and the impacts arising from reductions in thermal discharges that would be associated with closed-cycle. Changes in fish assemblages due to impingement, entrainment and thermal effects are also not fully valued.[477]

The problem is not a lack of effort or resources on EPA's part, but fundamental methodological and data gathering obstacles:

> Consideration of benefits in particular is complicated by the absence of well-developed tools or data to fully express the ecological benefits in monetized terms. EPA has, however, used the best currently available science to monetize the benefits of the various options in four major categories: Recreational fishing, commercial fishing, nonuse benefits, and benefits to threatened and endangered species.[478]

Even a (comparably) well resourced federal agency applying "the best currently available science" was forced to conclude that its estimates of non-use benefits and benefits to threatened and endangered species "are incomplete."[479] And since it was unable to monetize many categories of benefits, EPA's ability to base BTA decision making on the relationship of quantified costs and benefits alone was, by the agency's own admission, "challenging."[480]

The fact that EPA encountered such difficulties is unsurprising. They stem, in part, from the fact that monetizing the estimated benefits of this rule requires EPA to make difficult, sensitive, value-laden, and highly subjective assumptions. This comment letter summarizes key points from a more extensive environmental economic report prepared by two of Stockholm Environment Institute's senior economists, Frank Ackerman and Elizabeth Stanton.[481] The full Stockholm Environment Institute (SEI) report is attached to these comments as Appendix A.

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[476] *See* 76 Fed. Reg. at 22,244 (col. 3).

[477] 76 Fed. Reg. at 22,207 (col. 2-3).

[478] 76 Fed. Reg. at 22,197 (col. 1).

[479] 76 Fed. Reg. at 22,197 (col. 1).

[480] *See* 76 Fed. Reg. at 22,247 (col. 2).

[481] Comments of Frank Ackerman, Ph.D., and Elizabeth A. Stanton, Ph.D., Stockholm Environmental Institute-U.S. Center, Aug. 18, 2011, hereinafter ("SEI Report"), attached as Appendix A.

That report suggests that it may be impossible to infer accurate and meaningful measures of the value society places upon aquatic ecosystems from human behavior in markets:

> [e]thical statements about nature, environmental integrity, and obligations to protect ecosystems and biodiversity, which are at stake for many people, are only awkwardly translated into the language of monetized non-use values. The beliefs of many stakeholders may be distorted beyond recognition in this process (or ignored for lack of research meeting rigid specifications) – which is why cost-benefit analysis is poorly suited for this case.[482]

States that must oversee, review, and rely upon intensive cost-benefit analyses of the sort that EPA attempted will have no more success (and likely far less success) than EPA in their efforts to set clear entrainment standards. To conduct a fine-grained and monetized cost-benefit analysis of the kind that EPA attempted, the applicants (who are required to conduct the cost-benefit study in the first instance) will first need to accurately estimate the number of fish of different species and different life stages lost to cooling water intake structures. As the significant flaws in EPA's quantitative data show,[483] this is itself a difficult task. States will then need to provide applicants with methods to standardize fish counts across different life stages. To value forage fish species in terms of their impact on commercially and recreationally valued species, states will need to adapt trophic transfer models to the particular water bodies in their jurisdiction (since trophic transfer rates range from 2% to 24%) or will have to require applicants to study trophic transfer rates in their particular waterbody.[484]

States will also need to carefully police the way that regulated facilities monetize their benefit estimates. Valuing commercial fishing benefits entails retaining economists, assessing regional fish market price data, and evaluating economic models of producer and consumer surplus, taking into account any price shifts due to increased supply. To value breeding stocks for the ecosystem as a whole, states will have to assess fish population dynamics.[485] To value recreational fishing, applicants will have to attempt something akin to EPA's "Random Utility Model" (RUM). For ecosystem benefits, either the applicants or the States will need to conduct original stated preference studies or attempt a benefits transfer approach, which even EPA could not do. And the entire approach of treating non-use values as monetizable values rather than as ethical constraints is problematic for most people.

In short, EPA found it incredibly difficult to quantify the environmental benefits of this rule and can scarcely begin to estimate their monetary value. EPA admits that its efforts are awkward and its results are freighted with a great deal of uncertainty. Showing appropriate humility and honesty, EPA forthrightly admitted in its earlier draft (before OMB's intervention) that it lacked confidence in its cost-benefit analysis and could not rely upon it in making a BTA

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[482] Stockholm Environment Institute report.

[483] *See* discussion of EPA's undercounts in Section III.F.2.a.

[484] *See* Stockholm Environment Institute report.

[485] *See* 69 Fed. Reg. at 41,660 (Col. 1) (EPA acknowledging that its own analysis failed to account for the progeny of fish killed by impingement and entrainment and that "given the complexities of population dynamics, the significance of this omission is not clear.").

determination. The problems that frustrated EPA will plague the states as well. EPA's inability to complete a cost-benefit analysis provides specific, recent empirical evidence that states cannot conduct cost-benefit analyses of the kind that EPA envisions.

None of this comes as news to EPA. The states themselves, and others, have repeatedly told the agency that their inability to implement Section 316(b) without national standards is most pronounced when it comes to cost-benefit analysis. The Atlantic States Marine Fisheries Commission told EPA that "state permitting agencies do not have the appropriate staff to properly evaluate … comprehensive cost-benefit analyses."[486] In commenting on the Phase II rule, New York State wrote that site-specific cost-benefit analysis "could effectively negate the value of the entire Phase II rule … [because] the task of placing an accurate dollar value on aquatic resource impacts is rife with ecological and economic challenges; there is no widely accepted methodology."[487] Likewise, California informed EPA of its "experience … that it is difficult to obtain agreement on costs or benefits. The result is a long series of arguments involving dueling cost/benefit analyses."[488]

Site-specific and monetized cost-benefit analysis gives existing facilities a powerful tool to evade regulation by converting NPDES permitting into a lengthy, controversial and ultimately futile debate about fishing yields and fish prices, and how much environmental protection is worth to the public. Such delays are an enormous impediment to protecting the natural resources Congress intended to EPA to safeguard. As the D.C. Circuit explained in affirming EPA's refusal to consider receiving water quality in setting effluent limitations for the pulp and paper industry, "Congress clearly intended … to avoid such problems of proof so that a set of regulations with enforceable impact is possible."[489]

Accordingly, EPA should not require state agencies to conduct site-specific cost-benefit analyses in the context of permitting. It is arbitrary, capricious, and an abuse of discretion for EPA to demand that state permit writers undertake a task that it knows they cannot complete.

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[486] Letter from John V. O'Shea, Executive Director, Atlantic States Marine Fisheries Commission to Proposed Rule Comment Clerk, EPA, re: Cooling Water Intake Structure (Existing Facilities: Phase II), Aug. 7, 2002, at 1, Comments 1.059 (Exh. 102).

[487] Phase II Comment Letter from Peter Duncan, Deputy Commissioner of the Office of Natural Resources, NYS DEC, to EPA Proposed Rule Comment Clerk, re the NPDES Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, August 7, 2002, Comment 1.38, p. 3-4 (Exh. 90).

[488] Letter from Celeste Cantu, Executive Director of the California State Water Resources Control Board, to EPA Proposed Rule Comment Clerk-W-00-32, re Comments on National Pollution Discharge Elimination System Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities (Proposed Rule), August 5, 2002, at 4 (Exh. 103); *see also* Letter from Denise Sheehan, Executive Deputy Commissioner, New York DEC to Water Docket, EPA, re New York State Department of Environmental Conservation comments regarding the Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities; Notice of Data Availability (NODA), dated March 19, 2003 (June 2, 2003) (Exh. 104); NY DEC, Further Comments to the U.S. Environmental Protection Agency on its "Issues for Discussion at the Public meeting on September 10 and 11, 1998, Regarding §316(b) Rulemaking" held in Alexandria, VA (Oct. 5, 1998) (Exh. 105).

[489] *Weyerhaeuser*, 590 F.2d at 1044.

d. The Open-Ended Case-By-Case Format EPA Proposed (Based on Substantial Last-Minute Changes by OMB) Is Very Poorly Designed.

As discussed, EPA's decision to require states to set standards for entrainment controls on a case-by-case basis violates the Clean Water Act and is arbitrary, unworkable, and an abuse of discretion. In addition, the particular type of case-by-case decisionmaking format that EPA has proposed here is deeply flawed for many reasons.

First, under the Proposed Rule, studies that are highly sensitive to esoteric, value-laden assumptions about discount rates, valuation methodologies, and other issues will be bought and paid for by the regulated entities – as will the "independent" reviews of these studies. It will be critical, but impossible, for states to meaningfully oversee and review the work of consultants and industry experts. Regulated entities will end up self-regulating because they pay for the studies underpinning the state's entrainment control decision, pay for the review of those studies, and the state permitting authorities lack the capacity to provide a meaningful review of industry's submittals.

Second, the Proposed Rule leaves permit writers with unfettered discretion to set standards and reject better performing technologies. The Proposed Rule can be read to allow a permitting authority to consider an unlimited set of factors and then to reject *any* technology based on *any* of those criteria. Although EPA has set forth nine criteria that must be considered, the Director can consider any other criteria as well. And although they must all be "considered," there is no indication of which criteria are more important than others, and in any case, all of them can simply be overruled by an additional tenth criterion added by the state. This is an open-ended balancing test in which permit writers have unfettered discretion to reach and justify any decision at all on any grounds that they please. By leaving permit writers with unlimited discretion to make case-by-case decisions, EPA is not only failing to set a standard, but experience with unconstrained case-by-case decision making under Section 316(b) shows that it will invariably lead to inconsistent decisions from state to state, and this delegation of unfettered discretion is illegal because it conflicts "with the Act's goal of uniform standards within an industry."[490]

Third, EPA (actually, OMB) has proposed that states should perform an unlawful form of cost-benefit analysis. After OMB's revisions, the Proposed Rule abandons EPA's "wholly disproportionate" standard for cost benefit analysis, and allows permit writers to reject *any* superior technology if its benefits "do not justify" its costs.[491] This is problematic because it could allow permit writers to engage in a more searching and rigorous form of cost benefit analysis than is authorized even under the Act's weakest technology-based standard, the BPT standard.[492] As discussed above in Section III.A.3, the Clean Water Act severely limits EPA's discretion with respect to the type of cost-benefit test that it may employ under Section 316(b) and prohibits the establishment of BTA requirements on the basis of certain types of cost-benefit

[490] *NRDC v. U.S. EPA*, 863 F.2d 1420, 1432 (9th Cir.1988).

[491] *See* proposed 40 C.F.R. § 125.98(e), 76 Fed. Reg. at 22,288 (col. 1).

[492] *See Entergy*, 129 S.Ct. at 1508 ("Other arguments may be available to preclude such a rigorous form of cost-benefit analysis as that which was prescribed under the statute's former BPT standard . . . .").

analyses.[493] In particular, "the courts of appeal have consistently held that Congress intended Section 304(b) . . . to preclude the EPA from giving the cost of compliance primary importance."[494]

The "limited" cost-benefit analysis performed in setting the BPT standards was simply a comparison of the degree of effluent reduction with the costs to the affected industry of attaining such reduction.[495] The analogy to this approach in the context of Section 316(b) would be a comparison of the degree of reduction in impingement and entrainment with the costs of attaining such reduction. For the Proposed Rule, however, EPA is authorizing states to perform a second analysis quite different from anything contemplated by Congress for BPT: a comparison of monetized social benefits, calculated based on an assessment of consequential water quality effects, with monetized social costs.

EPA's use of the phrase "benefits justify the costs" may be lawful only as a reformulation of its long-standing "wholly disproportionate" test. But if, as appears to be the case, EPA (or OMB) is allowing the use of forms of cost-benefit analyses that elevate economic considerations to a degree of primary importance, then the new standard violates the Clean Water Act.

OMB removed from the Proposed Rule the few provisions that would have helped mitigate the problems noted here. EPA originally designed a case-by-case analysis format in which state permitting authorities would begin with a rebuttable presumption that the best-performing technology – closed-cycle cooling – was the best technology available. EPA also avoided making cost-benefit analysis a primary consideration, using it only to eliminate extreme results: it wrote that a state may not reject "an otherwise available technology . . . unless the social costs of compliance are wholly disproportionate to the social benefits."[496] But OMB changed that to allow a state to reject an otherwise available technology "if the social costs of compliance are not justified by the social benefits…"[497]

As a result, the rule creates an evidentiary quagmire for regulators, antithetical to NPDES permitting, which allows applicants to avoid installing environmentally protective controls for years, or even decades. If promulgated as proposed, the case-by-case entrainment provisions will sanction precisely the kind of regulatory uncertainty that Congress intended NPDES

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[493] *See* EPA's understanding of its cost-benefit authority, supra section III.A.3.

[494] *Chemical Mfrs. Ass'n v. EPA*, 870 F.2d 177, 204 (5th Cir. 1989). *See also American Iron & Steel Inst. v. EPA*, 526 F.2d 1027, 1051 (3d Cir. 1975) ("even with that 1977 [BPT] standard, the cost of compliance was not a factor to be given primary importance."); *BASF Wyandotte Corp.*,598 F.2d at 637, 656 (1st Cir. 1979) (In determining the BPT standard, "[c]ost, however, is not a paramount consideration. Congress self-consciously made the legislative determination that the health and safety gains that achievement of the Act's aspirations would bring to future generations will in some cases outweigh the economic dislocation it causes to the present generation. The obligation the Act imposes on EPA is only to perform a limited cost-benefit balancing to make sure that costs are not 'wholly out of proportion' to the benefits achieved.") (quotations and citations omitted).

[495] *Appalachian Power Co. v. EPA*, 671 F.2d. 801, 809 n.3 (4th Cir. 1982) ("[T]he 'benefits' that are to be related to 'costs' under § 304(b)(1)(B) are simply the benefits *assumed to result* ... from any reduction in the level of effluents being discharged.") (emphasis added).

[496] Redlined Version of Proposed Rule p. 344.

[497] *Id., see also* 76 Fed. Reg. at 22,262 (col. 2).

technology standards to eliminate. Because of the myriad uncertainties involved in determining the effects on waterbodies – as state agencies have explained and EPA acknowledges – permit writers will have unfettered discretion to unlawfully reject better performing technologies based on an open-ended balancing of factors, and to elevate cost and water quality considerations above technological efficacy. They will undoubtedly face substantial pressure to reduce the requirements for protection, given the lack of standards and the resources industry brings to bear in these proceedings. This is squarely at odds with the national technology-based scheme intended by Congress.

2. EPA Should Select Option 3's Entrainment Standard for the Final Rule.

a. Establishing National Categorical Standards Based on Closed-Cycle Cooling for Virtually All Existing Facilities, as the Agency Did a Decade Ago for New Facilities, Would Minimize Adverse Environmental Impacts.

In developing the Proposed Rule, "EPA concluded that closed-cycle cooling reduces impingement and entrainment mortality to the greatest extent."[498] That conclusion should come as no surprise because for more than a decade, EPA as well as state agencies, Congress, and virtually everyone else to have seriously considered the issue has come to the same conclusion that closed-cycle cooling (wet or dry) is most effective at reducing fish kills because it reduces intake flow to such a great extent. In addition to reducing impingement and entrainment, closed-cycle cooling also reduces thermal pollution, protect endangered species and the biological integrity of ecosystems, increase fish populations and fishing yields, increase the reliability of power plants in areas prone to drought, reduce competition for scarce water resources in these areas, and free power plants from the need to be located on waterfront lands, among other things.

No other technology comes anywhere close to the effectiveness and environmental benefits of closed-cycle cooling and EPA has not concluded, or even suggested otherwise. By EPA's own calculations (which are significant underestimates due to the age of the data and other factors), Option 3 would save more than 500 billion of individual aquatic organisms per year[499] and result in estimated increases to fishery yields from two to more than 100 times greater than those under Option 1, depending on the region.[500] In the 2001 Phase I Rule and in the requirements for new units at existing facilities proposed as a component of the Proposed Rule, EPA set or proposes to set a national categorical standard requiring those facilities to reduce their intake flow to a level commensurate with that which could be achieved with a closed-cycle recirculating cooling system.[501] Doing so here would minimize the adverse environmental impacts of cooling water intake structures at existing facilities, as Congress intended, and would not cause any collateral problems, contrary to industry's hyperbolic claims.

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[498] 76 Fed. Reg. at 22,207 (col. 1).

[499] 76 Fed. Reg. at 22,239.

[500] 2011 EEBA at 3-6 to 3-15.

[501] 40 C.F.R. § 125.84(b)(i); proposed 40 C.F.R. § 125.94(d)(i); 76 Fed. Reg. at 22,283 (col. 2).

b. The Rulemaking Record Demonstrates that Closed-Cycle Cooling is Available to the Existing Facilities Because Retrofits are Feasible and Inexpensive.

As noted in the preamble, "EPA's record shows numerous instances of existing facility retrofits to closed-cycle."[502] For example, retrofits of closed-cycle cooling on existing plants were completed many years ago at a gas-fired plant on a west coast estuary (Unit 7 of the 751 MW gas-fired Pittsburg Power Plant in Contra Costa County, California); a nuclear plant on a Great Lake (812 MW Palisades Nuclear Plant in Michigan), and coal-fired plants on eastern seaboard rivers (490 MW coal-fired Canadys Steam Plant and 346 MW Jefferies Coal Plant in South Carolina).[503] More recently, retrofits were completed at the McDonough (520 MW coal) and Yates (1250 MW, coal) plants on the Chattahoochee River in Georgia and at the Wateree Station (772 MW, coal) on the Wateree River in South Carolina, and are well underway at the Brayton Point power station (1500 MW, coal/oil) in Somerset, Massachusetts.

As discussed above, "technology-forcing" standards like BTA must compel industry to meet ever more stringent limitations and therefore must be established with reference to the best performer in any industrial category – "not the average plant, but the optimally operating plant, the pilot plant which acts as a beacon to show what is possible."[504] Thus, the fact that the technology is widely available to existing facilities makes it "available" as that term is used in Section 316(b).

Further, the costs of retrofitting to closed-cycle cooling are minimal from both a microeconomic and a macroeconomic perspective. At the company level, EPA estimated that, at the very most, 1.5 percent of existing power units would retire as a result of the compliance costs, and this is clearly an overestimate because EPA assumed for purposes of that analysis that companies would absorb all the costs, rather than passing any of them on to consumers. Looking at the economy as a whole, as the SEI Report explains, the costs are small by any reasonable measure because the annualized total cost of Option 3 at a 7 percent discount rate, the highest cost estimate in the analysis, is $4.86 billion, or 0.033 percent (1/30 of one percent) of the $14 *trillion* US GDP.

Moreover, the potential hurdles identified by EPA as potentially making closed-cycle cooling retrofits somewhat more difficult in some locations are not only legally irrelevant (for the reasons just described), but also dramatically overstate the extent of the potential problems.

(1) There Is Adequate Space for Closed-Cycle Cooling at Virtually Any Plant Site.

In the preamble, EPA found that "the majority of facilities have adequate available land for placement of cooling towers."[505] Further, even where facilities have constraints in this

[502] 76 Fed. Reg. at 22,204 (col. 1).

[503] 67 Fed. Reg. at 17,155 (col. 1) (Apr. 9, 2002); Phase II TDD, pp. 4-1 to 4-6.

[504] *Kennecott v. EPA*, 780 F.2d 445, 448 (4th Cir. 1985), citing legislative history *See A Legislative History of the Water Pollution Control Act Amendments of 1972*, 93d Cong., 1st Sess. (Comm. Print 1973), at 798.

[505] 76 Fed. Reg. at 22,209 (col. 2).

regard, "[b]ased on [EPA's] site visits, EPA has found that several facilities have been able to engineer solutions when faced with limited available land."[506] Allowing potential space-constraint considerations at some sites to justify a case-by-case approach for all facilities, as EPA has done in the Proposed Rule, is arbitrary and capricious. As explained in the attached engineering report prepared by Powers Engineering, EPA's estimate that as many as 25 percent of facilities might have space constraints that would limit retrofit of closed-cycle cooling for the entire facility or increase compliance costs is vastly overblown because EPA's assessment is based on the use of land-intensive in-line cooling cells, not the much more space efficient back-to-back cooling cell configuration.[507] A back-to-back cooling cell configuration requires about 17 percent of the space needed for two in-line towers for the same cooling capacity, assuming the spacing recommended for parallel banks of in-line towers.[508] Because cooling cells can be installed in a back-to-back configuration at virtually any site, EPA should not set a "limited acreage" exemption (such as the 160 acres per gigawatt threshold the agency is exploring) and should acknowledge that closed-cycle cooling is an available technology for the industry as a whole. Finally, even if there is are arguable site constraints, the use of eminent domain for matters relating to power transmission and generation (as well as a variety of other public goods and services) is well-established and should not be ruled out in this context.[509]

(2) Remaining Useful Life is Not Quantifiable, Certain, Binding or Relevant Unless a Plant Owner Has Committed to a Closure Date.

EPA's argument that it is impractical to ask plants with a very short remaining useful life to undertake a closed-cycle cooling retrofit is reasonable only to the extent that a plant owner makes a legally binding commitment to permanently retire the once-through cooled units within a 5-year period. If a plant operator cannot make a legally binding commitment to permanently retire the units within that timeframe, then the units should get no special consideration from the

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[506] 76 Fed. Reg. at 22,209 (cols. 2-3).

[507] *See* TDD at 8-23 ("The EPRI worksheet contains numerous assumptions and default values that can be modified using site-specific data. Specific relevant assumptions and default values are listed below . . . Tower configuration was in-line rather than back-to-back, meaning towers are oriented in single rows rather than rows of two towers side by side.").

[508] *See* Powers Report.

[509] For example, in New York, the state's general power of eminent domain has been previously used for, *inter alia*, Urban Renewal (*Jackson v. New York State Urban Dev. Corp.,* 503 N.Y.S.2d 298); public roadways and intersections (*Waldo's, Inc. v. Village of Johnson City,* 544 N.Y.S.2d. 809); maintaining the public shoreline (*Pfohl v. Village of Sylvan Beach,* 809 N.Y.S.2d. 367); providing electrical power (*Bergen Swamp Preserve Socy. v. Village of Bergen,* 741 N.Y.S.2d. 363); constructing water tunnels (*City of New York [Third Water Tunnel, Shaft 30B],* 795 N.Y.S.2d 229, affd. 814 N.Y.S.2d 592); controlling sewage (*Ranauro v. Town of Owasco,* 735 N.Y.S.2d 332); providing a site for a general hospital (*In Re Site for New General Hospital,* 112 N.Y.S.2d 101, affd. 305 N.Y. 835); expanding airports (*First Broadcasting Corp. v. City of Syracuse,* 435 N.Y.S.2d. 194); protecting the public from fire damage (*Engels v. Village of Potsdam*, 727 N.Y.S.2d 202); providing necessary public parking (*Salvation Army v. Central Islip Fire Dist.*, 646 N.Y.S.2d 558); developing blighted areas (*Murray v. LaGuardia* , 52 N.E.2d 884); expanding/creating public parks (*Woodfield Equities LLC v. Incorporated Vil. of Patchogue*, 813 N.Y.S.2d 184 (2006)); expanding municipal buildings (*Stankevich v. Town of Southold,* 815 NYS2d 225 (2006)); providing affordable housing to local residents (*Keegan v. City of Hudson*, 803 N.Y.S.2d 279); and building a sport stadium (*Murphy v. Erie County*, 28 N.Y.2d 80 (1971)).

EPA regarding remaining useful life. In the 1970s, and in every decade since then, power plant operators have made the argument that they have insufficient useful life remaining to impose significant capital costs, whether for closed-cycle cooling or other pollution control equipment. And for those forty years, the plants have continued to operate, killing fish and causing other forms of pollution with the same antiquated equipment.[510] If, however, a plant operator is willing to back up its claim of limited useful life by making the closure date binding, as the Oyster Creek nuclear plant in New Jersey recently did, and the closure date is reasonably close in time, then the remaining life becomes relevant and can be taken into consideration. Because so few plants have committed to a closure date, and experience shows that plants continue to operate well beyond the end of their expected useful life, remaining life is not an obstacle to the availability of closed-cycle cooling.

Ironically, some newer plant operators may even attempt to make the argument that consideration of "remaining useful life" excuses them from compliance with any sort of upgrade, as the operator has not yet been able to recoup original construction costs.[511] This is the argument made by the Los Angeles Department of Water and Power in its current attempt to avoid compliance.[512] Yet this cannot be what EPA intends by allowing "remaining useful life" considerations, otherwise it would always be both too early and too late to require plants to modernize their cooling systems, and Section 316(b) would be drained of all its meaning.

c. The Rulemaking Record Demonstrates that Requiring Antiquated Plants to Install the Same Cooling Technology as their Modern Counterparts Would Not Cause Any Significant Adverse Impacts on Energy Supplies, the Economy or the Environment.

(1) Requiring Closed-Cycle Cooling Would Not Cause Electricity Shortages.

There will be no adverse reliability impact to the electric sector from adoption of Option 3. EPA's electric system modeling analyses demonstrate that Option 3 would cause very few, if any, plant retirements and any consequential retirements will not adversely affect system reliability. According to EPA's estimates, the additional retirements (whether full or partial) caused by Option 3 would total only 17 gigawatts, which represents less than 1.5 percent of total capacity in 2028.[513] Moreover, even this estimate drastically overstates the extent of actual retirements for a number of reasons.

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[510] *See, e.g.,* Press Release "Nuclear Regulatory Commission, Department of Energy and Nuclear Energy Institute Sponsor February Workshop on Extended Operation for Nuclear Power Plants," December 22, 2010 (Exh. 106).

[511] *See, e.g.,* Dynegy Moss Landing, LLC, "State Water Resources Control Board Once-Through Cooling Water Policy Implementation Plan for the Moss Landing Power Plant" at 13-14 (April 1, 2011) (Exh. 107) (arguing that changes to the cooling system are unwarranted in light of recent, large capital investments).

[512] *See* e-mail from John Dennis, LADWP to Jonathan Bishop, California State Water Resources Control Board (Jul. 22, 2010) (Exh. 108) (arguing that LADWP should be allowed additional time for compliance with California's once-through cooling water policy in light of recent investments totaling over $600 million).

[513] *See* EPA, Economic and Benefits Analysis for Proposed 316(b) Existing Facilities Rule (2011), (hereinafter "2011 EBA") at Table 6-3.

First, EPA assumed for purposes of this analysis that none of the costs of the regulation would be passed on to consumers, an obviously incorrect and highly conservative assumption.[514] In fact, because plants will attempt to pass on as much of the costs as they can, and because in regulated states this happens relatively automatically, there will be far fewer retirements than EPA estimated.[515]

In addition, several other reasons why there will no adverse reliability impacts are discussed in a report prepared by Schlissel Technical Consulting, Inc. The full report is attached to this comment letter as Appendix C. As the attached report explains in more detail, EPA used out-of-date demand forecasts. Under current forecasts, demand is lower than EPA estimated and there is less need for the 1.5 percent of capacity that EPA (over)estimated might retire.[516]

Even if a few existing generating units were to retire as a result of Option 3, system operators and utilities will have long lead times to construct any needed replacement capacity for any retirements that might occur. Moreover, new energy efficiency, demand side measures and renewable resources can meet future electricity demands while maintaining electric system reliability.[517] Additionally, the Schlissel report also notes that EPA's analysis shows that all NERC regions will comfortably exceed their required reserves in off-peak periods even with outages related to retrofits.[518]

(2) Requiring Closed-Cycle Cooling Would Not Increase Electricity Prices.

EPA estimated that under Option 3, the average annual cost per residential household in 2015 would be less than $1.47 per month ($17.60 per year).[519] And even this very modest sum is, by EPA's own admission, an overestimate of the actual costs because EPA assumed "full pass-through of all compliance costs to electricity consumers,"[520] which is certain not to be the case in deregulated states where costs are not automatically passed on. As EPA admitted, "at least some facilities and firms are likely to absorb some of these costs, thereby reducing the impact of today's proposed rule on electricity consumers."[521] The extent to which power companies will absorb closed-cycle cooling costs (with negligible effects on their bottom line) is illustrated in a report by the economist Robert McCullough, entitled the *Economics of Closed-*

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[514] 76 Fed. Reg. at 22,223 (col. 2) ("For these two analyses, the Agency assumed that none of the compliance costs will be passed on to consumers through electricity rate increases and will instead be absorbed by complying facilities and their parent entities.").

[515] As discussed below, when estimating effects on electricity prices, EPA made the opposite (but equally unrealistic and conservative assumption), that 100 percent of the costs would be passed on to consumers.

[516] Schlissel report.

[517] *See* M.J. Bradley & Analysis Group, *Ensuring a Clean, Modern Electric Generating Fleet while Maintaining Electric System Reliability* (2010), at 3-5 (Exh. 109); Bipartisan Policy Center, *Environmental Regulation and Electric System Reliability*, at 39 (2011) (Exh. 110); J. McCarthy and C. Copeland, Congressional Research Service, *EPA's Regulation of Coal-Fired Power: Is a "Train Wreck" Coming?* (July 11, 2011) (Exh. 111).

[518] Schlissel report, citing 2011 EBA, Table 5-8.

[519] 76 Fed. Reg. at 22,228 (Exhibit VII – 10).

[520] 76 Fed. Reg. at 22,228 (Exhibit VII – 10, footnote "a").

[521] 76 Fed. Reg. at 22,228 (col. 1).

Cycle Cooling in New York. That report shows that the change in electricity prices as a result of requiring closed-cycle cooling for all existing plants in New York state would be minimal (less than 1 percent) because for the vast majority of the time, the market clearing price of electricity in New York (the price that all plants are paid for electricity regardless of their costs or the price they bid) is set by plants with closed-cycle cooling.[522] Thus, New Yorkers are *already* paying for closed-cycle cooling, and existing plants that still use once-through cooling are pocketing the difference. The same is likely true to a certain extent in other deregulated states. Accordingly, any increase in electricity prices would be negligible and barely noticed by consumers.

(3) Requiring Closed-Cycle Cooling Would Create Jobs and Improve the Economy.

A review of EPA's economic impact analysis by economists Professor Frank Ackerman and Dr. Elizabeth Stanton shows that a closed-cycle cooling standard would increase GDP and create jobs. EPA found, unambiguously, that stronger environmental protection leads to a greater GDP boost and a larger immediate spike in job creation. While Option 1 would *reduce* economic output by $194 million, Option 3 would increase GDP by over $4.2 billion.[523]

EPA wrongly concluded, however, that the initial job creation impact of Option 3 is outweighed, over time, by jobs losses caused by rising electricity prices. As Prof. Ackerman and Dr. Stanton's report explains, EPA's analysis is based on two significantly flawed assumptions. First, EPA wrongly assumes that all compliance costs will translate into higher electricity prices because electric generators will be able to pass on 100 percent of the rule's costs to customers. In fact, a better assumption is that, in deregulated states, only about half of compliance costs are likely to be passed on to consumers. In deregulated energy markets, infra-marginal producers will absorb rising costs as reductions in producer surplus. Second, EPA arbitrarily assumes that cost recovery occurs at a constant annual rate from 2013 through 2056. But traditional utility rate regulation would impose a phase-in period for cost recovery so that compliance costs are recovered as they are incurred, not before. This pushes the cost recovery back in time compared to EPA's estimate, thereby reducing its net present effect. After only partially correcting for these flaws, Ackerman and Stanton find that Option 3 would create over 2,000 new jobs.[524]

(4) Requiring Closed-Cycle Cooling Would Not Cause Air Pollution or Any Other Significant Adverse Environmental Impacts.

In the preamble to the proposed rule, EPA states that requiring closed-cycle cooling retrofits will impose energy penalties that result in increased air emissions of various pollutants to produce the same amount of power.[525] EPA argues that increased air pollution may render closed-cycle cooling infeasible on a local basis in some places because it will have adverse

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[522] R. McCullough, *Economics of Closed-Cycle Cooling in New York* at 20 (June 3, 2010) (Exh. 112).

[523] *See* Stockholm Environment Institute Report.

[524] *See* Stockholm Environment Institute Report.

[525] *See* 76 Fed. Reg. at 22,208-09.

health effects and "it may be difficult or impossible to obtain air permits for cooling towers at existing facilities located in nonattainment areas or attainment areas with maintenance plans."[526]

In fact, as the Powers Report explains, overall air emissions from U.S. power plants will not increase as a result of closed-cycle cooling retrofits. EPA admits that its estimates of future air pollution are overstated because they ignore the effects of new regulations that, by EPA's count, will reduce power plant sulfur dioxide emissions by 71%, nitrogen oxide emissions by 52%, and mercury emissions by 29%. Additionally, over the past few decades, electricity production in the United States has consistently shifted from coal plants to much cleaner natural gas-fired plants for economic reasons.[527] In reality, air emissions from U.S. power plants may decrease slightly less dramatically as a result of closed-cycle cooling retrofits, but they will not increase.

Further, EPA should assume that any additional power needed to compensate for energy penalties at older, coal-fired power plants will come from natural gas-fired sources whose primary function is to provide load following and peaking power. In comparison to these older coal plants, air emissions from modern natural gas-fired plants are exceptionally low. Additional power will also likely come from uprates at existing nuclear power plants and from the rising number of renewable energy sources in the United States. Generally, all of these sources have lower emissions than older existing facilities.

Air emissions also may decrease because some existing facilities will choose to repower to more efficient combined cycle natural gas as a consequence of this rule. In the Final Substitute Environmental Document for the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling ("Calif. OTC Policy SED"), the State of California determined that, in the most realistic scenarios, some existing facilities would respond to a closed-cycle cooling mandate by repowering.[528] The assumption is likely realistic at the national level too. (The California analysis is further explained below in Section III.E.5.c. of these comments.)

To avoid upgrading their plants, industry frequently claims that closed-cycle cooling itself has significant adverse environmental impacts, including air emissions and visual, aesthetic, and noise-related concerns, as well as fogging and salt drift from cooling cells,, which, in their view, should prevent closed-cycle cooling from being considered the Best Technology Available. That transparently false claim was rejected by EPA a decade ago in the context of the Phase I rule for new facilities. There industry raised all the same charges about these impacts, and EPA considered and rejected them (as did the reviewing court). In *Riverkeeper I*, the Second Circuit explained:

> [The electric power industry argues that] by focusing on impingement and entrainment, the EPA ignored other adverse environmental impacts and failed to consider whether its regulations will yield a net environmental benefit. … As for other environmental impacts,

[526] 76 Fed. Reg. at 22,208 (col. 3).

[527] *See* Powers Report.

[528] *See* Calif. OTC Policy SED, at 119 (Exh. 3).

> [industry] does not attempt to demonstrate what the EPA overlooked, except through vague and speculative references to "local air quality, water resources, [and] energy markets" (which, as noted[,] ... EPA did consider) and the suggestion that closed-cycle cooling may require increased land use and have undesirable "aesthetic" impacts. The EPA considered [and rejected] all of the factors that [industry] now raises.... *See, e.g.*, Public Comment & Response Nos. 062.026 at 1077, 056.012 at 927, 068.100 at 2137-41, 014.019 at 1098-1102.[529]

Thus, the debate – if there ever was a debate – about the environmental superiority of closed-cycle cooling was settled long ago.

(5) Requiring Closed-Cycle Cooling Would Cause Some Facilities to Repower their Plants, Yielding Additional Environmental and Economic Benefits.

Experience has shown that when power companies operating older, inefficient and, therefore, marginal plants are directed to upgrade their cooling systems, they will often choose to repower rather than retrofit or shut down. Repowering a heavily-polluting plant into a state-of-the-art modern facility that can produce electricity cleanly, efficiently and at lower cost is a win-win for the environment and the economy.

For example, as California developed a statewide policy for phasing out once-through cooling in recent years, "four of the original 21 coastal power plants have re-powered or are proceeding with re-powering projects that eliminate the use of once-through cooling water, either in whole or in part – Humboldt Bay, Long Beach, El Segundo, and Encina. A fifth closed-cycle cooled plant, Gateway, is being developed adjacent to the existing Contra Costa Plant."[530] These projects will produce more power using advanced control technology to reduce air emissions and virtually eliminate water withdrawals. Other examples exist, as well.

In New York, the state environmental agency generally seeks to require new power plants to use dry cooling and existing or repowered power plants to use wet closed-cycle cooling. As a result, when an independent power company purchased the Albany Steam Station on the Hudson River from a traditional utility in the early 2000s as a result of de-regulation, the company chose to repower the old plant and add closed-cycle cooling as part of the repowering, thereby reducing both its fish kills and air pollution emissions by more than 95 percent and increasing its capacity from 400 MW to 750 MW. As New York State DEC explained:

> Where impacts are large, the optimal approach from our standpoint is to repower an existing facility into a state-of-the-art power plant. The facility can thus be redesigned into an efficient new station (e.g. using combined cycle technology) that will reduce fuel use, greatly increase thermal efficiency and minimize

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[529] *Riverkeeper I*, 358 F.3d at 196-97 (internal citations omitted).

[530] *See* Calif. OTC Policy SED, at 122. *See also* El Segundo Homepage website, Modernizing El Segundo's Power Generating Station (Exh. 113) *also available at* http://www.elsegundorepowering.com/ and Sejal Choksi, "Alternatives to Once-Through Cooled Power Plants," *San Francisco Bay Crossings* (July 2009) (Exh. 114), *also available at* http://www.baycrossings.com/dispnews.asp?id=2192.

> impacts to air and water. ... The old 400 MW Albany Steam Generating Station, a once-through cooled plant was successfully repowered into the Bethlehem Energy Center (BEC), a 750 MW highly efficient, combined cycle station. Through use of the combined cycle process and mechanical draft cooling towers, cooling water was reduced from approximately 500 MGD to less than 10 MGD. The new BEC began commercial operation in mid 2005. Almost twice as much electricity is now being produced at far lower impacts to the aquatic resource.[531]

Similarly, the Bergen power station, originally constructed in 1959 as a coal-fired plant at the confluence of the Hackensack River and Overpeck Creek in Ridgefield, New Jersey, once withdrew more than half a billion gallons of river water per day through its once-through cooling system, but was repowered and converted from coal to gas in 1993. It has completely eliminated those withdrawals by retrofitting with closed-cycle cooling and running a pipeline under the river to a sewage treatment plant from which it now draws treated effluent for cooling.

Because repowering would play a highly significant role in the market response to a closed-cycle cooling mandate, the net effect of Option 3 would very likely be a decrease in air pollution emissions, virtually across the board. This result is confirmed by an analysis conducted by the State of California in conjunction with the development of its statewide BTA policy. In a section entitled "Effects on Electric Reliability," the Final Substitute Environmental Document for the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling explained that, while "predicting the future operation of any *one* plant is conjecture at best," when looking at the industry as a whole "certain trends are evident," in particular that, faced with a requirement to install closed-cycle cooling, plant owners may "retrofit their OTC [once-through-cooled] plants with an alternative form of cooling, [b] repower their plants by essentially building a new plant using alternative cooling and then decommissioning the old one, or [c] shut the plant down, either permanently and convert to another use, or temporarily while waiting for more favorable economics for repowering or retrofitting."[532] The environmental assessment continued:

> The *most realistic scenarios* examined, in which some OTC plants would be retired while others repower or convert their cooling systems, *showed potential for significant benefits to the environment because the overall power sector would be more efficient and produce fewer emissions*, and because marine ecosystem impacts caused by use of OTC technology would be greatly reduced.[533]

Analyzing one of these "most realistic scenarios," termed "Scenario 3," in which all fossil fuel units are repowered to combined-cycle systems with dry cooling (as several plants in California already have) and the nuclear units are retrofitted to wet cooling, with replacement generation provided by new combined-cycle units, California estimated that fuel usage by power plants and resulting emissions of SO2, NO2, CO2, CO, TOG, and ROG would all *decrease, by 3*

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[531] New York State Department of Environmental Conservation, Aquatic Habitat Protection website, at 4 (Exh. 115), *also available at* http://www.dec.ny.gov/animals/32847.ht ml (last visited, Aug. 2011).

[532] Calif. OTC Policy SED, p. 118 (emphasis added).

[533] Calif. OTC Policy SED, at 119 (emphasis added).

percent to 26 percent over current levels.[534] Those results are shown in the following table, which appears on page 110 of the Calif. OTC Policy SED:

Scenario 3: All fossil fuel units are repowered to combined-cycle systems with dry cooling. Nuclear units are retrofitted to wet cooling, with replacement generation provided by new combined-cycle units (Table 25).

Table 25. Estimated Stack Emission: Scenario 3

	Fuel Usage (MMBTU)	SO_2 (tons)	NO_2 (tons)	CO_2 (tons)	CO (tons)	TOG (tons)	ROG (tons)	PM10 (tons)
Baseline	151,648,525	53	557	9,070,258	3,116	413	116	262
Repowered Fossil [a]	118,351,861	43	402	7,030,961	2,104	280	104	267
Retrofitted Nuclear	12,760,349 [b]	5	63	757,965	321	28	9	20
Net Change	**-14%**	**-9%**	**-17%**	**-14%**	**-22%**	**-26%**	**-3%**	**10%**

Notes:
a. Based on average emission factors for new, dry-cooled combined-cycle units.
b. Fuel usage for retrofitted nuclear facilities refers to the additional fuel that would have to be consumed by a combined-cycle fossil unit to replace the generating shortfall from the nuclear facilities.

Accordingly, requiring closed-cycle cooling would cause some facilities to repower their plants, yielding additional environmental and economic benefits, particularly reductions in air pollution emissions.

3. Option 2's Entrainment Standard Is Far Superior to Option 1 and Option 4 in All Respects.

While Option 3 saves more fish and other aquatic organisms than Option 2 (the option which requires closed-cycle cooling for all facilities with an actual intake flow greater than 125 MGD), the costs of Option 3 and therefore the overall burden on industry is not much greater than that of Option 2. Further, the administrative burden on states is least for Option 3 because it does not require extensive consideration of technological, biological and economics studies as do Options 1 and 4 (to a tremendous degree) and Option 2 (to a somewhat lesser degree). Option 2, however, is far superior to Options 1 and 4, and would provide some, but not all, of the benefits of Option 3 and avoid some, but not all, of the fatal flaws of Options 1 and 4.

4. EPA Should Shorten the Entrainment Compliance Timelines.

EPA's extended implementation schedule for closed-cycle cooling retrofits is unnecessarily long. EPA's proposed schedule for information submittal is entirely too long and should be cut in half. As EPA noted in the Proposed Rule, facilities with a DIF greater than 50 MGD were previously subject to the withdrawn Phase II rule and therefore should have already compiled much of the proposed application data which can be used to meet many of the information submittal requirements.[535] Furthermore, the start-to-finish application process for

[534] Calif. OTC Policy SED at 110.

[535] *See* 76 Fed. Reg. at 22,254 (col. 2).

closed-cycle cooling conversions should be no more than 24 months. Competition of closed-cycle cooling retrofits should be required no later than 36 months after approval of the application at fossil plants, and no more than 48 months after approval at nuclear plants (nuclear plants may need additional time to synchronize the retrofit outage with a refueling outage).[536] The attached engineering report concludes that if EPA applies the suggested downtime estimates of 1 and 2 months for fossil and nuclear plants respectively, there is no technical justification for EPA's proposed extended implementation schedule for closed-cycle cooling retrofits.[537]

This schedule is consistent with what EPA required for the Brayton Point plant, where the final compliance order required the company to complete construction of closed-cycle cooling within 29 months of getting all permits and to fully meet the closed-cycle-cooling-based permit limits seven months after that, for a total of 36 months from permitting to final compliance.[538]

5. Any Variance EPA Includes as Part of a Categorical Entrainment Standard Must Clearly Delineate What Issues May Be Considered by the Director and How They Are to Be Considered.

Although OMB deleted it, in the version of the Proposed Rule EPA sent to OMB shortly before proposal, EPA stated:

> The Agency could have developed a proposed rule based on closed-cycle cooling as BTA that provides exceptions to take into account each of these four factors [i.e., energy reliability, air emissions, land availability, and remaining useful plant life] individually. In other words, EPA could have developed an option that would require closed-cycle cooling, but the rule would also necessarily provide numerous alternatives and exceptions to specifically address each of the identified factors.[539]

As discussed above, EPA should promulgate a rulemaking option that requires closed-cycle cooling (e.g., Option 3), and to the extent that such option includes a variance, EPA should carefully tailor that variance and set rules for the Director to follow in applying that variance.[540] In particular:

- The burden of proof must be placed squarely on the permit applicant to demonstrate entitlement to any variance.

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[536] *See* Powers Report.

[537] *See* Powers Report.

[538] U.S. EPA, Region I – New England, *In the Matter of Dominion Energy Brayton Point, LLC, Brayton Point Power Station, Somerset, Massachusetts, NPDES Permit No. MA0003654, Docket No. 08-007, Findings and Order for Compliance* at 6 (Exh. 116).

[539] Version of Proposed Rule Sent to OMB, p. 139 of 383 (Exh. 85).

[540] It should be noted that EPA's Fundamentally Different Factors (FDF) variance is designed to operate in both directions. That is, the FDF variance allows national standards to be made "*either more or less stringent*" on application by "[a]ny interested person." 40 C.F.R. § 125.30(b) (emphasis added).

- There should be no cost-benefit variance or any other site-specific cost-benefit analysis.
- Any calculation baseline must use an "actual flow" not a "full flow" operational baseline.
- Directors should be directed to find that there is adverse environmental impact (AEI) whenever there is impingement or entrainment and, further, AEI is not to be measured at the fish population level, or with adult-equivalent calculations such as age-1 equivalency.
- Fishery managnent models may not be used to assess the effects of impingement and entrainment.
- Density dependent models and the ecologically baseless concept of "surplus production" may not be considered in permitting proceedings.
- All species must be considered.
- Species of special concern, *e.g.*, not only threatened and endangered species, but also those awaiting listing and other sensitive, keystone or otherwise important species are entitled to enhanced protection.
- Arguments that some of entrained or impinged fish were dead before they were trapped by the intake structure may not be considered due to the difficulty in proving this.
- The degraded quality of source or receiving waterways may not be considered in permitting proceedings.
- Other aspects of source or receiving water quality may be considered only to make technology-based standard stricter, not to relax them.
- No waters of the U.S. are exempt from Clean Water Act protection or are deserving of lesser protection than others.
- Waterways that have been dammed by plant owners for use as cooling water reservoirs remain waters of the U.S.
- The impact on aquatic organisms from other sources may not be considered as a reason not to regulate intake structures or as a reason to regulate them less stringently.
- Entrainment survival claims may not be considered.
- As the courts have clearly held, restoration or mitigation measures may not be considered under Section 316(b).
- Section 316(b) requirements must be considered independently of any Section 316(a) variance application.
- The compliance costs or social costs to be considered may include only capital expenditures, operation and maintenance, and energy penalty, not speculative, indirect add-on costs.

- Arguments by permit applicants related to air quality issues must be evaluated by the Director in the context of the fact that, as EPA noted, most impacts from closed-cycle cooling itself are so localized as to occur wholly on the property of the plant itself;[541] and the fiinal air permitting analysis should be evaluated with the expectation that it would be the last step in the permitting process (due to ongoing changes in the classification of areas in "non-attainment" status and the regulatory procedure for air permits which allows only for a one-year duration before a new air permit must be sought).
- Arguments that the power industry is entitled to special treatment may not be considered.
- Projections of a plant's remaining useful life should not be considered unless a plant operator makes a binding and enforceable commitment to close a plant within a 5-year time frame.
- Arguments that retrofits should not be required at a plant that was recently built or refurbished may not be considered.
- Arguments that an older Section 316(b) determination should not be revisited now cannot be considered.
- The implementation time for BTA measures cannot be considered as a reason for requiring a less protective technology over a more protective one; instead, less protective technologies that can be implemented more rapidly should be considered as interim measures to reduce impacts while more protective technologies are being installed.

C. Although the Establishment of National Categorical Standards for Impingement Is Necessary and Appropriate, the Proposed Standards Are Impermissibly Weak and Problematic in Numerous Respects.

1. EPA Should Establish a National Categorical Impingement Standard Based on Closed-Cycle Cooling.

In the Proposed Rule "EPA concluded that closed-cycle cooling reduces impingement and entrainment mortality to the greatest extent."[542] As discussed above, EPA should set a national standard based on closed-cycle cooling for entrainment and establish a similar standard as the first component of the rule's impingement standards, as well.[543] Moreover, as explained below, while EPA did propose national standards for impingement, those standards are also insufficient because EPA did not primarily base them on velocity reduction.

[541] 76 Fed. Reg. at 22,209 (cols. 1-2).

[542] 76 Fed. Reg. at 22,207 (col. 1).

[543] It should be noted, however, that even though "virtually all facilities with wet cooling towers have a maximum intake velocity of 0.5 feet per second" (76 Fed. Reg. at 22,258 (col. 2)), a closed-cycle cooling standard is not alone sufficient for impingement. *Id.*

2. EPA's Rejection of the 0.5 Ft/S Velocity Limitation as the Primary National Standard Is Illegal.

a. EPA Has Found in Each Previous Section 316(b) Rulemaking, and Again for this Rule, that a 0.5 Ft/S Velocity Limitation Would Protect Approximately 96 Percent of Fish from Impingement and that Many Existing Facilities Already Meet that Standard.

As EPA has explained, "impingement is generally correlated to three factors: intake flow, intake velocity, and fish swim speed" and "[t]he latter two factors are closely related, as the ability of fish to evade impingement depends on the swimming ability of the individual fish and the intake velocity against which it is attempting to escape.[544] Based on this analysis, "EPA has consistently recognized that regulating the intake velocity at cooling water intake structures (CWIS) is an effective way to minimize impingement impacts."[545]

Accordingly, in the Phase I rule, EPA set a national categorical standard requiring all new facilities to have a maximum design intake velocity of 0.5 feet per second (ft/s or fps).[546] EPA established 0.5 ft/s as the appropriate minimum velocity requirement based on technical and scientific literature, state and federal studies, and an analysis of data from studies on fish swim speeds suggested that a 0.5 ft/s velocity would protect 96 percent of the tested fish.[547] EPA documented that 73 percent of manufacturing facilities and 62 percent of power plants constructed in the prior 15 years met the 0.5 ft/s through-screen velocity requirement.[548]

In addition, the record shows that in 2000, the Electric Power Research Institute (EPRI) submitted a report in which it "agreed that intake velocity was an appropriate regulatory criterion, and … that a limit of 0.5 fps was a useful threshold for screening out significant impingement events at CWISs.[549] Nevertheless, in *Riverkeeper I*, the power industry (UWAG) challenged the velocity requirement, arguing that there was insufficient support in the record for a through-screen velocity limit of 0.5 ft/s.[550] The Second Circuit rejected that challenge, finding that "EPA's choice of velocity limit was reasonable."[551]

"The Phase II rule used the same data, analyses and conclusions presented in Phase I to support a compliance alternative where an intake at a facility with a design through-screen velocity of 0.5 fps meets the impingement requirements."[552] Similarly, the proposed Phase III rule utilized the same regulatory framework as the Phase II rule, including the 0.5 fps intake

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[544] Memo to Paul Shriner, EPA from Kelly Meadows, Tetra Tech, Subject: Analysis of swim speed data (hereinafter "Swim Speed Data Memo") December 8, 2008, at 1 (DCN 10-6705A) (EPA-HQ-OW-2008-0 667-0660) (Exh. 117); *see also,* 69 Fed. Reg. at 41,612 (col. 2); *see also* Pisces Report.

[545] Swim Speed Data Memo at 1.

[546] *See* 40 C.F.R. § 125.84(b)(2) and (c)(1).

[547] 66 Fed. Reg. at 65,274 (cols. 2-3).

[548] 66 Fed. Reg. at 28,864 (col. 3.); see also Swim Speed Data Memo at 3, citing DCN 2-030.

[549] Swim Speed Data Memo at 3.

[550] *Riverkeeper I*, 358 F.3d at 198.

[551] *Id.*, 358 F.3d at 199.

[552] Swim Speed Data Memo at 3.

velocity threshold.[553] "In the final Phase III rule, EPA opted not to regulate land-based facilities, but continued to impose the intake velocity requirements on certain offshore facilities."[554] Industry did not specifically challenge the 0.5 ft/s standard in *Riverkeeper II* or in its challenge to the Phase III rule, *ConocoPhillips, et al. v. EPA*.

For the current rulemaking, EPA briefly re-examined the basis for the 0.5 ft/s threshold to ensure that it was still valid and conducted additional screening analyses. Based on that updated examination, EPA's technical consultant concluded:

> In reviewing the swim speed data in the record, the previous conclusions continue to be supported by the data. … 0.5 ft/sec through-screen velocity would be protective of 96% of species. … Given the potential for screen clogging and debris loading (which would reduce the open area of the screen and increase the through-screen velocity even further), the 0.5 fps threshold also provides for an appropriate safety margin for aquatic organisms. … Analyses were conducted to determine if the velocity threshold should vary by waterbody type. The swim speed data from the EPRI report was plotted by fish assemblage, a categorization of fish species by waterbody type (e.g., Pacific Ocean, rivers in the Eastern U.S., etc.). … These plots did not show any clear differentiation of swimming ability between fish in the various waterbodies nor did any waterbody type appear to be any more vulnerable than another; it is therefore reasonable to conclude that the 0.5 fps national intake velocity limit is appropriate for all waterbody types.[555]

EPA thus concluded that "a design through-screen velocity of 0.5 feet per second would be protective of 96% of motile organisms" and would therefore be "better than the selected technology," *i.e.*, modified travelling screens.[556]

In addition, EPA's updated analysis also showed, once again, that "many intakes already meet this standard, thereby reducing the burden of meeting the requirement."[557] Specifically, "[a]ccording to data from EPA's 2000 industry questionnaire, approximately 18% of intake structures meet the 0.5 fps threshold. Another 21% are less than 1.0 fps."[558] Moreover, "many intake technologies installed today (e.g., cylindrical wedgewire screens) are specifically designed to meet the 0.5 fps threshold."[559]

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[553] *Id.*

[554] *Id.*, citing 125.134(b)(2).

[555] *Id.* at 4.

[556] *See* 76 Fed. Reg. at 22,204 (col. 3). As discussed in the Pisces report attached as Appendix B, while the 0.5 ft/s velocity limit is more protective than modified travelling screens, it may not be as protective as EPA believes because not all fish with swim speeds faster than the velocity of the intake structure can and will actually avoid the intake. Thus, a 0.5 ft/s velocity limit should be one primary component of the impingement standards, but it is not itself sufficient.

[557] Swim Speed Data Memo at 4.

[558] Swim Speed Data Memo at 4, citing DCN 4-4023C "Preliminary Data Analyses Using Responses from the Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures (Draft)."

[559] Swim Speed Data Memo at 4.

b. EPA Lacks a Legitimate Legal or Evidentiary Basis for Rejecting the 0.5 Ft/S Velocity Limit.

Having found that a 0.5 ft/s velocity limit is an appropriate and highly protective standard, EPA did not, however, require existing facilities to meet it. Instead, the Proposed Rule gives facilities the option of choosing to meet the 12-percent-annual/31-percent-monthly impingement mortality reduction standard, which is a less protective standard and is inferior in many ways, as discussed below. EPA states that it did so because "EPA's record shows modified traveling screens are available for all facilities, whereas reduced intake velocity may not be available at all locations."[560] That is illegal for at least two reasons. First, as discussed above, EPA applied an unauthorized interpretation of the statutory term "available" and an improper approach to BTA. Second, analysis or evidence in the record to support a conclusion that reduced intake velocity is not cabable of being implemented at all locations appears to be lacking. To the contrary, the record evidence shows not only that 18 percent of intake structures presently meet the 0.5 ft/s velocity limit but also that many existing facilities can meet it.[561] As the Second Circuit stated in upholding that limit in *Riverkeeper I*: "The fact that a minority of facilities do not presently meet this requirement, of course, says nothing about whether the required technology is the 'best' or 'available.'"[562]

3. The 12 Percent/31 Percent Impingement Mortality Reduction Requirement Is Problematic In Numerous Respects.

As noted above, the 0.5 ft/s velocity limit is more effective than the technology on which the 12/31 percent standard is based, assuming that both restrictions operate as they are intended. Additionally, because those two standards work in very different ways, the 12/31 percent limit is also inferior in other ways. A velocity limit allows fish to swim away from the intake and avoid impingement altogether. The 12/31 percent limit allows an unlimited number of fish to be impinged, and instead requires that enough impinged fish be returned to the waterbody such that no more than 88 percent (the reciprocal of 12 percent) die over the course of a year and no more than 69 percent (the reciprocal of 31 percent) die in any given month.

A standard based on reduced impingement is superior to one based on impingement mortality because the former avoids the difficulties and uncertainties of determining how many fish of which species have survived impingement. In addition, the former also avoids sub-lethal harm to impinged fish. For many reasons, it is far more practical, certain and effective to address an environmental problem before it happens (which, in this case, means preventing impingement through a velocity limit) rather than to let it happen and attempt to mitigate the consequences (which, in this case, means allowing unlimited impingement and trying to return the impinged fish to the waterbody alive). In this regard, the velocity limit is simple, effective, and relatively

[560] *See* 76 Fed. Reg. at 22,197 (col. 2).

[561] TDD, Ch. 6.

[562] 358 F.3d at 199.

easy to measure compliance with, while the impingement mortality limit is not. Several related problems emerge here, as discussed below.

For a more extensive discussion of the problems with the Proposed Rule's 12/31 percent standard and the associated monitoring requirements, please see the report on biological issues prepared by PISCES Conservation, Ltd., and attached hereto as Appendix B.

a. Impingement Mortality Monitoring Is Inherently Difficult, Controversial, and Uncertain.

Facilities seeking to meet the 12/31 percent standard must develop and submit a "Proposed Impingement Mortality Reduction Plan." The plan must include a proposed biological sampling protocol for monitoring both impingement and impingement mortality and thereby demonstrating that the 12/31 percent standard is being met. Specifically, the plan must propose, at a minimum: (1) the duration and frequency of monitoring; (2) the monitoring location; (3) the organisms to be monitored; (4) the method in which naturally moribund organisms would be identified and taken into account; and (5) a latent mortality assessment procedure. This last item must involve a method for handling the organisms in a collection device "as little as possible," transferring them to a "holding area with conditions as close as practicable to the source water," and retaining them for 48 hours, at which time the number of dead organisms would be counted.[563] EPA envisions that the permitting authority would then review and approve the Impingement Mortality Reduction Plan, after making a determination that each of these issues has been properly addressed.

In practice, however, these issues are enormously complicated and controversial and will inevitably lead to disputes among the permitting authority, the permittee and others. As EPA acknowledges, "there are no standard methods for conducting impingement and entrainment studies and that there can be variability in designing a sampling plan between sites."[564] That variability, along with the complexity of the biological issues involved, will inevitably lead to disputes, delays and uncertainty. For example, because sampling is an expense that plant operators will want to minimize, they have every incentive to propose minimal sampling frequencies and to scale down the extent of monitoring in every other way. Unfortunately, permit writers will often oblige them so as to not burden industry or ratepayers. Moreover, while there is significant potential for disputes over the design of the sampling and the interpretation of the results, state agencies (as well as the general public) lack the resources to fully and properly evaluate the sampling plans being submitted.

In particular, disputes are highly likely to emerge with respect to the number of sampling events, the species to be monitored, how to properly account for periods when the plant is running at low capacity or when fish are relatively abundant or sparse in the waterbody and whether organisms died as a result of impingement or are naturally moribund (or plant operators may argue that organisms died as a result of the transferring and holding process). Especially controversial and fraught with difficulty is the latent mortality determination, whereby plant

[563] 76 Fed. Reg, at 22,257 (col. 2).

[564] *Id.* at n.103.

operators must seek to retain the samples for 48 hours in a manner that will minimize mortality from the holding itself. Significantly, latent mortality may occur after more than 48 hours, and while EPA is not proposing a longer latency period because of the potential for greater mortality as a result of the holding, the fact remains that mortality which occurs 72 or 96 hours after the impingement event would not be measured at all under the Proposed Rule. Consequently, the sampling results are likely to be disputed, leaving substantial uncertainty as to whether impingement mortality has been actually reduced to the levels suggested by monitoring.[565]

In contrast, determining the maximum velocity of an intake structure is far more straightforward. While it is unlikely that 96 percent of fish will be protected at every intake structure meeting the velocity limit, the statistical analysis underpinning that figure has already been conducted by EPA, used in four rulemakings, and upheld by the courts, and thus there is no reason to revisit it on a plant-specific basis. For that reason, extensive biological monitoring with latency holding periods is not required to determine compliance with the velocity limit, no sampling protocols to be developed, assessed, debated, approved, and ultimately disputed, and no holding period for assessment of latent mortality.

b. The 12 Percent/31 Percent Standard is Further Weakened by the Provision Allowing the Director to Exclude Certain Species from the Standard.

While the Proposed Rule provides that compliance with the entrainment and impingement provisions means achieving any applicable limitations "for all life stages of fish,"[566] the Proposed Rule also contains a provision stating that "the Director may determine invasive species, naturally moribund species, *and other specific species* may be excluded from any monitoring, sampling or study requirements of 40 CFR 122.21 and § 125.94."[567] This provision will invite plant operators and some regulators to seek to exclude certain species – in addition to species deemed to be "invasive"[568] or organisms that are determined to be naturally moribund – from the calculations in order to make a non-compliant facility appear to be compliant. For example, because certain fish species are more delicate than others and therefore less likely to survive impingement, by excluding those species from the monitoring requirements a facility that was not meeting the 12/31 percent limit would suddenly be deemed to be in compliance. Indeed, it is unclear whether the 12/31 percent standard can be met at every location using modified travelling screens unless the plant operator is able to convince the

[565] Relatedly, because the 12/31 percent standard allows plants to impinge as many fish as they can it provides no incentive to reduce impingement, only impingement mortality. In fact, because the baseline is the number of fish impinged, the more fish that a plant impinges, the more it can kill. That may give permitees a perverse incentive to increase rather than decrease impingement. While plant operators would not likely seek to increase their impingement across the board, one can envision circumstances where increasing impingement of relatively robust fish species more likely to survive impingement (or sampling when those species are more likely to be present) becomes a strategy for increasing a plant's average impingement survival results.

[566] Proposed 40 C.F.R. § 125.94(b)(1)(i), 76 Fed. Reg. at 22,282 (col. 3) (achieve impingement standards for all life stages of fish). *See also id.* §§ 125.94(b)(1)(iii)(A), 76 Fed. Reg. at 22,282 (col. 2-3) (the owner of a facility must count as impinged "any fish" carried over or removed from a screen).

[567] Proposed 40 C.F.R. § 125.98(c)(6) (emphasis added), 76 Fed. Reg. at 22,287 (col. 3).

[568] Allowing "invasive" species to be excluded is also problematic because there is no unanimity as to what species are considered invasive or whether all of those species are harmful.

director to exempt delicate species that would otherwise increase impingement mortality above the specified levels. In contrast, the 0.5 ft/s velocity limit will protect 96 percent of all fish. As discussed below, the director should not be allowed to exclude species from impingement monitoring or any other study, but the potential for such exclusion is further reason why the velocity limit is far more protective.

4. EPA Should Select the 0.5 Ft/S Velocity Limit as the Impingement Standard for the Final Rule.

In the Final Rule, EPA should abandon the 12-percent-annual/31-percent-monthly impingement mortality standard and instead set a national standard for impingement mortality at all existing in-scope facilities based on the 0.5 ft/s velocity limit. In addition, EPA should retain the additional fish-return, fish-entrapment, and shellfish barrier net requirements currently in the proposed rule. The maximum time frame for compliance should be shortened to three years or less. To the extent that some covered facilities might not be capable of meeting the velocity limit, a properly-crafted and properly-limited variance, consistent with that allowed under the Clean Water Act in these circumstances would be appropriate. Accordingly, 40 C.F.R. § 125.93 (a) should read:

> **§ 125.93 Compliance.**
>
> (a) The owner or operator of a facility subject to this subpart must comply with the applicable BTA standards for impingement mortality in § 125.94(b) as soon as possible based on the schedule of requirements set by the Director, but in no event later than [date 3 years after the effective date of the final rule].

And 40 C.F.R. § 125.94(b) should read:

> **§ 125.94 As an owner or operator of an existing facility, what must I do to comply with this subpart?**
>
> (b) *BTA Standards for Impingement Mortality*. By the dates specified in § 125.93(a), the owner or operator of an existing facility subject to this subpart must achieve the impingement mortality standards provided in paragraphs (b)(1) and (2) of this section:
>
> (1) The owner or operator of an existing facility must demonstrate to the Director that its cooling water intake system has a maximum intake velocity of 0.5 feet per second.
>
> (2) In addition, you must meet the following criteria:
>
> (i) The maximum velocity must be demonstrated as either the maximum actual intake velocity or the maximum design intake velocity as water passes through the structural components of a screen measured perpendicular to the screen mesh;

(ii) The maximum velocity limit must be achieved under all conditions, including during minimum ambient source water surface elevations and during periods of maximum head loss across the screens or other devices during normal operation of the intake structure. If the intake does not have a screen, the maximum intake velocity perpendicular to the opening of the intake must not exceed 0.5 feet per second during minimum ambient source water surface elevations;

(iii) Each intake must be operated and maintained to keep any debris blocking the intake at no more than 15 percent of the opening of the intake. A demonstration that the actual intake velocity is less than 0.5 feet per second through velocity measurements will meet this requirement;

(iv) The owner or operator of a facility that withdraws water from the ocean or tidal waters must also reduce impingement mortality of shellfish at a minimum to a level comparable to that achieved by properly deployed and maintained barrier nets. Passive screens such as cylindrical wedgewire screens, and through-flow or carry-over free intake screens such as dual-flow screens and drum screens, will meet this requirement;

(v) The owner or operator of a facility that employs traveling screens or equivalent active screens must incorporate protective measures including but not limited to: modified traveling screens with collection buckets designed to minimize turbulence to aquatic life, addition of a guard rail or barrier to prevent loss of fish from the collection bucket, replacement of screen panel materials with smooth woven mesh, a low pressure wash to remove fish prior to any high pressure spray to remove debris on the ascending side of the screens, and a fish handling and return system with sufficient water flow to return the fish to the source water in a manner that does not promote predation or re-impingement of the fish; and

(vi) The owner or operator of the facility must ensure that there is a means for impingeable fish or shellfish to escape the cooling water intake system or be returned to the waterbody through a fish return system. Passive screens such as cylindrical wedgewire screens, and through-flow or carry-over free intake screens such as dual-flow screens and drum screens, will meet this requirement.

In addition, since fish with swim speeds faster than 0.5 ft/s may nevertheless be impinged, particuarly at larger intake structures,[569] the rule should also require facilities to

[569] *See* PISCES report, Appendix B. For example, even a fast-swimmig fish may not be able to perceive that it is being impinged and in which direction safety lies until it is too late. *Id.*

conduct biologival monitoring to verify that the 0.5 ft/s limitation is effective. Such monitoring would not involve an assessment of impingement mortiality and would not require holding fish for a latency period, but would instead be used to verify whether fish species and life stages with faster swim speeds are being impinged in any appreciable numbers.

D. All Repowered, Replaced, or Rebuilt Facilities Must Be Subject to the Same Closed-Cycle-Cooling-Based Requirements as New Units at Existing Facilities.

1. Although the Closed-Cycle Cooling Standard for New Units at Existing Facilities Should Be Retained, the Definitions of New Unit and Existing Facility Are Problematic.

In Phase I, EPA required *new facilities* to reduce intake flows to a level commensurate with the performance of closed-cycle cooling systems, but deferred regulation of all existing facilities – meaning all facilities that did not fit EPA's strict definition of a "new facility"[570] – until the present rule.[571]

EPA promulgated a two-part definition of a new facility. The first part of the "new facility" test essentially restates EPA's definition of a "new source" of water pollution that is subject to new source performance standards under Section 306 of the Act.[572] In particular, a facility is only considered new if:

(i) It is constructed at a site at which no other source is located; or

(ii) It totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; or

(iii) Its processes are substantially independent of an existing source at the same site.[573]

Under the second part of EPA's test, a new facility also has another essential characteristic: it either uses a new cooling water intake or an existing intake "whose design capacity is increased to accommodate the intake of additional cooling water."[574]

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[570] An existing facility is any facility that is not a "new facility." *See* proposed 40 C.F.R. § 125.92, 76 Fed. Reg. at 22,281 (col. 3) ("*existing facility* means any facility that commenced construction . . . on or before January 17, 2002; and any modification of, or any addition of a unit at such a facility that is not a new facility at § 125.83."); *see also id.* at 22,193 (col. 2) ("EPA's definition of an 'existing facility' in today's proposed regulation is intended to ensure that all sources excluded from the definition of new facility in the Phase I rule are captured by the definition of existing facility in this proposed rule.").

[571] *See* 66 Fed. Reg. at 65,256 (col. 3).

[572] *See* 40 C.F.R. §§ 122.2, 122.29.

[573] *See* 40 C.F.R. § 125.83. In determining whether these processes are substantially independent, the Director shall consider such factors as the extent to which the new facility is integrated with the existing plant; and the extent to which the new facility is engaged in the same general type of activity as the existing source. *Id.*

[574] 40 C.F.R. § 125.83.

Thus, under EPA's Phase I rule, a facility is only "new" if it is both a "new source" and also uses a new or expanded intake.[575] In 2001, when it promulgated the Phase I rule, EPA reported that some commenters expressed a "well founded" concern with this two-part definition because "an existing facility could rebuild its whole facility behind the cooling water intake structure and not be subject to the requirements applicable to a new facility."[576] EPA admitted that, indeed, it was possible to "completely demolish an existing source, replace it with a smaller-capacity new source, and not be regulated under today's rule as a new facility."[577] However, EPA promised that to the extent any commenters "assert some inequity of treatment between new facilities and certain existing facilities, EPA will address this comment when it addresses what substantive requirements apply to existing facilities."[578]

In the current rule, EPA proposes to bring new units at existing facilities up to the level of control applied to new facilities.[579] In the preamble, EPA explains that a new unit at an existing facility should be treated like a new unit at a new facility for several reasons:

1. "As new units are built at existing facilities to provide additional capacity, facilities have the ideal opportunity to design and construct the new units without many of the additional expenses associated with retrofitting an existing unit to closed-cycle."

2. "The incremental downtime that can be associated with retrofitting to closed-cycle cooling is avoided altogether at a new unit."

3. "In addition, when new units are added, the condensers can be configured for closed-cycle, reducing energy requirements, and high efficiency cooling towers can be designed as part of the new unit, allowing for installation of smaller cooling towers. Thus, the capital costs for closed-cycle cooling at new units are lower than the capital costs for once-through cooling. These advantages may not always be available when retrofitting cooling towers at an existing unit."

4. "In consideration of the fact that additional unit construction decisions rest largely within the control of the individual facility, EPA decided that subjecting new units to the same national BTA requirements as those applicable to new facilities is warranted."[580]

In theory, all new units will now be required to approximate the performance of a closed-cycle cooling system – whether they are built at new or existing facilities. But in practice, many new units will not be subject to environmentally protective requirements because, in defining a "new unit," the proposed rule only counts additional units added to an existing facility to increase the facility's capacity. The definition of "new unit" excludes all other major changes at

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[575] 40 C.F.R. § 125.83, *see also* 66 Fed. Reg. at 65,259 (col. 1).

[576] 66 Fed. Reg. at 65,286 (col. 2).

[577] *Id.*

[578] 66 Fed. Reg. at 65,286 (col. 1).

[579] *See* 76 Fed. Reg. at 22,196 (col. 1-2) ("The requirements for new units are modeled after the requirements for a new facility in the Phase I rule.").

[580] 76 Fed. Reg. at 22,196 (col. 2).

an existing facility, including total replacements and repowerings, and even if the replacement unit adds capacity compared to the prior unit:

> new unit refers to newly built units added to increase capacity at the facility and *does not include any rebuilt, repowered or replacement unit,* including any units where the generation capacity of the new unit is equal to or greater than the unit it replaces."[581]

This is precisely the problem that commenters identified in 2001 and that EPA indicated it would address in this rule: under the proposed rule, a facility operator can completely demolish every part of a site behind the cooling water intake structure and rebuild an entirely new plant, yet potentially evade the protective standards imposed upon all other new units.

EPA's decision to call only units added in order to increase a facility's capacity "new units" and exclude other kinds of new units at existing facilities from comparable regulation is irrational, arbitrary, and capricious.[582] Replacements and repowerings are construction projects in which all of the significant equipment at an "existing facility" is removed and completely new equipment is installed. The electric generating unit that emerges from a replacement or repowering is, by any reasonable standard, a "new unit." Thus, replacement and repowered sites are new units and should be subject to the same standards as "additional" units.

Neither the rule, nor the preamble, provide any justification for singling out "additional" units as "new units" and not treating replaced, repowered, or rebuilt facilities as new units. The reasons that EPA gave for strictly regulating additional units apply equally to total replacements and repowerings (as do the reasons EPA gave for strictly regulating new facilities back in 2001, in the Phase I rule). The rule irrationally distinguishes between two total replacements of a facility. If an owner replaces every inch of the site, it is a new facility. But if the owner completely demolishes and replaces everything at the existing facility except for the cooling water intake structure itself, it is an existing facility. Yet all the equipment necessary to meet a closed-cycle cooling standard (cells, different piping, etc.) is built behind the cooling water intake structure. Significantly, EPA's technical experts agreed that the reasons for considering an additional unit to be a new unit apply equally to replacements and repowerings, but they were overruled by OMB. OMB has not justified its proposed change, and in any case the office does not have technical expertise thus its technical decision merits no deference. For EPA to accept OMB's unjustifiable modification to the rule would be arbitrary and unreasonable; it is also inconsistent with Congress's intent to control mortality at cooling water intakes.

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[581] Proposed 40 C.F.R. § 125.92, 76 Fed. Reg. at 22,282 (col. 1-2) (emphasis added).

[582] In *Riverkeeper II*, the Second Circuit found that EPA had illegally "expanded the scope of what may be classified as a 'new unit' while narrowing the Phase I definition of 'stand-alone' facility. Moreover, by including a potentially expansive definition of 'new unit' in the preamble to the Phase II Rule, the EPA has interpretively modified the definitions that appeared in the Phase I Rule without providing interested parties an opportunity for notice and comment."[582] EPA has (at the direction of OMB) once again improperly used the definitions of "new" and "existing" to narrow the class of facilities required to meet a closed-cycle-cooling-based standard.

2. All Repowered, Replaced, or Rebuilt Facilities Must Be Subject to the Same Closed-Cycle-Cooling-Based Requirements as "New Units at Existing Facilities."

Fixing the new units provision is simple: EPA should restore the Section 125.92(r) definition of "new unit" contained in the version of the Proposed Rule it submitted to OMB shortly before the proposal, which read:

> (r) *New unit* means any addition of an operating unit at an existing facility where the construction begins after [insert effective date of this rule], including but not limited to a new unit added to a new or existing facility for the same general industrial operation, but that does not otherwise meet the definition of a new facility at § 125.83. *New unit* includes any additional, rebuilt, repowered, or replaced unit where that unit is not subject to the requirements of Subpart I. For purposes of this definition, rebuilt refers to major modifications affecting operation of the cooling water intake structure such as replacement of the turbine, boiler, or condensers.[583]

In addition, EPA should restore the Section 125.94(d)(1) and (2) "BTA Standards for Entrainment Mortality for New Units at Existing Facilities" contained in the version of the Proposed Rule it submitted to OMB shortly before proposal, with an addition required by the *Riverkeeper I* decision (shown in italics). The necessity for that addition is further explained in Section V, below, in the context of the Phase I rule:

> **(d) BTA Standards for Entrainment Mortality for New Units at Existing Facilities.** The owner or operator of a new unit at an existing facility must achieve the entrainment standards provided in either § 125.94(d)(1) or § 125.94(d)(2).
>
> (1) The owner or operator of a facility must reduce actual intake flow (AIF) at a new unit, at a minimum, to a level commensurate with that which can be attained by the use of a closed-cycle recirculating system for the same level of cooling. The owner or operator of a facility with a cooling water intake structure that supplies cooling water exclusively for operation of a wet or dry cooling tower(s) and that meets the definition of closed-cycle recirculating system at 125.92(c) meets this entrainment mortality standard.
>
> (2) The owner or operator of a facility must demonstrate to the Director that it has installed, and will operate and maintain, technologies for each intake at the new unit that reduce entrainment mortality of all stages of fish and shellfish that pass through a 3/8 inch sieve. The owner or operator of a facility must demonstrate entrainment mortality reductions equivalent to 90 percent or greater of the reduction that could be achieved through compliance with § 125.94(d)(1). *In seeking to comply with the requirement set forth in this subsection, a facility must aim for 100 percent, and if it falls short within 10 percent, that will be acceptable. It may not, however, aim for 90 percent and achieve only an 89 percent reduction in entrainment mortality.*

[583] EPA Version of Proposed Rule submitted to OMB, at 360-61 of 383 (Exh. 85); *see also* Redlined Version of Proposed Rule, at 423 (Exh. 86).

E. Other Critical Provisions Should Be Revised.

1. EPA Should Clarify the Meaning of the Term "Species of Concern" and Restore Additional Protections for These Species.

The proposed rule repeatedly refers to "species of concern,"[584] but does not define the term. Presumably, EPA now assigns the same meaning to "species of concern" that it assigned in the earlier Phase II rule: "those species that might be in need of conservation actions, but are not currently listed as threatened or endangered under State or Federal law."[585] This definition is consistent with EPA's practice under the Phase I rule of offering stronger protection to "species of concern" than the rule's uniform standards would otherwise provide.[586] To be clear, EPA should set forth this meaning of "species of concern" as a definition in the regulatory text.

EPA should also extend additional protection to species of concern. Originally, EPA proposed to require facility operators who reduce intake velocity to 0.5 feet/second or less to document that this measure adequately protected "species of concern" and left Directors with discretion to impose additional requirements if the velocity limit was inadequate to the task.[587] But OMB suggested that this requirement should be deleted, and EPA now seeks comment on the wisdom of such a provision.[588] EPA should restore the provision as originally drafted.

Protection for species of concern is important because hundreds of candidate threatened and endangered species are caught in a regulatory backlog that, in many cases, has extended for decades.[589] Although the intake velocity limit is protective of the majority of species, some species of concern may be adversely affected even by a slow-speed intake. If the best available science shows that a particular species requires support from stronger conservation measures to survive, including more stringent protection from impingement and entrainment, then the species should not be denied vital support because of administrative shortcomings. Recognizing and restoring additional protections for species of concern is a way for EPA to address a governance failure within the Department of Interior and fulfill its mandate to protect the health and biological diversity of the nation's waters.

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[584] *See e.g.*, proposed 40 C.F.R. 125.97(a)(4) (Entrainment monitoring reports must "describe . . . the species of concern, the counts and percentage mortality of organisms sampled, and other information specified in the permit."). *See also* 76 Fed. Reg. at 22,204 (col. 3) (EPA is considering, as an additional impingement requirement, that facilities opting to reduce intake velocity also show that "species of concern are adequately protected.").

[585] 69 Fed. Reg. at 41,587 (col. 1).

[586] *See* 40 C.F.R. § 125.84(b)(4),(5) (requiring new facilities to take extra measures above and beyond implementation of closed-cycle cooling if necessary to protect "species of concern to the Director.").

[587] *See* Redlined Version of Proposed Rule at 397.

[588] *Id.*

[589] See, e.g., Columbia Basin Fish & Wildlife News Bulletin, "USFWS Announces Work Plan to Deal With Backlog of ESA Listing Determinations" (May 13, 2011) (Exh. 118).

2. EPA Should Prevent Directors from Excluding Any Species from the Rule's Scope.

EPA should delete its proposed Sections 125.98(c)(6) – the provision that allows a Director unfettered discretion to exclude any species, without limits and without standards, "from any monitoring, sampling, or study requirements of 40 CFR 122.21 and § 125.94."[590] Currently, Section 125.98(c)(6) provides an exception that could swallow the Clean Water Act. The proposed rule requires all existing units to reduce impingement mortality to 12 percent annually, and some units must also meet an entrainment standard based on the performance of closed-cycle cooling systems; others will use studies to propose entrainment standards. These standards are not met if a facility kills millions of fish that are simply not monitored or counted because they have been excluded by the Director. Under the Act, EPA and implementing state agencies are directed to minimize adverse environmental impacts – not ignore them.

3. EPA and States Should Maintain an Assumption of 100 Percent Entrainment Mortality in All Site-Specific Proceedings.

EPA is considering "allow[ing] facilities to demonstrate, on a site specific basis, that entrainment mortality of one or more species of concern is not 100 percent."[591] In general, neither EPA nor the states should be making entrainment decisions on a site-specific basis – EPA should set a national, uniform entrainment standard based on the performance of closed-cycle cooling systems. Such a standard would obviate virtually all biological monitoring requirements. But in any instance where entrainment monitoring is conducted, EPA should not allow permitees to attempt to demonstrate that entrainment mortality is less than 100 percent at their particular site. Assessing entrainment mortality on a site-specific and species-specific basis is administratively unworkable and will lead to significant delays in the permitting of cooling water intake structures for little gain.

An adequate demonstration of less than 100 percent entrainment mortality would require yet another study that states are not equipped to evaluate. Facilities would need to hold individuals after entrainment for days to ensure that apparent survivors do not succumb to latent mortality – for example, being so drastically weakened or injured that they die slowly or fail to develop properly into juvenile fish. There are, however, no objective criteria for entrainment mortality studies and this means that there inevitably would be disputes between permit applicants and regulators (and intervenors) about how long to hold samples to determine overall mortality, whether sampled individuals were dead before being entrained, and whether individuals who died after being entrained died because of the entrainment or for other reasons. The net effect will be to open a new set of biological controversies that delay effective permitting.

Further, there is little to be gained through the site-specific inquiry. As EPA noted, while *some* eggs of *some* species have been shown to survive entrainment under *some* conditions, there is no data to suggest that either the most common or the most endangered species are amongst

[590] Proposed 40 C.F.R. § 125.98(c)(6), 76 Fed. Reg. at 22,287 (col. 3).

[591] 76 Fed. Reg. at 22,273 (col. 3).

these lucky few.[592] And it is the most common entrained and most endangered species that drive the entrainment standard – the endangered because their protection can drive more stringent standards, and the most commonly entrained because they often die in simply overwhelming numbers. As a consequence, tinkering with the mortality rate for another species will have only a vanishingly small effect on overall entrainment mortality. Like EPA's proposal to engage in intensive site-specific cost-benefit analyses, this is yet another information gathering effort whose costs significantly outweigh its benefits. Accordingly, EPA should adhere to its presumption that any individual entrained is killed.

4. EPA Should Specify Minimum Monitoring Requirements.

EPA has requested comments on the monitoring requirements for impingement mortality. EPA should specify minimum monitoring requirements that meet the expectations it laid out in the preamble, rather than leaving monitoring terms to be determined by the Director. For example, EPA expects that regulated facilities will monitor impingement at least once weekly during primary periods of impingement, and that they will practice continuous monitoring in 6 to 8 hour shifts that cover an entire 24 hour cycle.[593] To ensure this expectation is met, EPA should codify the requirement in the final rule as a default practice. It is inefficient for each state to reinvent monitoring requirements (as EPA would have it) dozens of times – once for each facility. Moreover, as discussed above, since latent impingement mortality may occur up to 96 hours after an impingement event, if EPA retains the 12-percent impingement mortality standard, EPA should require facilities to retain impinged fish for 96 hours in order to determine the extent of latent mortality. EPA should specify uniform minimum monitoring requirements that meet the expectations it laid out in the preamble.

5. EPA Must Prohibit the Use of Freshwater for Once-Through Cooling in Arid Regions or Those at Risk of Drought.

EPA has requested comment on proposed regulatory provisions to encourage the use of recycled or reclaimed water as cooling water.[594] We support EPA's general belief that the use of reclaimed water for cooling can be beneficial to water resources.[595] However, defining BTA in any meaningful way requires more than merely providing an exception from regulation for existing and new units that may choose to use reclaimed water.[596] Instead, BTA must be defined to *require* reclaimed water use. Every gallon of reclaimed water used is one less gallon withdrawn. The potential benefits of using reclaimed water for power plant cooling are immense and would result in additional environmental protection and water savings and improved reliability at both once-through and closed-cycle facilities that utilize freshwater intake.

EPA's proposed approach fails to fully recognize either the availability of reclaimed water or the public and environmental benefits of using reclaimed water for cooling. Indeed,

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[592] 76 Fed. Reg. at 22,273 (col. 3).

[593] *See* 76 Fed. Reg. at 22,257 (col. 1).

[594] 76 Fed. Reg. at 22,274.

[595] *See, e.g.*, *id.* at 22,199.

[596] *See* 40 CFR 125.91(c) & 125.93(d)(3).

EPA's weak case-by-case approach fails to explicitly require local consideration of this readily available option at all.[597] It is arbitrary, capricious and an abuse of discretion for EPA to fail to require the use of reclaimed water where it is available, particularly given that water availability threats are well known, and that widespread use and availability of reclaimed water can address both withdrawal and consumption impacts from power plant cooling.

a. Use of Reclaimed Water is a Proven Technology for Power Plant Cooling.

Reclaimed (or treated) wastewater is a viable alternative to the use of freshwater or saltwater for cooling, and it eliminates the intake issues associated with once-through cooling and the consumptive use issues associated with closed-cycle cooling.

The use of reclaimed water for power plant cooling dates back as early as 1967.[598] Today, as shown in Appendix H, approximately 67 U.S. power plants use reclaimed wastewater for cooling purposes.[599] The volume of treated wastewater used at these facilities ranges from 0.1 MGD to 55 MGD, with the average facility using between 0.5 MGD and 5 MGD.[600] The largest current user of reclaimed water is the Palo Verde Nuclear Plant in Wintersburg, Arizona, which uses 55 MGD of reclaimed water for closed-cycle cooling makeup water. The 3.3 GW facility obtains its water from two wastewater treatment plants in Phoenix and Tolleson.

The majority of power plants relying on reclaimed water for cooling are coal-powered, although several are geothermal and nuclear. The states with the largest numbers of facilities using reclaimed water are Florida, California, Texas, and Arizona.[601] And while the use of reclaimed water generally tends to occur most in areas where water shortages are more severe, power plants in many other states have taken advantage of the benefits of reclaimed water for power plant cooling.

For U.S. power plants currently using reclaimed water, the distance between the power plant and the treatment facility ranges from 0 miles (the treatment facility is onsite) to approximately 56 miles, with over 90% of the plants using reclaimed water from a facility within 25 miles. The average distance of all facilities from their reclaimed water source is approximately 7.5 miles.[602]

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[597] While 40 CFR 125.98(e) mentions "impacts on water consumption" as a mandatory factor for local consideration, it does not require the Director to examine availability of reclaimed or recycled water in making any entrainment control determination.

[598] J.A. Veil, Argonne National Laboratory, *Use of Reclaimed Water for Power Plant Cooling* at 9 (Aug. 2007) (Exh. 119) *also available at* http://www.netl.doe.gov/technologies/coal_power/ewr/pubs/reclaimed%20water.pdf .

[599] *Id.* (with further analysis by Jenna Schroeder (e.g., some plants listed by Veil were proposed and never completed)). After research using the Energy Information Agency's 2009 EIA-860 data and cross-referencing with monthly EIA updates from 2010 and 2011, fourteen facilities were identified in addition to those listed by Veil.

[600] *Id.* One additional facility worth noting is the West County Energy Center, which is located in Palm Beach Florida and run by Florida Power and Light. It is reported on their website that as of early 2011, the facility will be using treated wastewater for all its cooling needs. However, repeated attempts to confirm this via phone and email were unreturned.

[601] *Id.*

[602] Jenna Schroeder, "Reclaimed Facilities Data" (attached hereto as Appendix H).

The level of treatment for the reclaimed water also varies by utility. All utilized reclaimed wastewater is treated to at least secondary treatment. Many power utilities enter into agreements with the wastewater treatment plant they are obtaining water from in order to have them conduct further (tertiary) treatment. Conversely, some facilities further treat the water onsite themselves. Under either scenario, effective measures, such as the addition of compounds to the reclaimed water, can be employed to prevent scaling, corrosion, and biofouling of the utility's infrastructure.[603]

b. Reclaimed Water is Widely Available for Cooling at Existing Once-Through Facilities.

Significant studies demonstrate widespread opportunities for treated wastewater to be used at power plants. A 2009 NETL study concluded that "[r]eclaimed water (treated municipal wastewater) is widely available in communities throughout the United States in sufficient volumes and is reliable enough to supply power plant cooling water."[604] Similarly, a 2008 study by EPRI found that "[m]unicipal effluent due to its abundance and quality is a viable alternative source for cooling water supply."[605]

Chief among the detailed studies on use and availability is Vidic (2009), a 445-page, multi-year report that painstakingly details the widespread availability and feasibility of using reclaimed water at both new and existing coal-burning power plants.[606] For existing plants in particular, Vidic showed that 75 percent of existing coal-burning power plants are within 25 miles of a wastewater treatment plant that could provide water for cooling. The Vidic report, conducted for the Department of Energy, further concluded that "finding alternative water resources to replace freshwater demand for cooling purposes is inevitable and urgent." According to DOE, the results from the Vidic study indicate it is feasible to use secondary treated municipal wastewater as cooling system makeup water.[607]

In addition to supporting the Vidic study, DOE's NETL is in the process of creating a GIS-based interface of non-traditional sources of water and coal-fired power plants.[608]

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[603] Radisav D. Vidic & David A. Dzombak, University of Pittsburgh Department of Civil and Environmental Engineering, *Reuse of Treated Internal or External Wastewaters in the Cooling Systems of Coal-Based Thermoelectric Power Plants* at 5-27 (2009) (Exh. 120) *also available at* http://www.netl.doe.gov/technologies /coalpower/ewr/water/pp-mgmt/ pubs/06550/42722FSRFG063009.pdf .

[604] National Energy Technology Laboratory, *Use of Non-Traditional Water for Power Plant Applications: An Overview of DOE/NETL R&D Efforts* at viii (2009) (Exh. 121) *also available at* http://www.netl.doe.gov/technologies/c oalpower/ewr/water/pdfs/Use%20of %20Nontraditional% 20Water%20for%2 0Power%20Plant%20Applications.pdf .

[605] Electric Power Research Institute, *Use of Alternative Water Sources for Power Plant Cooling* at 2-23 (2008) (Exh. 122).

[606] Radisav D. Vidic & David A. Dzombak, University of Pittsburgh Department of Civil and Environmental Engineering, *Reuse of Treated Internal or External Wastewaters in the Cooling Systems of Coal-Based Thermoelectric Power Plants* at 5-27 (2009) (Exh. 120).

[607] U.S. Department of Energy, Office of Fossil Energy, "Project Fact Sheet" (Exh. 123) *also available at* http://fossil.energy.gov/fred/factsheet.jsp?doc=6251&p rojtitle=Use%20of%20Treated%20Municipal%20Wastewate r%20as%20Power%20Plant%20Cooling%20System%20Mak eup%20Water:%20Tertiary%20Treatment%20versus %20Expanded%20Chemical%20Regimen%20for%20Recirculating%20Water%2 0Quality%20Management .

[608] U.S. Department of Energy, Office of Fossil Energy, *Internet-Based GIS Catalog of Non-Traditional Sources for Cooling Water for use at America's Coal-Fired Power Plants* (2009) (Exh. 124) *also available at*

Expected to be completed in the fall of 2011, the primary goal of the project is "to reduce/minimize high-quality freshwater withdrawal and consumption by creating an internet-based, GIS catalog of non-traditional sources of cooling water for coal-fired power plants." As stated in the NETL Fact Sheet, "[b]y pairing non-traditional water sources to power-plant water needs, the research will allow power plants that are affected by water shortages to continue to operate at full capacity without adversely affecting local communities or the environment."[609] Preliminary data available on the internet indicate that a significant number of existing, coal-fired power plants could benefit from the use of nearby non-traditional sources of cooling water.[610]

Carnegie Mellon and the University of Pittsburgh also continue to evaluate the most efficient way to treat reclaimed water for power plant cooling. The study is an economic and social analysis comparing tertiary treatment of reclaimed water to reclaimed water treated with an expanded chemical regimen. This study is currently underway.[611]

EPA should incorporate the findings from all of these studies into the proposed cooling water rule and require power plants to utilize available reclaimed water for the cooling water and environmental benefits it provides.

c. EPA's Stated Concerns About Reclaimed Water Availability are Unsupported and Unwarranted.

In the 2011 TDD at page 6-18, EPA claims, "many facilities substantially outpace the volume of water available to them from alternate sources." EPA relied on a single study in California in reaching this conclusion. However, EPA's conclusion is both erroneous and misses the point.

First, EPA appears to ignore important studies on the availability of reclaimed water for cooling water, including NETL 2009, EPRI 2008, Vidic 2009 and the latest GIS information from All Consulting. Vidic reported approximately 27.5 billion gallons a day of wastewater flow available in eleven of the thirteen original NERC regions in the United States, from approximately 18,000 wastewater treatment facilities.[612] As is noted above, Vidic also found that approximately 50 percent of *existing* coal-fired power plants had sufficient reclaimed water available within a 10 mile radius, and 75 percent had sufficient reclaimed water available within

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www.netl.doe.gov/publications/factsheets/project/Proj522.pdf .

[609] *Id.* at 2.

[610] *See* ALL Consulting, *GIS Catalog of Non-Traditional Sources of Cooling Water for Use at America's Coal-Fired Power Plants* (Exh. 125) *also available at* http://www.all-llc.com/projects/coal_water_alternatives/page.php?13 (last visited Aug. 17, 2011).

[611] National Energy Technology Laboratory, *Use of Treated Municipal Wastewater as Power Plant Cooling System Makeup Water: Tertiary Treatment Versus Expanded Chemical Regimen for Recirculating Water Quality Management* (Exh. 126) *also available at* http://www.netl.doe.gov/technologies/coalpower/ewr/water/pp-mgmt/wastewater.html .

[612] Radisav D. Vidic & David A. Dzombak, University of Pittsburgh Department of Civil and Environmental Engineering, *Reuse of Treated Internal or External Wastewaters in the Cooling Systems of Coal-Based Thermoelectric Power Plants* at 5-27, at 2-5 and 2-6 (2009) (Exh. 120).

a 25 mile radius.[613]

A 1995 report from the USGS estimated 41 BGD of treated wastewater from 16,400 facilities nationwide.[614] Of this 41 BGD, 2.4 percent (or 983 MGD) was reclaimed and used, which means the vast majority, approximately 97.6 percent or 40 BGD, was potentially available for use elsewhere, such as for power plant cooling. All of these studies demonstrate sufficient availability of reclaimed water for use as cooling water.

Second, EPA improperly characterizes the results of the California study. The California report cited by EPA evaluated 15 coastal power generation facilities that use once-through cooling to gauge the feasibility of converting these facilities to closed-cycle cooling. The report repeatedly states that it is the intent of the state to encourage alternate cooling methods whenever possible. Given this preference, the authors evaluated whether a sufficient volume of reclaimed water existed to meet the cooling needs at existing once-through facilities. This assessment was made assuming the facilities would maintain their *once-through* cooling configuration, not the closed-cycle needs of the upgrades they planned to undertake at these facilities. This is significant because, as the report states, the projected decrease in cooling water volume needed after the conversion would be between 93 percent and 98 percent, depending on the facility. For EPA to make a conclusion that using reclaimed water is not a feasible option because there is not sufficient volume available to replace *all* of the *original* once-through cooling needs is therefore incorrect and misguided. In fact, if one looks at the 15 facilities evaluated in the California report, the vast majority of plants could be serviced entirely by reclaimed water after their conversion to closed-cycle cooling, with the available volume often orders of magnitude greater than needed.[615]

Furthermore, even in areas where the once-through cooling water needs of facilities could not be met *entirely* by reclaimed sources, these reclaimed water sources oftentimes can provide a substantial portion, even a majority, of the cooling water needed under a once-through cooling configuration. For EPA to discount using reclaimed water as a cooling water source in these instances misses an important opportunity to conserve large volumes of water, as well as avoid the impacts procuring this water creates, such as impingement and entrainment of wildlife.

The use of reclaimed water should not be viewed as an all-or-nothing proposition, such that if there is not sufficient reclaimed water available for all cooling needs then reclaimed water cannot and should not be used at all. Even a 30 percent reduction in freshwater withdrawals for thermoelectric power generation using once-through cooling would result in withdrawal reductions of approximately 43 billion gallons a day,[616] nearly the same amount of reclaimed water available in the U.S., as reported by the USGS for 1995.[617]

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[613] *Id.* at 2-22 and 2-23.

[614] U.S. Geological Survey, *Estimated Water Use in the United States in 1995* at 58 (1998) (Exh. 127) *also available at* http://water.usgs.gov/watuse/pdf1995/pdf/wastewater.pdf . 1995 was the last year USGS kept track of this statistic.

[615] Jenna Schroeder, "CA Reuse Analysis.xlsx" (attached hereto as "Appendix I").

[616] U.S. Geological Survey, *Estimated Use of Water in the United States in 2000* at 41 (2004) (Exh. 128) *also available at* http://pubs.usgs.gov/circ/2004/circ1268/pdf/circular1268.pdf .

[617] USGS (1998) at 58.

d. The Use of Reclaimed Water for Closed-Cycle Cooling Addresses Any Consumption Issues.

Numerous studies address the consumptive versus withdrawal considerations of various cooling practices. EPRI estimates that "once-through consumption levels, when including downstream evaporation, are less than, but of the same magnitude as, wet recirculating cooling system consumption levels."[618]

The table below, taken from Mielke et al. (2010),[619] shows estimated once-through fossil plant water consumption levels of 300 gal/MWh versus closed-loop water consumption levels of 480 gal/MWh. For nuclear plants, the corresponding numbers are 400 gal/MWh and 720 gal/MWh.[620]

All units in gal/MWh	Steam condensing				Other use				Total			
	Withdrawal		Consumption		Withdrawal		Consumption		Withdrawal		Consumption	
	Low	High	*Low*	*High*	Low	High	*Low*	*High*	Low	High	Low	High
Steam turbine (coal, gas, biomass)												
Once-through	20,000	50,000	*300*	*300*	30	30	*0*	*30*	20,030	50,030	300	330
Closed-loop	300	600	*300*	*480*	30	30	*0*	*30*	330	630	300	510
Dry	0	0	*0*	*0*	30	30	*0*	*30*	30	30	0	30
Steam turbine (nuclear)												
Once-through	25,000	60,000	*400*	*400*	30	30	*0*	*30*	25,030	60,030	400	430
Closed-loop	500	1,100	*400*	*720*	30	30	*0*	*30*	530	1,130	400	750
Dry	0	0	*0*	*0*	30	30	*0*	*30*	30	30	0	30
Combined-cycle gas turbine												
Once-through	7,500	20,000	*100*	*100*	30	30	*0*	*30*	7,530	20,030	100	130
Closed-loop	230	230	*180*	*180*	30	30	*0*	*30*	260	260	180	210
Dry	0	0	*0*	*0*	30	30	*0*	*30*	30	30	0	30
IGCC (coal)												
Closed-loop	250	250	*200*	*260*	137	140	*137*	*140*	387	390	337	400

Most importantly, however, no matter how one calculates consumptive use of closed-cycle cooling, the consumption is relatively minor relative to available reclaimed water.

Relying on the Mielke data, the amount of water *consumed* at once-through facilities is anywhere between 0.5 percent and 1.6 percent of the water withdrawn. Therefore, because the EPA reports that approximately 200 BGD of cooling water is withdrawn for once-through

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[618] NETL 2010 at 21 (citing EPRI, *Water & Sustainability (Volume 3): U.S. Water Consumption for Power Production – The Next Half Century*, Topical Report No. 1006786 (Mar. 2002) [hereinafter "EPRI 2002"] (Exh. 129)). As EPA recognizes, most studies do not consider the consumptive impacts of once-through cooling *after* the cooling water leaves the power plant. 76 Fed. Reg. 22,199. Note: 40 CFR 125.98(e) does not expressly require consideration of the consumptive use of once-through cooling once the discharge leaves the facility, but it should.

[619] Erik Mielke, Laura Diaz Anadon, & Venkatesth Narayanamurti, "Water Consumption of Energy Resource Extraction, Processing, and Conversion: A review of the literature for estimates of water intensity of energy-resource extraction, processing to fuels, and conversion to electricity," Energy Technology Innovation Policy Discussion Paper No. 2010-15, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University (Oct. 2010) (Exh. 130) *also available at* http://belfercenter.ksg.harvard.edu/ files/ETIP-DP-2010 -15-final-4.pdf.

[620] NETL notes that its original analysis (relied on by Mielke) did not account for downstream evaporative losses, which are not insignificant. NETL 2010 at 21. Interestingly, EPRI 2002 also reveals that shifting from coal and nuclear-based generation to natural gas generation would reduce water consumption *more than* the amount increased due to closed cycle cooling requirements. NETL 2002 at vii-viii.

facilities,[621] then between 1 and 3.2 BGD is generally consumed at once-through facilities. Switching from once-through to closed-cycle cooling could marginally increase the amount of water *consumed* from anywhere between 0 percent and 80 percent at any given facility. Thus, switching these facilities to closed-cycle cooling would increase consumption to 1 BGD on the low end (no change in consumption) and 5.8 BGD on the high end (assuming 80 percent increase in consumption). The amount of reclaimed water available more than meets these needs, assuming it is distributed where needed.

Similarly, in 2002, EPRI predicted that "if EPA requires cooling system retrofits at plants with once-through cooling[,] then national power plant freshwater consumption will rise [] about 10% above the base projection."[622] This would result in increased consumption of less than 1 BGD across the 48 conterminous states.[623] Moreover, in 2010, NETL calculated a 26.6 percent increase in consumption from 2010 to 2035 with a phased approach to closed-cycle cooling retrofits. Under this scenario, NETL estimated an increase in consumption from 3.6 BGD to 4.6 BGD, or additional consumption of 1.0 BGD by 2035.[624] Again, the amount of reclaimed water available far exceeds these needs, assuming it is distributed where needed.

Finally, even under more extreme scenarios, reclaimed water could offset any increases in consumption due to modernization to closed-cycle cooling. For example, given that once-through generators use approximately 200 BGD of cooling water per year, if all of these facilities were to convert to closed-cycle wet cooling, the withdrawal rate would drop by about 95.6 percent on the low end to 99.4 percent on the high end.[625] Assuming *all of the remainder* is consumed, this would result in new consumption for closed-cycle cooling between approximately 2 to 8.8 BGD. Given the approximately 41 BGD of wastewater available in the U.S. reported by USGS in 1995, there is more than adequate daily reclaimed water flow in the United States to meet this demand, again assuming it is distributed where needed.

e. At a Minimum, EPA should Emulate California's Policy on the Use of Reclaimed Water for Cooling and Establish a Preference for Reclaimed Water.

Since 1975, California has encouraged the use of reclaimed wastewater for power plant cooling and placed a priority on using wastewater for cooling purposes.[626] The use of freshwater for power plant cooling in California is only allowed "when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or

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[621] Personal Communication with Paul Shriner, EPA (June 8, 2011).

[622] EPRI 2002 at 6-2.

[623] *See* EPRI 2002 at Figure 6-5.

[624] NETL 2010 at 1-2.

[625] Erik Mielke, Laura Diaz Anadon, & Venkatesth Narayanamurti, "Water Consumption of Energy Resource Extraction, Processing, and Conversion: A review of the literature for estimates of water intensity of energy-resource extraction, processing to fuels, and conversion to electricity," Energy Technology Innovation Policy Discussion Paper No. 2010-15, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University (Oct. 2010) (Exh. 130).

[626] California State Water Resources Control Board (SWRCB), Res. No. 75-058 at 4-5 (June 19, 1975) (Exh. 131) *also available at* http://www.swrcb.ca.gov/board_decisions/adop_ted_orders/resolutions/1975/rs75_058.pdf .

economically unsound."[627] The success of this policy has resulted in almost a dozen power plants in California using reclaimed water for closed-cycle cooling makeup water.[628]

Today, California Water Code § 13552.6 codifies the importance of using reclaimed water and declares the use of potable domestic water for closed-cycle cooling to be a waste or unreasonable use of water if safe and sufficient reclaimed water is available.

Unfortunately, EPA's Proposed Rule takes a very different approach by essentially elevating the use of inland waters over reclaimed water and by placing the burden on state agencies to evaluate the cooling water impact on water consumption. Yet the longevity and success of California's approach provides further evidence that the use of reclaimed water is the best technology available for minimizing environmental impact and consumption. Like California did more than three decades ago, EPA should at the very least establish a preference for the use of reclaimed water for power plant cooling in areas at risk of water scarcity.

6. EPA Should Not Exempt Cooling Water Withdrawals from the Rule Merely Because the Water Is Also Used for Desalination.

While we understand EPA's desire to encourage the reuse of cooling water for other processes, we have serious concerns about the blanket exemptions in Section 125.91(c) and Section 125.92. As drafted, these sections exempt water from the definition of "cooling water" if it is obtained from a desalination plant or is used in a manufacturing process either before or, more likely, after it is used for cooling purposes. This exemption promotes withdrawal – and associated aquatic mortality – and raises particular concerns with respect to the co-locating of desalination facilities with power plants.

EPA has acknowledged that: "[f]rom a biological perspective, the effect of intake structures on impingement and entrainment does not differ depending on whether an intake structure is associated with a power plant or a manufacturer."[629] This conclusion is true for seawater desalination facilities that withdrawal large amounts of water and do not employ the best technology available for minimizing entrainment and impingement and propose to co-locate with a power plant in order to utilize their existing intake structure for the desalination process feed water. The exclusion of seawater used for cooling and desalination from the definition of "cooling water," as contemplated by proposed Sections 125.91(c) and 125.92, would allow the power plant to characterize all of its intake as water that is not defined as "cooling water" because it is also used for desalination feed water – thereby effectively exempting the power plant from the Proposed Rule. Thus, if a power plant co-locates with a large enough ocean desalination facility to exempt it from the rule, the marine life mortality would go completely unregulated.

This exemption would thus allow both the first user and second user of the seawater to avoid impingement and entrainment controls, thus providing no protection for marine life.

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[627] *Id.* at 4.

[628] *See* J.A. Veil, Argonne National Laboratory, *Use of Reclaimed Water for Power Plant Cooling* at 9 (Aug. 2007) (Exh. 119).

[629] 76 Fed. Reg. at 22,192.

Significantly, new desalination plants in California have received NPDES permits under the presumption that they will cause no net impact to the marine environment by virtue of co-locating with power plants who are subject to Section 316(b) (on the theory that the power plant is already required to employ the best technology available to minimize adverse impacts under 316(b) and the desalination plant is withdraw no additional water beyond that used by the power plant).[630] Now, ironically, EPA's proposed rule would exempt a once-through-cooled power plant from Section 316(b) compliance if it gives its discharge water to a desalination plant (on the theory that the water is not cooling water if it is ultimately used for drinking). Consequently, both the first user and second user (the power plant and the desalination facility) might claim that they cause no impact because the other user is the primary consumer, while their massive water withdrawal kills sea life through entrainment and impingement at exactly the same levels as before.

EPA has provided no reasonable explanation for this broad exemption. Regardless of whether a desalination plant also uses it, if water is used for cooling it remains "cooling water" and must be regulated under Section 316(b). To ensure the objective of Section 316(b) to minimize entrainment and impingement from cooling water intakes is achieved, the proposed language in the regulations must be re-written to eliminate any and all definitions or exemptions that would potentially allow power plants to be excluded from the regulations simply because a seawater desalination facility happened to co-locate with the power plant.

7. EPA Should Require an Actual-Flow Calculation Baseline.

In the preamble to the Proposed Rule, EPA states that "[f]ollowing promulgation of the 2004 Phase II rule, … EPA became aware of certain elements of the 2004 rule that were particularly challenging or time-consuming to implement."[631] The very first of these "challenging" elements mentioned by EPA is the calculation baseline: "In practice, both permitees and regulatory agencies encountered difficulty with the calculation baseline. Specifically how a facility should determine what the baseline represented and how a particular facility's site-specific configurations or operations compared to the calculation baseline."[632]

A calculation baseline typically comes into play in either of two scenarios. First, where a performance standard is expressed in terms of a percentage reduction (as in the 2004 Phase II rule), the calculation baseline is the starting point from which the reductions are measured. Second, a calculation baseline is often used to compare two different technologies that protect fish in different ways. For example, regulatory agencies often employ a calculation baseline when comparing the performance of closed-cycle cooling to other flow reduction measures such as variable speed pumps or to screening technologies.

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[630] *See, e.g.,* Cal. Reg'l Water Quality Control Bd., San Diego Region, Order No.R9-2009-0038 Amending Order No. R9-2006-0065 (NPDES No. CA0109223) Waste Discharge Requirements for the Poseidon Resources Corporation Carlsbad Desalination Project Discharge to the Pacific Ocean via the Encina Power Station Discharge Channel 1 (2009) (Exh. 132) *also available at* http://www.waterboards.c a.gov/sandiego/board_decisions/adopted_orders/2009/R9_2009_0038_ rev1.pdf

[631] 76 Fed. Reg. at 22,185 (col. 2).

[632] *Id.* at cols. 2-3.

In the commenters' experience, the most controversial aspect of the Phase II calculation baseline definition was its operational component. In relevant part, the Phase II rule provided as follows:

> *Calculation baseline* means an estimate of impingement mortality and entrainment that would occur at your site assuming that: … *baseline practices [and] procedures* … are *those that your facility would maintain* in the absence of any … operational controls, including flow or velocity reductions, implemented in whole or in part for the purposes of reducing impingement mortality and entrainment.[633]

Where a facility has not implemented any operational controls to save fish, the operational baseline should be straightforward – it would simply reflect the actual intake flow (AIF) and the timing (seasonality) of that actual flow. But in practice, some power companies and at least one state agency has stated that the operational component of the calculation baseline should be a "full-flow" baseline, i.e., a baseline that assumes, contrary to actual practice at any power plant, that the facility runs 24 hours a day, 7 days a week, 365 days a year.

Use of a fictional full-flow baseline can allow, for example, a plant that runs 60 percent of the time (as many baseload fossil plants do) to take credit for "saving" 40 percent of the fish, when it has made no actual reductions at all. More important, using a "full-flow" calculation baseline tends to overestimate the effects of alternatives to closed-cycle cooling such as variable speed pumps. To illustrate the point from a particular permit proceeding, when issuing a draft permit for the Port Jefferson power station in 2009, New York State DEC estimated that the plant would entrain 1.1 billion organisms per year if it operated 100 percent of the time. Thus, the full-flow calculation baseline for entrainment at Port Jefferson is 1.1 billion organisms. In fact, the station was at that time entraining only 1.02 billion organisms per year under its actual operating conditions. Thus, the actual flow baseline (or, more precisely, the actual fish-kill baseline) is 1.02 billion organisms, which is about a 7 percent difference from the baseline. To illustrate the significance of this difference, closed-cycle cooling would reduce entrainment by 95 percent or more from the *actual* 1.02 billion entrainment figure, reducing entrainment to approximately 50 million organisms per year. But if the full-flow baseline is used, then a suite of technologies and operational measures that reduce entrainment to 55 million organisms per year would be deemed to be 95 percent effective (and therefore identical in effectiveness to closed-cycle cooling) and a suite of technologies and operational measures that reduce entrainment to 160 million organisms per year would be deemed to be 85.5 percent effective (and therefore "equivalent" to closed-cycle cooling using a 10 percent margin of error that DEC imitated from EPA's Phase I rule). The full-flow baseline distorts reality and provides less protection for aquatic resources because if an actual fish-kill baseline were used, then a 95 percent reduction would equate to 50 million organisms entrained regardless of which technologies were being used, and not 55 or 160 million organisms. In cases where the actual-flow baseline and full-flow baseline are further apart, such as with the Bowline Point Generating Station in New York, now operating below 10% of capacity,[634] the prejudice will be even greater. Clearly, EPA cannot intend that this gross distortion be permissible.

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[633] 69 Fed. Reg. at 41,683 (col. 3)-41,684 (col. 1) (adopting 40 C.F.R. § 125.93) (emphasis added).

[634] *See* supra note 218, p. 36.

Recognizing the problematic nature of the calculation baseline, EPA states that it "has developed a new approach to the technology-based requirements proposed today that does not use a calculation baseline."[635] What EPA presumably means is that, unlike the Phase II rule, the Proposed Rule does not include performance standards expressed in terms of a percentage reduction and does not include a definition of calculation baseline. But by proposing a site-specific, case-by-case approach to BTA determinations for entrainment, EPA is requiring regulators to compare the performance of different technologies. Because the Proposed Rule does not forbid use of a calculation baseline, many state agencies will no doubt employ one in comparing different candidate BTA technologies. Likewise, to the extent that facilities propose impingement reduction technologies that are "comparable" in performance to barrier nets for shellfish or that meet the "90 percent or greater" (i.e., Track II) standard for new units, regulators may employ calculation baselines to make those comparisons. The Proposed Rule thereby invites the use of calculation baselines but without defining the term or otherwise providing guidance on how they should be defined and applied. The result is therefore even worse than the Phase II rule in this regard because EPA is punting to the states, with less guidance and direction than before, the primary problem it had identified from its implementation experience under the 2004 Phase II rule.

Accordingly, EPA should either include a provision in the rule prohibiting states and EPA regional offices from using any calculation baseline in implementing the rule, or if EPA allows use of calculation baselines then EPA should make clear in the rule that a "full-flow" calculation baseline is impermissible, and that the operational component of a calculation baseline must reflect the plant's actual operations (for example, taking the last 3 years of actual operation), modified only in the rare instance where there have been reductions in flow actually implemented to protect fish (and only to that extent). Most importantly, because power plants never operate 100 percent of the time, a full-flow baseline should never be allowed.

8. EPA Should Remove the Special Provision for Nuclear Facilities.

EPA created an exception to the entrainment mortality requirements for nuclear facilities if compliance "would result in a conflict with a safety requirement established by the [Nuclear Regulatory] Commission [NRC]."[636] However, OMB broadened it to also cover impingement mortality requirements and deleted EPA's clarifying statement that the exception was narrow and that "[t]echnical infeasibility, and not cost, is the only consideration in evaluation of a potential conflict with Commission safety requirements."[637] If this provision is retained, EPA should revert to the version contained in the proposed rule sent to OMB. Better yet, EPA should remove the provision entirely because the exception is unnecessary and potentially confusing, given the design and operation of U.S. nuclear plants' cooling water systems and existing NRC regulations.

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[635] 76 Fed. Reg. at 22,185 (col. 3).

[636] Proposed 40 C.F.R. § 125.94(e); 76 Fed. Reg. at 22,284 (col. 1).

[637] Redlined Version of Proposed Rule at 431.

Currently operating nuclear power plants that utilize once-through cooling have two completely separate and independent cooling systems; one system to cool the steam used to generate electricity, which is the subject of this rulemaking, and a second "service water" system which provides water to cool plant buildings and equipment, and emergency cooling water to cool the reactors, spent fuel pools and other critical plant systems in the event of an accident.[638] The first system is considered "non-safety related" by the Nuclear Regulatory Commission, and the second "service water" system is considered "safety-related." The two systems are completely separate in that they rely on different pumps, piping and intakes to function. It is extremely unlikely that compliance with Section 316(b) could in any way implicate or create safety concerns related to the operation of the safety-related service water system, given this separation. Moreover, the NRC's existing regulations adequately address proposed changes to a nuclear facility, rendering this additional process unnecessary.[639]

Furthermore, by creating a unique process for the Director to make a secondary BTA determination in response to a facility operator raising safety concerns with the NRC, the provision creates confusion as to when NRC review of BTA requirements would occur. Any review by the NRC of a BTA determination should be limited to ensuring that the implementation of BTA, as determined by EPA and implemented by the Director, would not reduce safety margins at an operating nuclear plant. Such review should occur after the BTA requirements have been specified, not before.

9. EPA Should Require Interim Measures to Reduce Cooling Water Flow Until Long Term Compliance Solutions Are in Place.

The proposed rule does not set a firm deadline for entrainment compliance and gives facilities up to eight years to comply with the rule's impingement standard. In the interim, a number of technologies exist, which while not commensurate with the effectiveness of closed-cycle cooling, nevertheless offer reductions in adverse impacts, move a facility's performance closer to BTA, and can be installed relatively quickly. Accordingly, we request that EPA include a definition of interim measures in the proposed rule and require that the interim measures be implemented as NPDES permit conditions until full compliance is achieved.

The interim measures can include technologies and operational changes that reduce the flow of cooling water, particularly at peak spawning times. For example, peaking facilities can install variable speed pumps that allow them to use less water when not operating at full capacity. All facilities can alter their standard procedures to implement aggressive shutdowns of pumps when offline, rather than leaving cooling water pumps running. And facilities can typically schedule regular maintenance outages for peak spawning periods. These kinds of operational measures should be within reach of most facilities and there is no reason why they should not be required immediately while long-term BTA requirements are being studied, developed, and implemented.

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[638] For a description of the different cooling systems employed at nuclear power plants, see *Got Water? Issue Brief*, David Lochbaum, Union of Concerned Scientists, December 2007 (Exh. 41).

[639] *See* 10 C.F.R. § 50.59.

10. EPA Should Clarify that Only Offshore Seafood Processing Facilities, Not Onshore Facilities, Are Exempt from the Rule.

EPA intended to exempt seagoing vessels from the rule because of concerns about space limitations and retrofits that could compromise the seaworthiness of drilling rigs, liquefied natural gas terminals, and fishing boats. As the rule is drafted, however, it is unclear whether all seafood processing facilities are exempted, including land based facilities, or whether only vessels are exempted. The preamble discussion of seaworthiness and related concerns makes it clear that only vessels are exempted.[640] But proposed 40 C.F.R. § 125.91(d) reads "This subpart does not apply to seafood processing facilities, offshore liquefied natural gas terminals, and offshore oil and gas extraction facilities that are existing facilities as defined in § 125.92." By not prefacing "seafood processing facilities" with the word "offshore," some might read ambiguity where EPA intended none. Therefore, EPA should include the word "offshore" as a preface to "seafood processing facilities."

F. EPA's Cost-Benefit Analysis is Deeply Flawed and Illegal.

1. EPA's Extensive Monetized Cost-Benefit Analysis Far Exceeds the Restrictions Imposed by Congress.

As discussed above, while Section 316(b) permits EPA to consider costs in relation to benefits in choosing a regulatory option and establishing nationwide performance standards for the Section 316(b) existing facilities rule, the statute restricts EPA's investigation of, and reliance upon, such comparisons. Congress intended EPA to consider environmental benefits in non-monetized terms, avoid lengthy cost-benefit proceedings and futile attempts at comprehensive monetization, and take account of the Clean Water Act's technology-forcing objectives. If used at all in developing intake structure requirements, cost-benefit analysis should be used only to prevent results that are absurd in light of extreme disparities between costs and benefits, for example through EPA's traditional wholly disproportionate test. Most importantly, any cost-benefit comparison must be limited and subsidiary, not a primary or paramount factor. Congress intended to allow only a limited consideration of costs when it directed EPA to set technology-based standards. Cost-benefit comparisons must be limited in light of the difficulty of quantifying and monetizing all the benefits of minimizing the adverse impacts of cooling water intake structures, which consistently causes unreasonable regulatory delays and underestimates of benefits.

The cost-benefit analysis that EPA performed, however, went well beyond what Congress intended. Instead of leaving its consideration of the rule's costs and benefits in non-monetized terms, EPA attempted to monetize them. And instead of avoiding lengthy cost-benefit proceedings, EPA expended considerable time and energy over the course of several years on this analysis, and now intends to require state permitting authorities to oversee hundreds of these lengthy, monetized cost-benefit reviews as well. EPA's efforts to conduct a fine-grained and monetized cost-benefit analysis have spanned several years and included multiple rounds of data gathering, volumes of economic analysis, extensive literature reviews, and several economic

[640] *See, e.g.*, 76 Fed. Reg. at 22,193 (col. 2) ("EPA decided to propose requiring the Director, exercising BPJ, to establish BTA impingement and entrainment mortality standards for . . . a seafood processing vessel . . . .").

modeling runs. EPA is embroiled in a far more intense comparison of costs and benefits then Congress intended even under the BPT standard – the Clean Water Act's only technology-based standard that actually required some form of cost-benefit analysis.

But when it comes time to make a final decision, it seems that this fine-grained, time intensive, and costly approach to cost-benefit analysis provides relatively little useful information. By its own admission, the agency still cannot adequately monetize the benefits of this rule and cannot rely on the analysis it has performed to date in determining the best technology available. After years of analysis, during which existing plants have killed billions more fish, continued to degrade hundreds of aquatic ecosystems, and placed threatened and endangered species in jeopardy, EPA still has not come to a clear conclusion about the precise monetary benefits of saving one fish or one billion fish. Instead, the agency proposes to kick the problem down to the states, which is exactly what Congress did not want EPA to do.

2. EPA Vastly Underestimated the Benefits of the Rulemaking Options Such that Any Reliance on the Cost-Benefit Analysis Would Be Arbitrary and Capricious.

Despite a considerable expenditure of time and effort, EPA was unable to value the benefits of this rule in monetary terms. EPA also made several errors in those parts of its analysis that it was able to complete. This section summarizes key points from a more extensive environmental economic report prepared by two of Stockholm Environment Institute's senior economists, Frank Ackerman and Elizabeth Stanton. The full Stockholm Environment Institute (SEI) report is attached to these comments as Appendix A. As the attached report explains in more detail, the errors in EPA's analysis are significant enough that for the agency to rely on this faulty cost-benefit analysis would be arbitrary, capricious, and an abuse of the agency's discretion.

Calculating the value of the rule's benefits in monetary terms is a two stage process: EPA must first quantify the rule's physical impacts – the baseline number of fish and other organisms[641] that are now being killed by cooling water intake structures but will be saved by the rule. Then, EPA faces the challenge of attaching monetary values to those physical impacts. The agency has made significant errors at both stages.

Making only partial and conservative corrections for the errors in EPA's benefits estimates, the SEI report attached to this comment letter concludes that the monetized benefits of regulation approach or exceed EPA's cost estimates for every option that EPA explored. The corrected benefits estimates, coupled with revised cost estimates provided by Powers Engineering that address flaws in EPA's estimate of compliance costs,[642] demonstrate that the benefits of a national entrainment standard based on the use of closed cycle cooling outweigh the costs.

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[641] Significantly, EPA does not even attempt to quantify the issues of phytoplankton and the small organisms (other than fish and shellfish) despite the fact that they are important components of the food chain.

[642] *See* Section III.F.3, below.

a. EPA Has Drastically Underestimated the Number of Fish Killed by Cooling Water Intake Structures.

EPA appears to have significantly underestimated the baseline number of fish killed by cooling water intake structures. Errors in this baseline calculation inevitably propagate through the rest of EPA's cost-benefit analysis, thereby casting serious doubts on the whole effort.

For example, EPA's estimate of the number of walleye entrained and impinged annually in the entire Great Lakes region is orders of magnitude less than the number of walleye reported to have been entrained in one year at a single facility. EPA estimates that all of the power plants and manufacturing facilities in the Great Lakes combined impinge and entrain less than 10,000 individual walleye: eggs, larvae, juveniles, and adults.[643] In 2005 and 2006, the operator of the Bay Shore Power Plant, located on the shore of Lake Erie in Ohio, hired the independent consulting firm Kinectrics to analyze and report impingement and entrainment sampling data from Bay Shore and provided this data of the Ohio Environmental Protection Agency.[644] By its own estimate, Bay Shore killed over 7,000,000 walleye larvae and 499,000 juveniles in a single year.[645] There is no way to square EPA's estimate of less than 10,000 individual walleye deaths in all of the Great Lakes with the plant's evidence-based conclusion that it killed 7.5 million.

Nor are EPA's walleye numbers the only dubious statistics in its Great Lakes analysis. EPA estimates that 221 million individual freshwater drums are impinged and entrained every year in all of the Great Lakes.[646] In 2005/06, Bay Shore estimated that it killed 940 million individual freshwater drums by itself.[647] Similarly, EPA estimated Great Lakes logperch deaths at 10.5 million annually.[648] Bay Shore reports killing over 30 million.[649] And EPA estimates white perch deaths at less than 10,000 for the entire Great Lakes, while Bay Shore reports killing nearly 490,000 individuals by itself.

EPA has thus grossly underestimated the number of fish killed by power plants and manufacturing facilities in the Great Lakes region. The agency should investigate, document and correct any similar gross errors in its estimates for that and other regions. These errors are

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[643] *See* EEBA Table C-12, p. C-16 (reporting number of "individuals" impinged and entrained); *see also id.* at 3-2 (explaining that EPA employs a model to convert organisms of any particular age into an equivalent number of "individuals" of any other age), 76 Fed. Reg. at 22,238 (col. 3) (defining age-one equivalent losses as "the number of individuals of different ages impinged and entrained by facility intakes, standardized to equivalent numbers of 1-year old fish").

[644] *See* Kinetrics, *Bay Shore Power Plant Cooling Water Intake Structure Information and I&E Sampling Data*, 16 (Table 5.4), 22 (Table 5.7) (Jan. 2008) (Exh. 11), *also available at* http://www.epa.state.oh.us/portals/35/perm its/bayshore_IE_data_collection.pdf.

[645] *Id.* at. 16 (Table 5.4), 22 (Table 5.7).

[646] *See* EEBA Table C-12, p. C-15.

[647] *See* Kinetrics, *Bay Shore Power Plant Cooling Water Intake Structure Information and I&E Sampling Data*, 16 (Table 5.4), 22 (Table 5.7). (Jan. 2008) (Exh. 11) *also available at* http://www.epa.state.oh.us/portals/35/perm its/bayshore_IE_data_collection.pdf.

[648] *See* EEBA Table C-12, p. C-15.

[649] *See* Kinetrics, *Bay Shore Power Plant Cooling Water Intake Structure Information and I&E Sampling Data*, 16 (Table 5.4), 22 (Table 5.7) (Jan. 2008) (Exh. 11) *also available at* http://www.epa.state.oh.us/portals/35/perm its/bayshore_IE_data_collection.pdf.

deeply problematic because the number of fish killed by cooling water intake structures is the fundamental basis of all of EPA's benefit calculations. EPA's underestimate of mortality – a thousand-fold undercounting of some species – undermines the validity of its entire cost-benefit analysis.

b. EPA Cannot Accurately Monetize the Benefits of Saving Non-Market Fish, Other Aquatic Organisms, and Ecosystems.

The problems with EPA's cost-benefit analysis do not end with its gross underestimates of the number of fish that would be saved by a more stringent rule. Even if the agency's physical estimates were corrected, EPA would still need to address significant errors and gaps in its efforts to put a dollar figure on the true value to society of fish, other aquatic organisms, and entire ecosystems that are not bought and sold in commercial markets. Several of the most significant problems with EPA's analysis identified in the SEI report are summarized below.

Even the most straightforward of the non-market calculations – estimating the direct use values of fish as objects of sport – has proved quite challenging. EPA seems to have severely underestimated recreational fishing benefits. The value that EPA concludes that the average angler derives from catching a walleye in the Great Lakes – approximately four dollars – is based on EPA's own meta-analysis. It does not appear to match other estimates in the economic literature, which are over twenty dollars per fish, nor does it accord with the perception of companies in the sportfishing industry.[650]

Beyond direct use values, the problems escalate dramatically. To begin with, EPA admits that entire and substantial categories of benefits, including many non-use values, are beyond its capacity to estimate.[651] EPA has not yet estimated the non-use value of any of the billions of aquatic organisms and thousands of ecosystems that are affected by cooling water intake structures outside of the North and Mid-Atlantic Regions. And EPA has failed to capture the indirect use benefits of fish and healthier aquatic ecosystems, such as scuba diving, or hunting and watching birds that eat fish. Currently, EPA places a zero value on these activities.[652]

Even in the North and Mid-Atlantic regions, where EPA was able to conduct a partial non-use value calculation, the agency made the problematic and unjustified assumption that people place no value whatsoever on the welfare of fish and ecosystems outside of their home region.[653] Thus, EPA assumes that Alaskans would place no value on saving endangered sea turtles in Florida, and that Floridians, in turn, do not care about the health of such iconic American rivers as the Hudson, Colorado, Columbia, Delaware, and Mississippi. In making this assumption, EPA is ignoring empirical evidence from leading environmental economists that people place substantial value on the health of ecosystems and animals even if they are hundreds

[650] *See* SEI Report, attached as Appendix A; *see also* Gentner Consulting Group, Economic Damages of Impingement and Entrainment of Fish, Fish Eggs, and Fish Larvae at the Bay Shore Power Plant (Sept. 2009) at Table 8 (Exh. 133).

[651] *See* SEI Report.

[652] *See id.*

[653] *See id.*

or thousands of miles away.[654] John Loomis, a leading economist in the field who EPA relies on and cites for other purposes, concluded that "on average, measuring only the benefits at the state level would result in just 13 percent of the national total public good benefits."[655]

EPA also failed to take into account the particular value that people attach to protecting threatened and endangered species. EPA notes that cooling water intakes have significant impacts on threatened and endangered species, but claims an inability to come up with any reasonable estimates for the value of these impacts. Yet model calculations that EPA included in the EEBA demonstrate that EPA is well aware of the research literature on methods for estimating the non-use value of threatened and endangered species.[656]

EPA's model calculations, however, are problematic and would need to be refined before further use. EPA's model calculations of the non-use value of threatened and endangered species – which are not included in the final cost-benefit analysis – depend crucially on the assumed percentage of the affected population that is lost under baseline conditions. This is doubly problematic. First, EPA used different assumed percentage losses for different species without providing any basis for its chosen percentages (all of which were very low). Second, EPA's analysis simply will not be credible until the agency corrects the drastic quantitative impact assessment errors discussed above. For example, even if EPA could justify its assumption that requiring closed-cycle cooling would save only one percent of endangered sea turtles, one percent of a severely underestimated baseline number of turtles remains a severe underestimate.

Until and unless EPA corrects its estimates of fish kills and recreational fishing benefits, completes its planned willingness to pay study, accounts for the substantial value that people place on environmental preservation (even from a distance), and corrects the serious deficiencies in its approach to valuing threatened and endangered species, the agency will continue to dramatically undervalue the benefits of a uniform national standard based on closed-cycle cooling. The flaws in EPA's present analysis, both in its quantification and monetization of the rule's benefits, are sufficiently large that to rely upon it would be arbitrary, capricious and an abuse of discretion.

3. EPA Overestimated the Costs of Closed-Cycle Cooling.

In the proposed rule, EPA significantly overestimates the costs of installing closed-cycle cooling at existing facilities. The greatest flaw in EPA's approach to estimating the cost of retrofits was EPA's irrational decision, in 2007, to abandon its own thoroughly documented cost estimation model and instead use unverified figures provided by the Electric Power Research Institute (EPRI), which is an arm of the electric power industry being regulated by the rule.

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[654] *See id.*

[655] *See id.* (quoting John B. Loomis, "Vertically Summing Public Good Demand Curves: An Empirical Comparison of Economic versus Political Jurisdictions," 76(2) *Land Economics* 312, 319–20 (2000)).

[656] *See id.*

This section summarizes key points from a more extensive engineering and cost report prepared by Powers Engineering. The full report is attached to this comment letter as Appendix D. As the attached report explains in more detail:

a. EPA Has Significantly Over-Estimated the Costs of Retrofitting Existing Power Plants to Closed-Cycle Cooling.

EPA developed a model for estimating the costs of closed-cycle cooling retrofits. The inputs for EPA's model are thoroughly explained and corroborated with actual fossil and nuclear plant retrofit cost data. EPA concluded that its model generates accurate and conservative estimates for closed-cycle cooling retrofits at both conventional and nuclear power plants.[657]

But EPA abandoned its model in 2007, when the Electric Power Research Institute (EPRI), a power industry body, provided EPA with cost estimates based on the results of a self-administered industry survey. EPA stated that it would use EPRI's capital cost estimates and energy penalty estimates instead of its own model results because the two sets of estimated costs were similar.[658]

The estimates produced by EPRI and EPA are not similar at all: EPRI's capital cost estimates are between 50% and 100% higher than EPA's.[659] EPRI has also estimated energy penalties several times larger than EPA. And EPRI's cost estimates are also higher than those of SPX, the largest manufacturer of power plant cooling towers in the United States.[660]

EPA should not have used EPRI's estimates. EPRI cannot be considered a neutral party in assessing the cost or difficulty of closed-cycle cooling retrofits because EPRI member companies have consistently opposed such retrofits. And in contrast to EPA's well documented and well understood model, there is no record evidence to corroborate EPRI's extremely high cost estimates. Thus, EPA should have continued to use its own model.

There are only two areas in which EPA's model requires substantial changes: nuclear plant retrofit costs, and nuclear plant outage (downtime) estimates. With these notable exceptions aside, the cost estimation model that EPA used until 2007 is conservative and fairly accurate.

EPA's new cost estimates – based on EPRI's model – are not remotely similar to EPA's original estimates, nor are they realistic, for several reasons.

First, at conventional plants, EPA's final cost estimate is greatly inflated because EPA replaced its own well-grounded and conservative[661] cost estimate of $27 million with EPRI's $53

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[657] *See* Powers Engineering comments on EPA 316(b) March 28, 2011 TDD, William Powers, P.E., Powers Engineering, hereinafter ("Powers Report") (attached as Appendix D).

[658] *See* Technical Development Document at 8-15.

[659] See Powers Report (section II).

[660] *See* Powers Report.

[661] In this context conservative means that actual costs are likely to be lower.

million estimate. EPA is wrong to claim that these are "similar results." EPA's model generates two different estimates of the capital cost of a retrofit, depending on whether a plant uses conventional (fossil fuel burning) or nuclear technology. EPRI's model generates three different capital cost estimates, and these differ not by the plant's technology, but by whether site conditions make a retrofit "easy", "average," or "difficult." The table below, drawn from EPA's technical development document, displays the different estimates generated by EPA and EPRI.[662]

Exhibit 12-3. Cost Comparison for a 350 MW Plant with Cooling Flow of 200,000 gpm (288 MGD)

	Tower Type	Capital Costs - Tower and Piping	Condenser Upgrade[1]	O&M	Tower Electricity Usage (Pumps & Fans)	O&M Total[2]	Annualized Capital Not Including Condenser Upgrade[3]	Annualized Condenser Upgrade	Total Annualized Cost Not Including Condenser Upgrade	Annual Heat Rate Penalty[4]
EPA Phase II	Redwood Tower	$27,000,000	$5,200,000	Included in O&M Total	Included in O&M Total	$2,900,000	$2,200,000	$400,000	$5,100,000	?
	Redwood Tower - Nuclear	$49,000,000	$9,400,000	Included in O&M Total	Included in O&M Total	$4,200,000	$3,900,000	$800,000	$8,100,000	?
EPRI Costs	Easy	$32,000,000	-	$260,000	$2,600,000	$2,860,000	$2,600,000	-	$5,460,000	$1,040,000
	Average	$53,000,000	-	$260,000	$2,600,000	$2,860,000	$4,200,000	-	$7,060,000	$1,040,000
	Difficult	$83,000,000	-	$260,000	$2,600,000	$2,860,000	$6,600,000	-	$9,460,000	$1,040,000

In this chart, EPA took the example of a cooling system with a flow rate of 200,000 gpm. EPA wrongly concluded that its cost estimates and EPRI's estimates are similar because it compared its conventional plant capital cost estimate of $27 million to EPRI's lower bound "easy" estimate of $32 million, and its nuclear plant capital cost estimate of $49 million with EPRI's "average" estimate of $53 million.[663] But EPA did not use EPRI's lower bound estimate to determine capital costs at conventional plants, it used EPRI's higher value – $53 million – as the basis for estimating costs at *all* power plants.[664]

At conventional plants, EPRI's estimate of $53 million is nearly double EPA's $27 million estimate. And EPA's original estimate was already generous because it assumed a low approach temperature, deliberately over-estimated pump and fan sizes, used a cost estimate for surface condenser upgrades that is considerably higher than a manufacturer's estimate, and did not take into account the 0.5 percent efficiency improvement that typically results from a condenser upgrade (which would considerably offset efficiency losses associated with installation of closed-cycle cooling).[665] By replacing a well documented and conservative cost estimate of $27 million with an unsupported industry estimate of $53 million, EPA has significantly overestimated retrofit costs at conventional plants.[666]

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662 *See* Powers Report.

663 *See* Powers Report.

664 *See* TDD 8-17.

665 See Powers Report. (Sections II.B & II.C)

666 Some adjustment to the EPA model cost would be necessary to account for the rise in costs between 1999 and 2009. However, the rise in costs is on the order of 37 percent between 1999 and 2009, not a factor of two. At best, EPRI's cost estimates are 50% higher than EPA's. See Powers Report (providing industry standard cost inflation references and performing calculation).

Second, at nuclear plants, EPA's estimates are erroneously inflated because of unspecified safety concerns. EPA's underlying model, developed in 2002, generates estimates of retrofit costs at nuclear power plants far lower than the $49 million value that EPA provides in the present rulemaking. EPA stated that its 2002 model was both conservative and very accurate at nuclear plants. And EPA presented the data behind its cost model in extensive detail, including the costs of actual closed-cycle cooling retrofits, to support its position. But, as the attached Powers report explains, the agency then arbitrarily applied a cost multiplier to its estimates in order to account for unspecified and undocumented concerns about the added expense of safely retrofitting a nuclear power plant.[667]

Using these cost multipliers, EPA estimates that the same retrofit that costs $27 million at a conventional power plant will cost $22 million more at a nuclear plant. And it is on the basis of this inflated $49 million estimate that EPA claims it is acceptable to adopt EPRI's even higher estimate of $53 million. But there is no support in the current record for EPA's decision to double many retrofit costs at nuclear plants, just as there was no record evidence to support this practice when EPA began it in 2002. Indeed, as the attached report shows, the record contains evidence that partially contradicts EPA's stance: statements by nuclear plant operators and regulators indicating that construction in close proximity to an operating nuclear plant is a familiar practice (it takes place, for example, when new generating units are built alongside an existing one) and does not raise significant safety concerns.[668]

Third, EPA's estimates of the turbine efficiency penalty and closed-cycle cooling parasitic fan and pump loads for nuclear and fossil plants are unreasonably high. The attached report shows that these overestimates again result from EPA's adoption of EPRI's unsupported figures. EPRI's figures contradict both EPA's own model and record evidence from existing retrofits. EPRI's estimated turbine efficiency penalty is approximately five times the average efficiency penalty found in EPA's own cost model, and about ten times the average efficiency penalty observed at some sites that have been retrofitted to a closed-cycle system.[669] And compared to EPA's original model, the EPRI cost spreadsheet overestimates fan and pump energy requirements by 30%. Overall, as the attached report makes clear, EPA's closed-cycle cooling cost model provided reasonably accurate estimates of annual average turbine efficiency penalties, fan energy demand, and pump energy demand.[670] EPA should reinstate its retrofit closed-cycle cooling cost model's estimates of energy demand and efficiency penalties and not rely on the EPRI figures.

b. EPA Overestimated the Downtime (and Attendant Costs) Required for Closed-Cycle Cooling Retrofits at Nuclear Plants.

In 2002, EPA estimated that if facilities are given a period of several years to come into compliance, as they are under the Proposed Rule, then closed-cycle conversions at both fossil

[667] *See* Powers Report.

[668] *See* Powers Report. (Section II.D)

[669] With respect to the turbine efficiency penalty, part of the overestimate arises from EPA's erroneous decision to model the long-run energy penalty on the peak energy penalties observed at the height of summer, rather than adopting the average energy penalty observed over time. *See* Powers Report. (Section III.A)

[670] *See* Powers Report.

and nuclear plants would require no more than two months of additional downtime beyond that which is ordinarily scheduled. EPA provided considerable support for this position on the record based on its experience at several power plants.[671]

EPA later increased its estimate from two months to seven months at nuclear plants. Nothing in the record developed by EPA between 2002 and 2011 can support this drastic revision. EPA's 350 percent increase in the outage time estimate was based on a single weak data point: a letter from a planner at the Palisades II nuclear plant, written in 2002, describing a retrofit at the plant that was conducted in the early 1970's.[672] Thirty years later, plant staff could not state definitively how long the retrofit had taken and could only infer an estimate of the plant's outage time from whatever records remained from the 1970s.[673]

As the attached Powers report explains, information from better-documented retrofits and other complicated construction projects at nuclear plants completed within the past ten years strongly supports EPA's original view that two months of additional downtime is a reasonable and conservative estimate (i.e., actual costs are likely to be lower). EPA pointed out in the April 2002 TDD that four surface condensers at an Arkansas nuclear plant were upgraded during two days of downtime. More complicated construction projects at nuclear power plants, such as plant replacements, have been completed in much less than seven months. For example, the 2008 replacement of four steam generators at the Diablo Canyon nuclear facility, Units 1 and 2, which involved cutting an opening in the nuclear reactor containment dome, required an outage of only ten weeks. The attached engineering report points out that:

> it is not credible that the outage time for a highly invasive nuclear reactor steam generator replacement that occurs inside the nuclear containment dome averages 2 to 2-and-a-half months, and yet the hook-up of circulating water piping to an existing nuclear reactor surface condenser, an action the NRC predecessor agency stated would create no nuclear safety concerns, would require a 7-month outage.[674]

EPA should assume that, at most, a closed-cycle cooling hook-up requires no more than two months outage time.

4. If EPA Relies on, or Authorizes Use of, a Cost-Benefit Analysis, that Analysis Must Be Significantly Improved.

If EPA uses cost-benefit comparisons at all, the agency may use them only as Congress intended: as secondary "reality checks" intended only to avert extreme disparities between the costs and benefits of technologies that deliver the greatest reductions in entrainment, impingement, and thermal pollution. This kind of practical cost-benefit analysis would lead EPA to set a uniform national standard based on the performance of closed-cycle cooling systems.

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[671] *See* Powers Report.

[672] *See* Letter from John A. Gulvas, Consumers Energy to Timothy Connor/Ashley Allen, U.S. EPA dated Feb. 28, 2002 (EPA-HQ-2002-0049-2341).

[673] *See id.* at 7.

[674] Powers Report.

But even if EPA completes this rulemaking under the unlawful approach to cost-benefit analysis that it has applied to date, the result should be the same. The economic analysis performed by SEI that is attached to this comment shows that, after correcting significant errors in EPA's cost-benefit analysis, the benefits of a closed-cycle cooling standard actually exceed its costs.[675] Thus, the benefits of protecting fish and aquatic ecosystems clearly "justify" the costs of a uniform, national closed-cycle cooling standard.

a. EPA's Approach to Cost-Benefit Analysis Should Be Reformed.

Had EPA followed the cost-benefit approach that Congress envisioned, it would have proposed a uniform national entrainment standard based on the use of the best technology available: closed-cycle cooling. The Clean Water Act allows EPA to consider whether the costs of a closed-cycle cooling standard can be reasonably borne by an industry; they can. And EPA's data show that the costs of a closed-cycle cooling standard are not wholly disproportionate to its benefits.

But EPA decided to compare costs and benefits more extensively and probingly than Congress deemed appropriate in setting technology-based standards. Despite a determined and good faith effort, EPA produced a cost-benefit analysis that overlooks many benefit categories entirely and underestimates others, both physically and monetarily. This is not surprising. Through 40 years of failed environmental regulation, Congress learned that elaborate efforts to precisely assess environmental harms and benefits would be futile and, what is worse, would leave the agency unable to enact effective environmental regulations at all. That is why Congress prohibited EPA from making cost-benefit comparisons a primary consideration in setting the best technology available standard.

Further, there is a severe imbalance in any cost-benefit analysis when, as here, the costs of the proposed action can be valued commercially but the benefits cannot be monetized with any meaningful degree of accuracy. Faced with such uni-directional uncertainty, EPA should set a rule that errs on the side of environmental protection.

If EPA were to apply its longstanding "wholly disproportionate" test to the information that it has already analyzed, the agency could quickly set a uniform national standard based on the performance of closed-cycle cooling systems. The non-use values of the fish and other organisms saved by this rule are substantial. EPA's initial effort to monetize them through a habitat valuation analysis generated a value of several billion dollars.[676] Thus, EPA has firm grounds to conclude that the costs of this rule are reasonable and proportionate to its benefits and, indeed, that the rule's benefits exceed its costs. At the very least, however, there is no extreme disparity between the benefits and costs of a uniform national standard based on closed-cycle cooling.

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[675] *See* SEI Report.

[676] EEBA chapter 9; see also Stockholm Environment Institute report (discussing EPA's habitat valuation analysis).

b. EPA's National Benefits Assessment Requires Certain Adjustments.

The most significant errors in EPA's benefits analysis are described above in Section III.F.2 of these comments and in the report of the Stockholm Environmental Institute, attached as Appendix A. Briefly, EPA has underestimated the number of fish and other organisms affected by this rule and the recreational and non-use benefits that people derive from healthier aquatic ecosystems. The Stockholm Environment Institute has provided a general estimate of benefits that addresses many of the deficiencies in EPA's analysis. Specifically, the Stockholm Environment Institute:

- applied EPA's habitat area restoration method (discussed in the EEBA) for non-use values, but extrapolates the method's results nationally;
- used a benefits transfer method to infer national threatened and endangered species benefits; and
- modified EPA's estimated recreational benefits to account for the significant discrepancies between EPA's estimates and others.

Together, these basic modifications result in benefits estimates that are greater than or approach EPA's cost estimates for all of the options that EPA considered, including for a uniform national standard based on closed-cycle cooling. And, as noted above, EPA's cost estimates are themselves inflated.[677] Correcting the errors in both the costs and the benefits estimates leads to the conclusion that the benefits of regulation are greater than the costs for every option that EPA considered. EPA should correct its national estimate to account for the deficiencies identified in the Stockholm Environment Institute's report, which is attached as Appendix A.

c. EPA's National Costs Assessment Requires Certain Adjustments.

As explained above (and more extensively in the attached report of Powers Engineering), there are multiple flaws in EPA's estimate of the costs of closed-cycle cooling retrofits. Many of the problems with EPA's figures stem from the agency's decision to abandon its own well-grounded cost estimates and rely instead on significantly higher estimates provided by EPRI. To correct these errors, EPA should re-estimate the costs of retrofits at plants around the country using the following default values for unit costs, recommended by Powers Engineering.[678] These unit costs are based on EPA's original estimates and some recent data from a leading cooling tower manufacturer:

Installed cost, wet tower (in-line or back-to-back), $/gpm:	182 – 223
Installed cost, plume-abated tower (in-line or back-to-back), $/gpm:	316 – 411
Average turbine efficiency penalty (fossil or nuclear), %:	0.30 – 0.40
Average fan parasitic energy penalty (fossil or nuclear), %:	0.40 – 0.60
Average pump parasitic energy penalty (fossil or nuclear), %:	0.40 – 0.60

[677] *See* Section III.F.3, supra.

[678] The ranges provided represent the variation from 12° F to 8° F design approach temperatures at different power plants.

Total retrofit downtime, months: fossil – 1, nuclear – 2

Based on these more realistic unit cost estimates, and assuming some variation in design approach temperatures and a mix of wet and plume-abated towers, Powers Engineering concludes that the annualized national pre-tax compliance costs for power plants under Option 2 and Option 3 would be $3,029 million and $3,104 million annually (compared to $4,933 million and $5,079 million in EPA's estimates, as shown in *EBA*, Table 3-8). Assuming no change in EPA's estimates of costs to manufacturers, this implies that the total cost of Option 2 is 62.8 percent of EPA's estimate and the total cost of Option 3 is 62.9 percent of EPA's estimate.

Moreover, both EPA's and Powers Engineering's calculations are very conservative (i.e., actual costs are likely to be lower) because they both use total current nationwide design intake flow (DIF) to calculate the capital cost of cooling tower retrofits under Options 2 and 3. Given the ongoing coal plant retirement trends unrelated to projected 316(b) compliance costs, the actual number of existing plants needing to be retrofit will likely be smaller. For example, a December 2010 compilation of various studies by The Brattle Group evaluating the amount of coal plant retirements found estimates ranging from 10 GW to 75 GW of coal capacity will be retired between now and 2020.[679] In fact, more than 27.5 GW of coal plant retirements have already been announced by utilities throughout the country.[680] EPA should factor these retirements into its cost analysis because plants that are to be retired in the near future will not need to be retrofitted with cooling towers and, therefore, will avoid a significant cost.

d. Any Site-Specific Benefits Assessment Should Adhere to Precise Regulatory Requirements Established by EPA.

As explained previously, requiring states to conduct site-specific cost-benefit assessments violates the Clean Water Act, offends the Congressional intent behind the Act, and is arbitrary, capricious, and an abuse of EPA's limited discretion to consider the costs and benefits of setting a uniform, *national* standard. State agencies should not be authorized to conduct any cost-benefit analysis in the process of issuing NPDES permits, because they simply cannot perform or meaningfully review such analysis in a manner that provides any useful information. However, to the extent that EPA persists in allowing states to undertake any cost-benefit assessment, the rule should require those analyses to adhere to precise requirements established by EPA. As the attached report of the Stockholm Environment Institute explains in greater detail, EPA should start by making four important changes to the site-specific cost-benefit analysis process envisioned in the Proposed Rule.

First, EPA should clarify how costs and benefits are to be compared. EPA's novel formulation in the Section 316(b) context that benefits should "justify" the costs of entrainment controls is unclear and some states may interpret it as a departure from the "wholly disproportionate" standard. A clear interpretive standard set by federal regulation would prevent states from making cost-benefit comparisons under disparate standards. It would also

[679] The Brattle Group, Potential Coal Plant Retirements Under Emerging Environmental Regulations (December 8, 2010) (Exh. 134).

[680] *See* Electric Generating Units Planned Retirement Date Spreadsheet (developed from publicly available information), Aug. 15, 2011 (Exh. 135).

prevent states from relying on cost-benefit considerations in a manner that is inconsistent with the limits that Congress placed on the use of cost-benefit comparisons. Therefore, EPA should establish that the new "benefits justify the costs" standard is consistent with its existing Clean Water Act guidance: the costs of a protective measure are justified so long as they are not wholly disproportionate to the benefits conferred by that measure.

Second, EPA should ensure that government employees or contractors are the sole arbiters of the technical adequacy of all cost-benefit analyses. The integrity of the analytical process can only be assured if the State, not the applicant, selects the contractors and oversees the studies.

Third, applicants require additional guidance on how to conduct complex cost-benefit analyses. Therefore, EPA should restore guidance statements that OMB had deleted, including EPA's explanation of the difference between the social costs and the private costs to facilities of installation downtime and energy penalties and how these costs should be calculated to avoid overestimating the social costs, as well as EPA's guidance on discount rates, which called for facilities to use a "social discount rate . . . reflecting society's rate of time preference as opposed to a facility's cost of capital," and suggested 3%, as per existing OMB guidance.[681]

Finally, EPA should provide standardized default values and valuation methodologies for costs of control technologies, and for all major benefits categories, suitable for use in local analyses. As the attached SEI report explains in more detail, EPA should require:

- *Estimates of national, not regional, non-use values* – economic studies have repeatedly shown that people place a high value on preserving and protecting ecosystems even if they do not live close to them. A complete benefits analysis must include the value that all Americans derive from protecting wildlife, not just the benefits to those people who live close to a particular waterbody.

- *A clear explanation of how the heightened value of protecting threatened and endangered species is included in the benefits analysis* – Americans place a particularly high value on protecting and preserving threatened and endangered species. This additional value must be reflected in the benefits analysis.

- *Quantified uncertainty estimates* – EPA should require that all cost-benefit studies include a quantitative measure of the uncertainty in the estimates of the number of fish and other organisms affected by a cooling water intake structure, and in the estimates of the economic costs and benefits of protecting these organisms. Regulators should understand the error range associated with the estimates they have received.

- *A buffer or margin of safety for threatened and endangered species* – The difference between killing 1 percent and 2 percent of all the individuals in an endangered population can be hugely significant – it may be the difference between life and extinction for that species. Where threatened or endangered species, or species of concern are involved, EPA should require that applicants do their utmost to quantify the uncertainties in their

[681] *See* Redlined Version of Proposed Rule, p. 340.

benefits estimate, and then base their benefits calculations on the upper end of the error range.

- *Non-use value estimates no lower than those found by EPA* – Presently, EPA is conducting a national willingness to pay study to develop accurate and transferable estimates of the non-use benefits of wildlife. If applicants or regulators can document a substantial basis to deviate upwards from EPA's estimates, this should be permitted. But contingent valuation of environmental goods is difficult and must be done with care and transparency because an applicant can significantly alter the results of a site-specific cost-benefit analysis by manipulating estimates of non-use values. As a safeguard against inaccurate estimation studies, EPA should not allow applicants to present non-use values for fish and aquatic ecosystems that are lower than those found in EPA's forthcoming study.

G. EPA Cannot Issue a Final Rule Without First Consulting NMFS and FWS and Fully Complying with its Duties under Other Applicable Federal Environmental Laws.

Although EPA is promulgating this proposed rule under the Clean Water Act, the agency has a separate duty to comply with the Endangered Species Act. Under that Act, EPA has a mandatory duty "to use . . . all methods which are necessary to bring any endangered . . . or threatened species to the point at which the protections of the Act are no longer necessary."[682] Also, EPA must consult with the Secretaries of the Departments of Interior and Commerce to insure that any action it authorizes, funds, or carries out "is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of [critical] habitat of such species."[683]

To date, EPA has not consulted the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS), the designees of the Secretaries of the Interior and Commerce, to obtain their opinions on the biological and ecological impacts of this rule and the advisability of reasonable and prudent alternatives to EPA's Proposed Rule. Reasonable and prudent alternatives to EPA's proposed action exist, including the other regulatory options under consideration.

In promulgating this rule, EPA will be taking an action within the meaning of the Endangered Species Act.[684] Specifically, EPA is requiring states to make case-by-case entrainment control decisions and is declining to set a uniform, national, technology-based standard based on the performance of closed-cycle cooling systems. Thus, EPA is authorizing existing cooling water intake structures to continue to take endangered species, and to adversely modify habitat that is critical to multiple endangered species, on the vain hope that states may be

[682] *Nat'l Wildlife Fed'n v. Hodel*, No. S-85-0837, 1985 U.S. Dist. Lexis 16490 at *11 (Aug. 26, 1985) (E.D. Cal.) (citing 16 U.S.C §§ 1536(a)(1), 1532(3)).

[683] 16 U.S.C. § 1536(a)(2).

[684] *See* 40 C.F.R. § 402.02 ("Action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to . . . the promulgation of regulations...").

able to take effective action to regulate these intakes. Where an EPA action directly continues a situation in which endangered species are being taken, EPA must first consult the Secretary of Interior, Commerce, or Agriculture as appropriate.[685]

EPA has evidence that cooling water intake structures take endangered and threatened species of fish. And the Proposed Rule authorizes continued operation of existing cooling water intake structures in a manner that EPA claims will at best "minimize" over an extremely extended schedule – and, significantly, will not end – the killing of fish and other aquatic organisms, as well as the wholesale degradation of aquatic ecosystems by CWISs. Under these circumstances, EPA has a mandatory duty to consult with the NMFS and FWS prior to promulgating a final rule.

In addition, EPA's has duties to protect and conserve wildlife, and to cooperate with other federal agencies in the protection and conservation of wildlife, under a number of federal laws including but not limited to: the National Environmental Protection Act,[686] the Endangered Species Act,[687] the Fish and Wildlife Coordination Act,[688] the Bald and Golden Eagle Protection Act,[689] the Migratory Bird Treaty Act,[690] the Migratory Bird Conservation Act,[691] the Marine Mammal Protection Act,[692] the Wilderness Act,[693] the Coastal Zone Management Act,[694] the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006,[695] and Federal Land Policy and Management Act,[696] and the National Forest Management Act.[697] EPA cannot promulgate a final regulation without first insuring that it has met its particular duties under these acts, and its general duty to protect and conserve wildlife – particularly endangered and threatened species.

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[685] *See Defenders of Wildlife v. EPA*, 882 F.2d 1294, 1300 (8th Cir. 1989).

[686] *See* 42 U.S.C. §§ 4321-70d.

[687] *See* 16 U.S.C. §§ 1531-44.

[688] *See* 16 U.S.C. §§ 661-67e.

[689] *See* 16 U.S.C. §§ 668a-668d.

[690] *See* 16 U.S.C. §§ 703-712.

[691] *See* 16 U.S.C. §§ 715-715s.

[692] *See* 16 U.S.C. §§ 1361-1421h.

[693] *See* 16 U.S.C. §§ 1132-1136.

[694] *See* 15 U.S.C. §§ 1451-65.

[695] *See* 16 U.S.C. §§ 1801-91d.

[696] *See* 43 U.S.C. §§ 1701-85.

[697] *See* 16 U.S.C. §§ 1600-87.

IV.

ADDITIONAL REVISIONS TO THE PHASE I RULE ARE WARRANTED IN LIGHT OF THE *RIVERKEEPER I* DECISION

In addition to removing from the Phase I new facility rule the restoration-based compliance alternative and the associated monitoring and demonstration requirements (as EPA is currently proposing), another revision is also warranted in light of the *Riverkeeper I* decision.

In its Phase I rule, EPA required new facilities to limit intake volume to a level commensurate with closed-cycle cooling (Track I),[698] while also allowing those facilities to use technologies other than closed-cycle cooling so long as they could demonstrate that "the technologies employed will reduce the level of adverse environmental impact from [the] cooling water intake structures to a comparable level" to that which would be achieved by closed-cycle cooling (Track II).[699] EPA further defined "comparable level" to mean a reduction in impingement mortality and entrainment of all life stages of fish and shellfish to 90 percent or greater of the reduction that would be achieved by closed-cycle cooling.[700]

In the *Riverkeeper I* litigation, Riverkeeper and other environmental groups challenged EPA's 90-percent threshold because it appeared to allow facilities to choose technologies that were designed to achieve only 90 percent of the reductions that EPA had selected as BTA. In defending the 90 percent threshold, EPA explained to the court that:

> given the numerous factors that must be considered to determine the required level of reduction in impingement and entrainment for Track II [*i.e.*, the 90 percent option] and the *complexity inherent in assessing the level of performance of different control technologies*, EPA believes it is appropriate for a new facility following Track II to achieve reductions in impingement and entrainment that are 90 percent or greater of the levels achieved under Track I [*i.e.*, closed-cycle cooling].[701]

In ruling on the issue, the Second Circuit stated that "impingement and entrainment … cannot always be measured directly and with mathematical precision, the use of any alternative technologies would require the EPA to make a judgment call as to whether those technologies yield results 'equivalent' to Track I's."[702] Thus, the court concluded as follows: "We think it was reasonable for the EPA to make clear … how much ambiguity it is willing to tolerate in measuring compliance and what it considers a reasonable margin of error in comparing the performance of different technologies."[703] However, the court then added a critical caveat:

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[698] 40 CFR § 125.84(b)(1).

[699] 40 CFR § 125.84(d)(1).

[700] 40 CFR § 125.86(c)(2)(i).

[701] *Riverkeeper I,* 358 F.3d at 187-88 (emphasis added), citing 66 Fed. Reg. at 65,279 .

[702] *Id.* at 188-89.

[703] *Id.* at 189.

> Based on the EPA's representation that "90 percent" compliance is permitted because of measuring error, EPA Br. at 52, it would, of course, be inappropriate for the EPA to use 90 percent as a benchmark and allow an additional margin of error in measuring compliance with that benchmark. *A facility must aim for 100 percent, and if it falls short within 10 percent, that will be acceptable. It may not, however, aim for 90 percent and achieve only an 89 percent reduction in impingement and entrainment.*[704]

In other words, where an applicant proposes a suite of technologies and operational measures as equivalent to closed-cycle cooling, it must submit data showing that the reductions are expected to be 100 percent of the level that would be achieved by closed-cycle cooling. So long as such a demonstration is made in the permitting process, actual monitoring showing that performance was within the 10 percent margin of measuring error will be deemed to be in compliance.

In the Proposed Rule, EPA makes this same point in the context of the proposed 12 percent annual impingement mortality standard for existing facilities:

> EPA recognizes that some variability in the annual average is inevitable, and thus the only way to consistently achieve the 12 percent annual standard is to *target a better level of performance as the long-term average performance*.[705]

The Phase I rule, however, does not make it clear that facilities must – as the Second Circuit held – "aim for 100 percent" of Track I, and thus applicants and permit writers may be under the mistaken impression that facilities can instead aim for 90 percent and fall short of that reduced target without violating the regulations. Accordingly, to respond to the *Riverkeeper I* decision, EPA should revise 40 CFR § 125.89(b)(1)(ii) to read as follows (additions shown in italics):

> **§ 125.89 As the Director, what must I do to comply with the requirements of this subpart?**
>
> (b)(1)(ii) For a facility that chooses Track II, you must review the information submitted with the Comprehensive Demonstration Study information required in § 125.86(c)(2), evaluate the suitability of the proposed design and construction technologies and operational measures to determine whether they will reduce both impingement mortality and entrainment of all life stages of fish and shellfish to 90 percent or greater of the reduction that could be achieved through Track I. *In seeking to comply with the requirement set forth in this subsection, a facility must aim for 100 percent, and if it falls short within 10 percent, that will be acceptable. It may not, however, aim for 90 percent and achieve only an 89 percent reduction in entrainment mortality.*

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[704] *Id.* n.16 (emphasis added).

[705] 76 Fed. Reg. at 22,203 (col. 2) (emphasis added).

V.

RESPONSES TO EPA'S SPECIFIC REQUESTS FOR COMMENT

A. Responses to Numbered Requests.

On pages 22,273-75 of the preamble, EPA provided a numbered list of 28 "Specific Solicitations of Comment and Data," which summarized and pulled together in one place many of the requests for comment that were otherwise scattered throughout the preamble. We respond to those requests here.

1. **Definition of "Design Intake Flow."** *EPA requests comment on whether the definition of DIF should be further revised to clarify that EPA intends for the design intake flow to reflect the maximum volume of water that a plant can physically withdraw from a source waterbody over a specific time period. This would mean that a facility that has permanently taken a pump out of service or has flow limited by piping or other physical limitations should be able to consider such constraints when reporting its DIF. See Section V.G.*[706]

Response:

So long as facilities are not receiving impingement and entrainment mortality reduction "credit" for fictional flow reductions (see discussion above regarding full flow baseline) DIF should reflect the maximum amount of water than can be withdrawn by the plant.

2. **National BTA Categorical Standards for Offshore Oil and Gas Extraction and Seafood Processing Facilities.** *EPA requests comment and data on the appropriateness of a single BTA categorical standards* [sic] *for offshore oil and gas extraction facilities and seafood processing facilities. Today's rule would continue to require that the BTA for existing offshore oil and gas extraction facilities and seafood processing facilities be established by NPDES permit directors on a case-by-case basis using best professional judgment. See Section V.H*[707]

Response:

Like all other facilities, existing offshore facilities should be subject to categorical standards that minimize adverse environmental impact. EPA determined that a categorical standard requiring technologies more advanced than the screens presently in use on ocean going vessels would "result in unacceptable changes in the envelope of existing platforms, drilling rigs, mobile offshore drilling units (MODUs), seafood processing vessels (SPVs), and similar facilities as the technologies would project out from the hull, potentially decrease the seaworthiness, and potentially interfere with structural components of the hull."[708] EPA should

[706] 76 Fed. Reg. at 22,273 (col. 2); *see also* 76 Fed. Reg. at 22,195 (col. 3).

[707] 76 Fed. Reg. at 22,273 (col. 2); *see also* 76 Fed. Reg. at 22,196 (col. 1).

[708] 76 Fed. Reg. at 22,195-96 (col. 3).

clarify whether, in reaching the conclusion that no better categorical standard is technically feasible, it considered (1) installation of variable speed pumps that would better match cooling water intake with process needs, and (2) operational changes, such as limiting or delaying activities that require cooling water intake while a vessel is in near-shore and other highly biologically productive waters.

Additionally, as discussed above in Section III.E.10 of these comments, EPA should clarify the text of proposed 40 C.F.R. § 125.91(d) to make it clear that only offshore seafood processing facilities – i.e., ocean going vessels – are exempt from the categorical standards proposed.

The following section of this comment letter is most relevant to this request for comment:

- III.E.10 - EPA Should Clarify that Only Offshore Seafood Processing Facilities, not Onshore Facilities, Are Exempt from the Rule.

3. **Cost-cost Alternative From Phase II Rule.** *EPA does not have technical data for all existing facilities. EPA concluded that the Phase II rule costs provided in Appendix A are not appropriate for use in a facility-level cost-cost test. See Section III. Moreover, under the national requirements EPA is proposing today, EPA concluded that a specific cost-cost variance is not necessary because the Director already has the discretion to consider such factors. EPA requests comment on these conclusions.*[709]

Response:

The cost data provided in Appendix A to the Phase II rule are highly speculative, unreliable, irrelevant to today's rulemaking, out-dated, problematic in numerous other respects and should not be considered in facility level cost-cost tests because, among other things, they reflect only EPA's estimate of the cost of installing screens at some facilities. As EPA recognizes that screens are less effective than closed-cycle cooling, the screens-only cost data is of limited utility. If EPA establishes a variance from a national standard based on closed-cycle cooling, and if that variance mechanism allows for consideration of costs (which is not required), then the appropriate comparison will be between a facility's cost of implementing closed-cycle cooling and EPA's estimate of the average cost of such conversions nationwide.

As noted above, and as explained further in the attached report of Powers Engineering, EPA's current estimates for the costs of closed-cycle cooling are significantly overestimated. Finally, the compliance costs to be considered in any cost-cost variance should include only capital expenditures, operation and maintenance, and energy penalty, not speculative, indirect add-on costs.

The following sections of this comment letter are most relevant to this request for comments:

[709] 76 Fed. Reg. at 22,273 (col. 3).

- III.B - EPA Should Establish a National Categorical Entrainment Standard Based on Closed-Cycle Cooling;

- III.F.3 - EPA Overestimated the Costs of Closed-Cycle Cooling.

4. **Entrainment Survival.** *There are circumstances where certain species of eggs have been shown to survive entrainment under certain conditions, however EPA has not received any new data for either the most common species or the species of concern most frequently identified in available studies. For purposes of today's national rulemaking, entrainment is still presumed to lead to 100 percent mortality. See Section VI. Today's proposed rule would allow facilities to demonstrate, on a site specific basis, that entrainment mortality of one or more species of concern is not 100 percent. EPA requests comment on this approach.*[710]

Response:

As explained more fully above, in any instance where entrainment monitoring is conducted, EPA should not allow permitees to attempt to demonstrate that entrainment mortality is less than 100 percent at their particular site. Assessing entrainment mortality on a site-specific and species-specific basis is administratively unworkable and will lead to significant delays in the permitting of cooling water intake structures for little gain.

The following section of this comment letter is most relevant to this request for comments:

- III.E.3 - EPA and States Should Maintain an Assumption of 100 Percent Entrainment Mortality in All Site-Specific Proceedings.

5. **Alternative Impingement Mortality Compliance Requirements.** *EPA requests comment and data on a provision that would require facilities seeking to comply with the impingement mortality standard by meeting an intake velocity requirement either to demonstrate that the species of concern is adequately protected by the maximum intake velocity requirements, or else to employ fish friendly protective measures including a fish handling and return system. EPA is considering this provision because the Agency is concerned that some facilities that comply with the impingement mortality requirements by reducing intake velocity to 0.5 fps or less, may still impact species of concern. See Section VI.D.1.a.*[711]

Response:

As discussed above, EPA should require existing facilities to reduce their intake velocity to 0.5 ft/s and should additionally require those facilities with travelling screens to employ fish

[710] 76 Fed. Reg. at 22,273 (col. 3).

[711] 76 Fed. Reg. at 22,273 (col. 3); *see also* 76 Fed. Reg. at 22,203 (col. 3).

friendly protective measures including a fish handling and return system because reducing intake velocity alone is not sufficient to protect fish.

The following section of this comment letter is most relevant to this request for comments:

- III.C - Although the Establishment of National Categorical Standards for Impingement Is Necessary and Appropriate, the Proposed Standards Are Impermissibly Weak and Problematic in Numerous Respects.

In addition, with respect to the term "species of concern" please see:

- III.E.1 - EPA Should Clarify the Meaning of the Term "Species of Concern" and Restore Additional Protections for These Species;
- III.E.2 - EPA Should Prevent Directors from Excluding Any Species from the Rule's Scope
- III.G - EPA Cannot Issue a Final Rule Without First Consulting NMFS and FWS and Fully Complying with its Duties under Other Applicable Federal Environmental Laws.

6. **Monthly and Annual Limits on Impingement Mortality.** *EPA requests comment on the need to tailor the impingement mortality requirements of today's proposal to account for site-specific circumstances and/or technologies, including location of cooling water intakes that impinge relatively few fish or other approaches that achieve impingement mortality reductions equivalent to the proposed performance standards. For example, if EPA were to consider number of fish killed as an alternative, it might statistically model the data or select the minimum observed value. Studies and information supporting these alternatives would be most helpful. EPA also requests comment on the monthly and annual limits in the proposed rule and way in which they were calculated.*[712]

Response:

In general, EPA should not set (or ask Directors to set) impingement mortality limits on a site-specific basis. Nor should EPA's national uniform standard for impingement mortality be set on a percentage basis, as the agency now proposes. Instead, EPA should set a nationally uniform technology standard that minimizes both impingement and entrainment based on the performance of closed-cycle cooling systems and a velocity limit of 0.5 ft/s. As discussed above, the percentage mortality approach that EPA has adopted at present is flawed, and the 12 percent annual and 31 percent monthly limits are based on very limited data. Moreover, EPA and states are not permitted to weaken technology-based standards on the basis that the source waters are already "degraded."

The following sections of this comment letter are most relevant to EPA's request for comments:

[712] 76 Fed. Reg. at 22,273 (col. 3); *see also* 76 Fed. Reg. at 22,187 (col. 3), 22,203 (col. 1).

- III.C - Although the Establishment of National Categorical Standards for Impingement Is Necessary and Appropriate, the Proposed Standards Are Impermissibly Weak and Problematic in Numerous Respects.

  In particular:

  - III.C.1 - EPA Should Establish A National Categorical Impingement Standard Based on Closed-Cycle Cooling.

  - III.C.3 - The 12 Percent/31 Percent Impingement Mortality Reduction Requirement Is Problematic In Numerous Respects.

- Appendix B - Comments of Dr. Peter Henderson and Richard Seaby, PISCES Conservation, Ltd.

7. **Flow Basis for Option.** *EPA requests comment on both the threshold and the flow basis for a variation of option 2 that would use 125 MGD Actual Intake Flow (AIF) rather than a 125 MGD Design Intake Flow (DIF) as the threshold. See Section VI.D.2.*[713]

Response:

EPA should maintain the use of a DIF threshold rather than an AIF threshold. A DIF threshold is simpler to establish and the administrative burden on states of vetting claims from applicants is already considerable; EPA should not increase that burden.

Also, demand for energy has declined somewhat during the current economic downturn. A facility may currently have a historically low AIF, but without an enforceable commitment to maintain the current rate of operations in the future, the facility may not stay below the AIF threshold for long as the economy recovers. Once the NPDES permit is issued it will not be revised, and with many states facing a NPDES permitting backlog that sees facilities operate on administratively continued permits for years – or, in some cases, decades – an erroneous determination that a facility falls below the threshold may go uncorrected for ten years or longer.

If EPA is concerned about the costs or feasibility of a national categorical standard for entrainment, it must undertake a thorough effort to craft a national standard by looking at various thresholds and options for subcategorizing the more than 1,200 facilities with cooling water intake structures affected by this rule. But those thresholds should be set on a clear and easily determined basis. DIF provides such a basis; AIF does not.

8. **Waterbody Type as a Basis for Different Standards.** *EPA's reanalysis of impingement and entrainment data does not support the premise that the difference in the density of organisms between marine and fresh waters justifies different standards. More specifically, the average density of organisms in fresh waters may be less than that found*

[713] 76 Fed. Reg. at 22,274 (col. 1); *see also* 76 Fed. Reg. at 22,206 (col. 1).

on average in marine waters, but the actual density of aquatic organisms in some specific fresh water systems exceeds that found in some marine waters. EPA also believes the different reproduction strategies of freshwater versus marine species make broad characterizations regarding the density less valid a rationale for establishing different standards for minimizing adverse environmental impact. EPA requests comment on its proposal not to differentiate requirements by water body type.[714]

Response:

EPA has provided a firm environmental basis for not distinguishing between facilities situated on different waters of the United States: the variation in organism densities and reproduction strategies within marine and freshwater ecosystems is sufficiently high that no category of waterbodies can be singled out for different treatment. EPA should therefore maintain its intention to set uniform national impingement standards across all water bodies (though these should be improved, as noted above), and EPA should also set a uniform national entrainment standard (based on the use of closed-cycle cooling) across all water bodies.

There is also a legal requirement for uniform national standards across all waters of the United States. Congress intended "that the 'design' of intake structures be regulated directly, based on the best technology available, and without resort in the first instance to water quality measurements."[715] Closed-cycle cooling and a velocity limit of 0.5 ft/s are the best technologies available to minimize adverse environmental impacts in all waters of the United States. Congress intended that the best technologies available be used, and that technology-based standards not be relaxed based on assessments of local water quality, which in this context means considerations of the density or reproductive strategies of the aquatic populations in a particular water body.

Establishing different standards for different water bodies based on their existing ability to support certain densities and populations would allow facilities to impact the remaining and badly stressed aquatic populations in water bodies that have already been severely harmed by prior use as industrial dumping grounds. This runs directly contrary to the Clean Water Act's goals of *restoring* and maintaining aquatic ecosystems, and courts forbade this outcome in the earlier *Riverkeeper* litigation.[716]

The following section of this comment letter is most relevant this request for comment:

- I.B.2 – The 1972 CWA Amendments Fundamentally Restructured U.S. Water Pollution Regulation by Replacing Ineffectual Site-Specific Assessments of Water Quality with National Technology-Based Standards;

9. **Capacity Utilization Rating as a Basis for Different Standards.** *Electric generating facilities may still continue to withdraw significant volumes of water when not generating*

[714] 76 Fed. Reg. at 22,274 (col. 1).

[715] *Riverkeeper I*, 358 F.3d at 190; *see also Riverkeeper II*, 475 F.3d at 108-09.

[716] *See Riverkeeper II*, 475 F.3d at 108-09.

electricity. Further, EPA found that load-following and peaking plants operate at or near 100 percent capacity (and therefore 100 percent design intake flow) when they are operating. Peaking facilities (those with a CUR of less than 15 percent, as defined in the 2004 Phase II rule) may withdraw relatively small volumes on an annual basis, but if they operate during biologically important periods such as spawning seasons or migrations, then they may have nearly the same adverse impact as a facility that operates year round. EPA requests comment on its decision not to exclude facilities with a low capacity utilization rate. Comments who believe that EPA should include a CUR threshold in the final rule should provide a suggested threshold and explain the basis for it.[717]

Response:

EPA is correct to avoid setting any kind of capacity utilization rate threshold for the reasons that the agency has already articulated.

10. **Flow Commensurate With Closed-Cycle Cooling.** *EPA requests comment on whether the demonstration that a facility's flow reduction will be commensurate with closed-cycle cooling should be based on a defined metric, or determined by the permitting authority on a site-specific basis for each facility. EPA is proposing that a facility seeking to demonstrate flow reduction commensurate with closed-cycle cooling using flow reduction technologies and controls other than through closed-cycle cooling (e.g., through seasonal flow reductions, unit retirements, and other flow reductions) would have to demonstrate total flow reductions approximating 97.5% for freshwater withdrawals and 94.9% for saltwater withdrawals. See Section IX.D.*[718]

Response:

The 97.5 percent freshwater/94.9 percent saltwater flow reduction metrics that EPA has proposed for determining when a facility has reduced its intake flow commensurate with closed-cycle cooling are clear and workable, and supported by EPA's record. They should be maintained in the final rule. But in that final rule, these metrics should apply to all facilities, not merely to new units at existing facilities. As explained above, EPA is required to set a uniform national standard under this rule based on the performance of closed-cycle cooling systems. There is no need, or legal basis, for EPA to require permitting authorities to define "commensurate" anew at every facility.

11. **Credits for Unit Closures.** *EPA requests comments on the proposed approach to allow credits for unit closures to be valid for 10 years from the date of the closure. In EPA's current thinking this approach reasonably allows facilities to get credit for flow reductions attributable to unit closures, but also requires such facilities to make future progress to ensure its operations reflect best available entrainment controls. See Section IX.D.*

[717] 76 Fed. Reg. at 22,274 (col. 1).

[718] 76 Fed. Reg. at 22,274 (col. 2); *see also* 76 Fed. Reg. at 22,253 (col. 3).

Response:

EPA should not allow any "credit" whatsoever for flow reductions attributable to unit closures. Plant operators may choose to close a unit, but the remaining units must still use BTA to minimize the adverse environmental impacts of their cooling water intake structures.

12. **Land Constraints.** *EPA requests comment on the use of a ratio for determining the land constraint threshold for retrofit construction of cooling tower, as well as data for determining alternative thresholds. EPA has not identified any facilities with more than 160 acres/1000MWs that EPA believes would be unable to construct retrofit cooling towers. EPA is exploring the use of such a ratio to support determinations regarding adequate land area to construct retrofit cooling towers. See Section IX.D (footnote 1).*[719]

Response:

As explained in the attached engineering report prepared by Powers Engineering, EPA's estimate that as many as 25 percent of facilities might have space constraints that would limit retrofit of cooling towers for the entire facility or increase compliance costs is vastly overblown because EPA's assessment is based on the use of land-intensive in-line cooling towers, not the much more space efficient back-to-back cooling tower configuration. A back-to-back cooling tower configuration requires about 17 percent of the space needed for two in-line towers for the same cooling capacity, assuming the spacing recommended for parallel banks of in-line towers. Because cooling towers can be installed in a back-to-back configuration at virtually any site, EPA should not set a "limited acreage" exemption (such as the 160 acres per gigawatt threshold the agency is exploring) and should acknowledge that cooling towers are an available technology for the industry as a whole.

The following sections of this comment letter are most relevant this request for comment:

- III.B.2.b.1 – There Is Adequate Space for Cooling Towers at Virtually Any Plant Site;
- Appendix D – Comments of William Powers, P.E., Powers Engineering

13. **Proposed Implementation Schedule.** *EPA requests comment on its proposed schedule for implementing the proposed rule. The proposed schedule uses a phased approach for information submittal, requiring some facilities to submit application materials as soon as six months after rule promulgation. The longest timeframe for information submittal would not exceed seven years and six months. EPA solicits comment on the proposed schedule, and specifically seeks comment and data on the appropriate amount of time to collect data, conduct reviews, obtain comment, provide for public participation, and issue final permit conditions. See Section IX.E.*[720]

[719] 76 Fed. Reg. at 22,274 (col. 2); *see also* 76 Fed. Reg. at 22,252 (col. 3).

[720] 76 Fed. Reg. at 22,274 (col. 2); see also 76 Fed. Reg. at 22,254 (col. 3).

Response:

EPA's proposed schedule for information submittal is entirely too long and should be cut in half. As EPA noted in the Proposed Rule, facilities with a DIF greater than 50 MGD were previously subject to the withdrawn Phase II rule and therefore should have already compiled much of the proposed application data which can be used to meet many of the information submittal requirements.[721] The maximum time frame for impingement compliance should be shortened to three years or less. Further, completion of cooling tower retrofits should be required no later than 36 months after approval of the application at fossil plants, and no more than 48 months after approval at nuclear plants (nuclear plants may need additional time to synchronize the retrofit outage with a refueling outage).[722]

The following sections of this comment letter are most relevant to EPA's request for comments:

- III.B.4 - EPA Should Shorten the Entrainment Compliance Timelines.

- III.C - Although the Establishment of National Categorical Standards for Impingement Is Necessary and Appropriate, the Proposed Standards Are Impermissibly Weak and Problematic in Numerous Respects.

  In particular:

  - III.C.4 - EPA Should Select the 0.5-Feet-per-Second Velocity Limit as the Impingement Standard for the Final Rule.

14. Methods for Evaluating Latent Mortality Effects Resulting From Impingement. *EPA requests comment on methods for evaluating latent mortality effects resulting from impingement. EPA requests comment on whether it should specifically establish 24 or 48 hours after initial impingement as the time at which to monitor impingement mortality. EPA's record demonstrates that a holding time of no more than 48 hours is optimal for evaluating the latent mortality associated with impingement while at the same time minimizing mortality associated with holding the organisms. See Section IX.F.1.*[723]

Response:

EPA should not measure latent mortality from impingement at all. Instead, EPA should eliminate the 12/31 percent impingement mortality standard as a compliance option and set a 0.5 ft/s velocity limit to control impingement as the national standard.

Measuring latent mortality is deeply problematic. As EPA acknowledges, "there are no standard methods for conducting impingement and entrainment studies and that there can be

[721] *See* 76 Fed. Reg. at 22,254 (col. 2).

[722] *See* Powers Report.

[723] 76 Fed. Reg. at 22,274 (col. 3); see also 76 Fed. Reg. at 22,257 (col. 3).

variability in designing a sampling plan between sites."[724] That variability, along with the complexity of the biological issues involved, will inevitably lead to disputes, delays and uncertainty. Also, latent mortality may occur after more than 48 hours. While EPA is not proposing a longer latency period because of the potential for greater mortality as a result of the holding, the fact remains that mortality which occurs 72 or 96 hours after the impingement event would not be measured at all under the Proposed Rule. As the attached biological report from PISCES Conservation explains, latent impingement mortality has been demonstrated to occur 96 hours after the impingement event. Thus, if latent mortality evaluations are conducted, they must include a holding time of at least 96 hours.

It is both more straightforward and more effective to reduce impingement altogether by lowering intake velocities, rather than allowing unlimited impingement but attempting to reduce the mortality rate. EPA has already concluded that "a design through-screen velocity of 0.5 feet per second would be protective of 96% of motile organisms" and is better than attempting to reduce impingement mortality through the use of technologies such as modified travelling screens.[725] The evidence shows not only that 18 percent of intake structures presently meet the 0.5 ft/s velocity limit but also that many existing facilities can meet it.[726]

The following sections of this comment letter are most relevant to this request for comment:

- III.C - Although the Establishment of National Categorical Standards for Impingement Is Necessary and Appropriate, the Proposed Standards Are Impermissibly Weak and Problematic in Numerous Respects.

In particular:

  - III.C.2 – EPA's Rejection of the 0.5 Ft/S Velocity Limitation as the Primary National Standard Is Illegal.
  - III.C.3 - The 12 Percent/31 Percent Impingement Mortality Reduction Requirement Is Problematic In Numerous Respects.

- Appendix B - Comments of Dr. Peter Henderson and Richard Seaby, PISCES Conservation, Ltd.

15. Counting Impinged Organisms With the "Hypothetical Net." *EPA requests comment on the "hypothetical net" approach to measuring impingement mortality. Facilities could apply a "hypothetical net" in that they could elect to only count organisms that would not have passed through a net with 3/8" mesh. For example, a facility that uses a finemesh screen or diverts the flow directly to a sampling bay would only need to count organisms that could be collected if the flow passed through a net,*

[724] *Id.* at n.103.

[725] *See* 76 Fed. Reg. at 22,204 (col. 3).

[726] *See* TDD, Ch. 6.

screen, or debris basket fitted with 3/8'' mesh spacing. See Section IX.F.1. EPA further solicits comment on alternative approaches that would not penalize facilities for employing fine mesh screens.[727]

Response:

The response to this request is similar to the previous response: EPA should not measure impingement mortality at all. Instead, EPA should eliminate the 12/31 percent impingement mortality standard as a compliance option and set a 0.5 ft/s velocity limit to control impingement as the national standard. Furthermore, as the PISCES report explains, there is not a distinct cut-off for the size of animal that will pass through a 3/8"inch mesh. It depends on many factors, such as body shape of a particular species (long thin forms can pass through the mesh when many times longer than 3/8"), the angle at which a fish approaches the mesh (head on, most fish are smaller than side on), the amount of debris already on the mesh, among other factors.

16. **Incentives for Reducing I&E by Reducing Water Withdrawals.** *EPA requests comment on incentives or alternative requirements for exceptionally energy efficient or water efficient facilities. See Section III. EPA also solicits comment on the regulatory provisions that encourage the use of recycled water as cooling water, including reclaimed water from wastewater treatment plants and process water from manufacturing facilities, EPA solicits comment on other incentives to encourage use of recycled water to supplement or replace marine, estuarine, or freshwater intakes.*[728]

Response:

In principle, the commenters support efforts to encourage the conservation, use and reuse of water and believe that EPA should incentivize the use of reclaimed water wherever possible. As discussed more thoroughly above, reclaimed water is widely available for use as cooling water and EPA has underestimated the availability of this resource. EPA should incentivize the use of reclaimed water by following the State of California in requiring that all facilities demonstrate that they have made use of all reasonably available reclaimed water for cooling before any withdrawal of water from a water of the United States is allowed.

However, we are concerned that EPA is not effectively encouraging reuse, and is instead providing a huge and unwarranted loophole from BTA requirements, when it exempts cooling water withdrawals where the water is also used for desalination. In particular, we have serious concerns about the blanket exemptions in Section 125.91(c) and Section 125.92. As drafted, these sections exempt water from the definition of "cooling water" if it is obtained from a desalination plant or is used in a manufacturing process either before or, more likely, after it is used for cooling purposes.

The problem arises because new desalination plants in California have received NPDES permits under the presumption that they will cause no net impact to the marine environment by

[727] 76 Fed. Reg. at 22,274 (col. 3).

[728] 76 Fed. Reg. at 22,274 (col. 3).

virtue of co-locating with power plants that will be required to employ the best technology available to minimize adverse impacts under 316(b).[729] But EPA's proposed rule would exempt a once-through-cooled power plant from Section 316(b) compliance if it gives its discharge water to a desalination plant. Consequently, in California (and soon in other states), both the power plant and the desalination facility will be able to claim that they cause no impact because the other user is the primary consumer, while their massive water withdrawal kills sea life through entrainment and impingement at exactly the same levels as before. To ensure the objective of Section 316(b) to minimize entrainment and impingement from cooling water intakes is achieved, the proposed language in the regulations must be re-written to eliminate any and all definitions or exemptions that would potentially allow power plants to be excluded from the regulations simply because a seawater desalination facility happened to co-locate with the power plant.

The following sections of this comment letter are most relevant to this request for comment:

- I.A.13 - Water Availability and Related Energy Impact
- III.E.5 - EPA Must Prohibit the Use of Freshwater for Once-Through Cooling in Arid Regions or Those at Risk of Drought.
- III.E.6 - EPA Should Not Exempt Cooling Water Withdrawals from the Rule Merely Because the Water Is Also Used for Desalination.

17. Options Which Provide Closed-Cycle Cooling as BTA. *EPA solicits comment on regulatory options that establish closed-cycle cooling as BTA. EPA specifically requests comment on the regulatory options 2 and 3 included in today's proposal, which would establish closed-cycle cooling as BTA for EM at a DIF of 2 MGD and 125 MGD, respectively. See Section VI and VII. EPA further solicits comment and supporting data on alternative thresholds, including whether such alternative thresholds should be based on DIF or AIF. EPA also solicits comment and supporting data for alternative criteria that would establish closed-cycle cooling as BTA for some facilities.*[730]

Response:

EPA should establish an entrainment standard based on closed-cycle cooling as envisioned in the agency's Option 3. Option 3 would set a national categorical standard based on closed-cycle cooling and include a narrow safety-valve variance for those plants with factors fundamentally different than the majority of plants that can meet such a standard. Option 3 would minimize adverse environmental impacts with feasible and readily affordable technology.

[729] *See, e.g.,* Cal. Reg'l Water Quality Control Bd., San Diego Region, Order No.R9-2009-0038 Amending Order No. R9-2006-0065 (NPDES No. CA0109223) Waste Discharge Requirements for the Poseidon Resources Corporation Carlsbad Desalination Project Discharge to the Pacific Ocean via the Encina Power Station Discharge Channel (May 13, 2009) (Exh. 136) *also available at* www.swrcb.ca.gov/rwqcb9/board_decisions/adopted_orders/2009/R9_2_009_0038_rev1.pdf.

[730] 76 Fed. Reg. at 22,275 (col. 1); see also 76 Fed. Reg. 22,205 (col. 1).

Contrary to industry's hyperbolic claims (many of which EPA uncritically accepted), Option 3 would not cause electric reliability problems, would not increase electricity prices, and would not cause any significant adverse environmental effects. Further, EPA's economic findings are unambiguous: the stronger the regulation, the greater the boost to the economy and job creation. At either discount rate EPA used in its analysis, Option 3 creates jobs and stimulates the economy to a greater degree than any of the other options. At a 7 percent discount rate, it produces 10,102 new jobs under EPA's analysis, but the actual benefits to the economy of Option 3 are likely much greater. Option 3 is therefore a job-creating rule that will improve the economy.

In its cost-benefit analysis, EPA was unable to quantify whole categories of benefits, and even where EPA was able to quantify benefits, it was unable to monetize the overwhelming majority of them. A complete cost-benefit analysis, if that were even possible using existing economic tools, would show that the benefits of Option 3 clearly exceed the costs and thus the benefits obviously justify the costs, and the costs are not wholly disproportionate to the benefits.

The following sections of this comment letter are most relevant to this request for comment:

- I.B.3 – As Part of the CWA's Technology-Based Regime, Section 316(b) Requires EPA to Adopt Uniform, National, Categorical, Technology-Based and Technology-Forcing BTA Standards for Cooling Water Intake Structures;

- I.C – Regulatory Background: For Forty Years, Regulation on a Case-by-Case Site-Specific Basis Has Caused Bureaucratic Paralysis and Perpetuated the Unacceptable Status Quo, Contrary to Congress's Intent;

- II.D – The Rulemaking Process: Changes Made at the Suggestion or Recommendations of OMB;

- III.A – EPA's Interpretation of Section 316(b) and its "Approach to BTA" Contradicts the Plain Meaning of the Act and Congress's Clearly Expressed Intent;

- III.B – EPA Should Establish a National Categorical Entrainment Standard Based on Closed-Cycle Cooling; and

- III.F – EPA's Cost-Benefit Analysis is Deeply Flawed and Illegal.

18. Costs of Controls to Eliminate Entrapment. *EPA assumes facilities with modified traveling screens including a fish handling and return system would meet the proposed requirements to eliminate entrapment of fish and shellfish. EPA believes those facilities with an offshore velocity cap leading to a forebay but without a fish return system would incur costs to meet the proposed requirements for entrapment. For facilities with closed-cycle cooling systems, EPA does not have data on the number of facilities that also have a fish handling and return system. Further, EPA does not have data on the number of facilities that have less than 0.5 feet per second intake velocity but have a cooling water*

intake system that may cause entrapment. EPA solicits comment and data on the types and numbers of facilities with a cooling water intake system that may cause entrapment, and the costs to eliminate entrapment.[731]

Response: No comment.

19. **Analysis of New Capacity.** *EPA requests comment on the number of new units and the amount of new capacity construction projected. See Section VII.*[732]

Response:

As discussed above, even the most expensive of EPA's options will cause so few power plant retirements that the number of new units and amount of new capacity is irrelevant. Any retirements would be replaced many times over under even the most modest new capacity projections.

20. **Monitoring Reports.** *EPA solicits comment on how frequently I&E mortality monitoring reports should be submitted. EPA further solicits comment on incorporating the monitoring reports into monthly DMRs, or whether less frequent reporting is appropriate. EPA also requests comment on whether minimum monitoring frequencies should be established in this rule or left to the discretion of the Director. See Section IX.*[733]

Response:

To the extent biological monitoring is conducted pursuant to the rule, EPA should specify minimum monitoring requirements that meet the expectations it laid out in the preamble, rather than leaving monitoring terms to be determined by the Director. It is inefficient for each state to reinvent monitoring requirements (as EPA would have it) dozens of times – once for each facility.

The following sections of this comment letter are most relevant to this request for comment:

- III.E.4 - EPA Should Specify Minimum Monitoring Requirements.
- Appendix B - Comments of Dr. Peter Henderson and Richard Seaby, PISCES Conservation, Ltd.

21. **Seasonal Operation of Cooling Towers.** *EPA solicits comment on an option that would require cooling towers on some or all facilities but recognize the site-specific nature of EM by allowing seasonal operation of cooling towers during peak entrainment season.*

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[731] 76 Fed. Reg. at 22,275 (col. 1); *see also* 76 Fed. Reg. at 22,251 (col. 2) and 76 Fed. Reg. at 22,204 (col. 3)

[732] 76 Fed. Reg. at 22,275 (col. 1).

[733] 76 Fed. Reg. at 22,275 (col. 1); *see also* 76 Fed. Reg. at 22,262 (col. 2).

EPA also requests comment on including a similar provision for new units at existing facilities, which are required to achieve I&E reductions commensurate with closed-cycle cooling in the proposed rule.[734]

Response:

Closed-cycle cooling should operated year-round because of the potential to entrain and impinge aquatic organisms well beyond "peak entrainment season." To the extent that a facility operating closed-cycle cooling nevertheless entrains large numbers of organisms during peak entrainment season, additional fish protective measures should be required, such as seasonal outages.

22. New Unit Provision. *EPA solicits comment on the new unit provision. Specifically, EPA solicits comment on the clarity of the definition of new unit, and whether it should be expanded to include other units such as those that are repowered or rebuilt. EPA also solicits comment on whether the new unit provision should be deleted, therefore subjecting these units to the same site-specific entrainment BTA determination required of existing units.*[735]

Response:

EPA should revert to the new units definition and standards that it proposed to OMB with minor revisions noted above. The version of the proposed rule that EPA sent to OMB would have required all replacements, repowerings, and rebuilt power plants to meet standards based on closed-cycle cooling because those plants have the ability to include closed-cycle cooing systems as part of the initial design of the rebuilt, repowered or replacement plant. But OMB modified those provisions such that only "new units at existing facilities," a very narrowly-defined class of entities, now have to meet the closed-cycle cooling standards.

Neither the rule, nor the preamble, provide any justification for not treating replaced, repowered, or rebuilt facilities as new units. The reasons that EPA gave for strictly regulating additional units apply equally to total replacements and repowerings[736] – this is evident from the version of the preamble that EPA sent to OMB. The current rule irrationally distinguishes between two total replacements of a facility. If an owner replaces every inch of the site, it is a new facility. But if the owner completely demolishes and replaces everything at the existing facility except for the cooling water intake structure itself, it is an existing facility. Yet all the equipment necessary to meet a closed-cycle cooling standard is built behind the cooling water intake structure.

EPA's technical experts agreed that the reasons for considering an additional unit to be a new unit apply equally to replacements and repowerings, but they were overruled by OMB.

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[734] 76 Fed. Reg. at 22,275 (col. 2).

[735] 76 Fed. Reg. at 22,275 (col. 2).

[736] As do the reasons EPA gave for strictly regulating new facilities back in 2001, in the Phase I rule.

OMB has not justified its proposed change, and in any case the office does not have technical expertise. For EPA to accept OMB's unjustifiable modification to the rule is arbitrary and unreasonable; it is also inconsistent with Congress's intent to control mortality at cooling water intakes.

The following sections of this comment letter are most relevant to EPA's request for comments:

- II.D.3 - OMB Determined that Replacements/Repowerings Are Not New Units and Deleted EPA's Contrary Statements and Rationale.

- III.D - All Repowered, Replaced, or Rebuilt Facilities Must Be Subject to the Same Closed-Cycle-Cooling-Based Requirements as New Units at Existing Facilities.

23. Review Criteria to Guide Evaluation of Entrainment Feasibility Factors. EPA solicits comment on the criteria specified in the regulation for guiding the evaluation of closed-cycle cooling as BTA for EM. EPA further solicits comment on additional criteria that EPA should address, and whether such criteria should be developed in the regulation or provided in guidance.[737]

Response:

State permitting directors should not be required to evaluate whether closed-cycle cooling is the best technology available to minimize entrainment on a site-specific basis because EPA's record evidence supports – and the Clean Water Act requires – establishing a national categorical standard based on the performance of closed-cycle cooling systems. Further, the evidence shows that states are incapable of making these determinations in a timely manner, if at all, and certainly not in the manner that EPA envisions in the proposed rule. But in cases where a facility seeks a variance from national standards, Directors will be required to determine whether a variance is warranted. As discussed above, EPA should carefully tailor any variance provision and set rules for the Director to follow in apply that variance.

The following section of this comment letter is most relevant to this request for comments:

- III.B.5 – Any Variance EPA Includes as Part of a Categorical Entrainment Standard Must Clearly Delineate What Issues May Be Considered by the Director and How They Are to Be Considered.

24. Alternative Procedures for Visual or Remote Inspections. *EPA requests comment on its proposal to permit the Director to establish alternative procedures for conducting visual or remote inspections during periods of inclement weather. EPA also requests comment on whether the rule should specific minimum frequencies for visual or remote*

[737] 76 Fed. Reg. at 22,275 (col. 2).

inspections, or leave this to the determination of the permitting authority. See Section IX.F.[738]

Response:

EPA should maintain the requirement that cooling water intake structures be inspected at least weekly to ensure that any technologies installed to comply with § 125.94 are maintained and operated to ensure that they will continue to function as designed.

25. **Threshold for In-Scope Facilities.** EPA requests comment on the threshold of DIF greater than 2 MGD for identifying facilities in-scope of this rule.[739]

Response:

The 2 MGD DIF threshold is appropriate for defining the universe of facilities within the scope of the Clean Water Act. Facilities above this level have an impact on water bodies that is more than *de minimis* and the 2 MGD threshold matches the threshold set in the Phase I rule. If EPA is concerned about costs and impacts on small business of meeting a national standard that is also suitable for the nation's largest power plants, EPA must undertake a thorough effort to craft a national standard by looking at various thresholds and options for subcategorizing the more than 1,200 facilities with cooling water intake structures affected by this rule. But EPA should not and cannot set a higher threshold and leave all below-threshold facilities to have their BTA determination made on a BPJ basis.

26. **Application Requirements.** *EPA requests comment on the burden and practical utility of all of the proposed application requirements. EPA is particularly interested in the burden of application requirements to facilities with DIF < 50 MGD. EPA also requests comment on its proposal to limit application requirements for facilities that have already installed closed-cycle cooling, or opt to do so without a site-specific assessment of BTA, and whether there are additional requirements that could be relaxed for this group.*[740]

Response:

The application burdens imposed by the open-ended case-by-case process in the Proposed Rule can be dramatically lessened by selecting Option 3. This would avoid the need for 1,200 site-specific applications, with multiple studies included in each application. Such studies would only be required in the context of a variance from a uniform national closed-cycle cooling standard. To the extent that EPA leaves any significant aspect of cooling water intake regulation to site-specific determination, the studies that EPA is requiring as part of the proposed application requirements are necessary and unavoidable. EPA, the states, and the public lack reliable information as to specific power plants' technologies, operations and fish kills and the

[738] 76 Fed. Reg. at 22,275 (col. 2); *see also* 76 Fed. Reg. 22,259 (col. 2).

[739] 76 Fed. Reg. at 22,275 (col. 2).

[740] 76 Fed. Reg. at 22,275 (col. 2); *see also* 76 Fed. Reg. at 22,249 (col. 2).

required studies should fill this data gap. Application requirements can be lessened for facilities with closed-cycle cooling or those that opt to install closed-cycle cooling.

27. **Comment from State and Local Officials.** EPA specifically requests comment on this proposed rule from State and local officials. See Section X.E.[741]

Response:

As discussed above, many states have previously commented to EPA that they lack the resources and expertise to make BTA determinations or conduct cost-benefit analyses on a site-specific, case-by-case basis in the absence national categorical standards.

The following sections of this comment letter are most relevant to this request for comments:

- I.C. Regulatory Background: For Forty Years, Regulation on a Case-by-Case Site-Specific Basis Has Caused Bureaucratic Paralysis, Litigation Quagmires, and the Perpetuation of the Unacceptable Status Quo, Contrary to Congress's Intent.
- III.B.1.c(1) – States Cannot Complete Case-By-Case BTA Determinations.
- III.B.1.c(2) – States Cannot Conduct, or Meaningfully Review, Site-Specific Cost-Benefit Analyses.

28. **Comment From Tribal Officials.** EPA specifically requests additional comment on this proposed action from Tribal officials. See Section X.F.

Response: No comment.

B. Responses to Additional Requests.

In addition, the preamble also contains other specific requests for comments that were not included in the list of 28 responded to above. We respond to these, which appear at various places in the preamble, here.

From Preamble Section VI.C.

EPA also considered applying a confidence or tolerance limit to the long-term average in deriving the annual average standard. EPA rejected this approach because EPA believes that facilities can achieve better long-term performance than documented in the data by maintaining tight control on their technology and operations and adaptively managing the technology to achieve the best possible performance. While EPA has not included any additional costs for this adaptive management, EPA believes that such adaptive management should be part of the routine maintenance an operation of the technology

[741] 76 Fed. Reg. at 22,275 (col. 3).

and additional costs should not be necessary. EPA has occasionally used annual limits in the effluent guidelines program (most recently for the pulp and paper industry category (40 CFR 430, promulgated in 1998) and has previously not included a variability factor for annual limits. Thus, EPA's proposed approach to calculating the annual standard for mortality impingement is consistent with past practice. ***EPA requests comment*** *on its proposed approach for calculating and implementing the annual standard. This technology does not minimize adverse environmental impacts associated with entrainment, and does not specifically address impingement mortality of shellfish.*[742]

Response:

As noted above, EPA should not measure impingement mortality as a percentage of impingement at all. Instead, EPA should eliminate the 12/31 percent impingement mortality standard as a compliance option and set a 0.5 ft/s velocity limit to control impingement as the national standard. Please see the responses above to EPA's fourteenth and fifteenth requests for comments.

But it is conceivable that, in the context of a variance from a national impingement standard that requires facilities to meet a 0.5 ft/s velocity limit, measuring impingement mortality may be necessary. In that situation, EPA should not apply a variability factor for the reasons EPA presents in the preamble.

From Preamble Section VI.D.1.b.

Entrainment Controls

The proposal would require consideration of site-specific entrainment controls for each facility above 2 MGD DIF. EPA considered proposing no further controls to address entrainment mortality, and to rely instead only on the BTA impingement mortality controls, which would achieve up to a 31 percent reduction in total AEI. EPA has not selected this option as the basis for national BTA because EPA believes that some facilities may be able to do more to control entrainment and that requiring a structured site-specific analysis of candidate BTA technologies for entrainment control will allow the Director to determine where it is appropriate to require such controls. However, one outcome of the site specific analysis may be that the Director would determine that no other technologies beyond impingement control meet the criteria for election as BTA, because no other technologies are feasible and/or their benefits do not justify their costs. ***EPA requests comment*** *on the option of basing national BTA on impingement controls only and dropping the specific requirement for a structured site specific analysis of entrainment BTA options, as discussed below.*[743]

Response:

The evidence that EPA has gathered compels EPA to establish an entrainment standard based on closed-cycle cooling as envisioned in the agency's Option 3 because closed-cycle cooling is the best technology available. Anything less –particularly a decision to set no

[742] 76 Fed. Reg. at 22,203 (col. 2-3).
[743] 76 Fed. Reg. at 22,205 (col. 1).

entrainment standard at all – is a wholesale abdication of EPA's statutory duty. Congress specifically enacted Section 316(b) to address the massive fish kills caused by closed-cycle cooling. EPA has consistently found that the primary adverse environmental impacts of cooling water intake structures are impingement and entrainment. EPA has no authority to require BTA for minimizing impingement only and not entrainment.

The following sections of this comment letter are most relevant to this request for comment:

- I.A – Factual Background: Once-Through Cooling Causes Adverse Environmental Impacts of Staggering Proportions;
- I.B. – Congress Enacted Section 316(b) as Part of the 1972 Clean Water Act Amendments to Standardize Permitting and Minimize Once-Through Cooling's Massive Water Withdrawals and Fish Kills;
- III.A – EPA's Interpretation of Section 316(b) and its "Approach to BTA" Contradicts the Plain Meaning of the Act and Congress's Clearly Expressed Intent;
- III.B – EPA Should Establish a National Categorical Entrainment Standard Based on Closed-Cycle Cooling; and
- III.F – EPA's Cost-Benefit Analysis is Deeply Flawed and Illegal.

From Preamble Section VI.E. Option Selection

> ***EPA solicits comment*** *on Option 4 and the impacts, including the cumulative impacts of today's proposal on small entities generally.*[744]

Response:

Option 4 is the least protective and most legally inadequate of all the options that EPA considered and should be given no further consideration.

> ***EPA also requests comment*** *on whether, if Option 4 were adopted for the final rule, it should include uniform national requirements for new units at existing facilities with DIF less than 50 MGD based on closed-cycle cooling.*[745]

Response:

Option 4 is the least protective and most legally inadequate of all the options that EPA considered and should be given no further consideration. New units (as properly defined) with a DIF of 2 MGD or above should be subject to uniform national requirements based on closed-cycle cooling.

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[744] 76 Fed. Reg. at 22,208 (col. 2).

[745] 76 Fed. Reg. at 22,208 (col. 2).

From Preamble Section VI.I. EPA's Costing of the Preferred Option

These hypothetical scenarios illustrate the site-specific costs if a significant number of facilities install and operate a closed-cycle cooling system. These scenarios assume facilities would install only closed-cycle cooling and operate it year-round. This may represent an upper-bound cost for those facilities. EPA also assumed that cooling towers will be installed at fossil fuel plants within 10 years. EPA is aware that there are other possible scenarios for projecting which facilities might be required to install closed-cycle cooling or other entrainment mortality technologies as a result of individual BTA determinations. Some of these would show lower or higher costs than those presented here. ***EPA requests comment*** *on other scenarios that might better capture the range of costs that result from the structured analysis of entrainment mortality BTA required by today's proposed rule.*[746]

Response:

As explained above, and in more depth in the attached report of Powers Engineering, EPA overestimated the costs of closed-cycle cooling. The greatest flaw in EPA's approach to estimating the cost of retrofits was EPA's irrational decision, in 2007, to abandon its own thoroughly documented cost estimation model and instead use unverified figures provided by the Electric Power Research Institute (EPRI), which is an arm of the electric power industry being regulated by the rule. Consequently, EPA has overestimated the costs of closed-cycle cooling by approximately 60 percent.

The following sections of this comment letter are most relevant to this request for comment:

- III.F.3 - EPA Overestimated the Costs of Closed-Cycle Cooling.
- Appendix D – Comments of William Powers, P.E., Powers Engineering

From Preamble Section IX.B. ***When would affected facilities be required to comply?***

...if a facility plans to retrofit to wet cooling towers to both reduce entrainment mortality and to use the resulting lower intake velocity to comply with requirements for impingement mortality, the Director may be able to allow for compliance with the IM requirements to extend to the same schedule as the entrainment mortality requirements. However, where the Director determines a facility would need longer than 8 years to comply with the EM requirements established by the Director, the proposed rule would not allow the compliance schedule for IM to extend beyond 8 years. EPA recognizes that this limitation may penalize facilities that might install cooling towers to meet both IM and EM requirements but are unable to complete installation within 8 years. ***EPA requests comment*** *on this limitation.*[747]

[746] 76 Fed. Reg. at 22,211 (col. 2).

[747] 76 Fed. Reg. at 22,248 (col. 2).

Response:

In the draft of this proposed rule that EPA originally sent to OMB, the agency explained the firm eight year deadline for impingement compliance by saying that it "does not intend for the facility to do nothing to reduce [impingement] until the technologies for [entrainment] have been implemented." All facilities should be able to install closed-cycle cooling in less than eight years, and impingement controls should be required in three years or less. To the extent that a facility installs closed-cycle cooling to meet impingement and entrainment standards, and the retrofit is expected to take longer than usual, the facility should be required to install interim measures to reduce impingement.

From Preamble Section IX.D. ***What information must I submit in my permit application?***

Section 122.21(r)(12) Non-Water Quality Impacts Assessment

EPA recognizes that in some cases it may be efficient for permit applicants to combine several of the required studies into a single document and have them reviewed holistically by a single set of peer reviewers. Such an approach is not precluded by the proposed rule as long as the peer review panel has the background appropriate to conduct the combined review and the permitting authority approves. ***EPA requests comment*** *on the peer review requirements and the level of specificity regarding peer review in the draft rule text.*[748]

Response:

The current study process is deeply flawed because consultants and peer reviewers will be hired and paid by the applicant. In many cases, they will become advocates for the applicant's position rather than impartial adjudicators. This risk is multiplied because most applicants are repeat players: the parent company owns or operates multiple facilities and can provide pliant consultants and reviewers with a steady stream of work. Even if applicants pay for the cost of conducting studies and peer reviews, the integrity of the analytical process can only be assured if the State, not the applicant, selects the contractors and oversees the studies.

Under 125.94(d)(2), EPA would allow facilities to implement technologies other than closed-cycle cooling systems that reduce entrainment mortality by at least 90 percent of what would have been obtained via flow reduction commensurate with closed-cycle cooling under 125.94(d)(1). This compliance provision mirrors the Track II provision of the Phase I rule, and is intended to provide opportunities for facilities to consider technologies such intake relocation or fine mesh screens, or operational measures such as the recycle and reuse of cooling water for other purposes... ***EPA seeks comment*** *on this provision.*[749]

[748] 76 Fed. Reg. at 22,253 (cols. 1-2).

[749] 76 Fed. Reg. at 22,254 (col. 2).

Response:

EPA should clarify that, in seeking to comply with the entrainment mortality requirement by demonstrating reductions in mortality that are commensurate with use of a closed-cycle system, a facility must aim for 100 percent, and if it falls short within 10 percent, that will be acceptable. It may not, however, aim for 90 percent and achieve only an 89 percent reduction in entrainment mortality.

The following sections of this comment letter are most relevant to this request for comment:

- III.D.2 – All Repowered, Replaced, or Rebuilt Facilities Must Be Subject to the Same Closed-Cycle-Cooling-Based Requirements as "New Units at Existing Facilities."
- IV – Additional Revisions to the Phase I Rule Are Warranted in Light of the *Riverkeeper I* Decision.

From Preamble Section IX.J. What is the Director's role under today's proposal?

(4) The Director would review and approve the site-specific impingement mortality plan including the duration and frequency of any monitoring beyond the minimum specified by the rule, the monitoring location, the organisms to be monitored, and the method in which naturally moribund organisms would be identified and taken into account. ***EPA solicits comment*** *on whether the Director should review, but not approve, the identified plans.*[750]

Response:

EPA should not measure impingement mortality at all. Instead, EPA should eliminate the 12/31 percent impingement mortality standard as a compliance option and set a 0.5 ft/s velocity limit to control impingement as the national standard. Please see the responses above to EPA's fourteenth and fifteenth requests for comments.

However, if a facility should face technical constraints that prevent it from complying with a 0.5 ft/s velocity limit and impingement mortality monitoring is required, monitoring plans should depend on approval by the Director. Facilities should not be able to design their own monitoring plans without oversight because sampling is an expense that plant operators will want to minimize, they have every incentive to propose minimal sampling frequencies and to scale down the extent of monitoring in every other way.

At the same time, however, the Director's ability to approve monitoring studies, as set forth in proposed 40 CFR § 125.98(c)(6), should be revised to prevent state permit directors from excluding "other specific species," which are neither invasive nor naturally moribund, from monitoring, sampling, and study requirements. Since BTA determinations and compliance with

[750] 76 Fed. Reg. at 22,260 (col. 3).

BTA standards will be in large part determined through monitoring, sampling and studies, this "species of [no] concern" provision would allow states to simply ignore, rather than minimize, mortality to certain species.

The following sections of this comment letter are most relevant to this request for comment:

- III.E.2. – EPA Should Prevent Directors from Excluding Any Species from the Rule's Scope.

> *(6) The Director would review and approve the site-specific entrainment mortality sampling plan for new units at existing facilities (other than those employing closed-cycle cooling) including the duration and frequency of monitoring, the monitoring location, the organisms to be monitored, and the method in which latent mortality would be identified.* ***EPA solicits comment*** *on whether the Director should review, but not formally approve, the identified plans.*[751]

Response:

As with impingement monitoring, entrainment monitoring plans should also depend on approval by the Director. Facilities should not be able to design their own monitoring plans without oversight because sampling is an expense that plant operators will want to minimize, they have every incentive to propose minimal sampling frequencies and to scale down the extent of monitoring in every other way.

At the same time, however, the Director's ability to approve monitoring studies, as set forth in proposed 40 CFR § 125.98(c)(6), should be revised to prevent state permit directors from excluding "other specific species," which are neither invasive nor naturally moribund, from monitoring, sampling, and study requirements. Since BTA determinations and compliance with BTA standards will be in large part determined through monitoring, sampling and studies, this "species of [no] concern" provision would allow states to simply ignore, rather than minimize, mortality to certain species.

The following section of this comment letter is most relevant to this request for comment:

- III.E.2 – EPA Should Prevent Directors from Excluding Any Species from the Rule's Scope.

[751] 76 Fed. Reg. at 22,260 (col. 3) - 22,621 (col. 1).

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To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
From: CN=Elizabeth Southerland/OU=DC/O=USEPA/C=US
Sent: Thur 5/3/2012 11:28:25 AM
Subject: Re: Water-Energy Nexus
sfleischli@nrdc.org
www.nrdc.org

Ex. 5 - Deliberative

From: "Fleischli, Steve" [sfleischli@nrdc.org]
Sent: 05/02/2012 02:37 PM AST
To: Bob Rose
Cc: Nancy Stoner
Subject: Water-Energy Nexus

Bob,

It was nice to meet you today at the EPA brownbag lunch on water. Attached is the comment letter I mentioned regarding power plant cooling water issues. I think both you and Nancy might find the discussion on pages 16-22 and 110-117 relevant to your water-energy nexus work. Please let me know if you have any questions or would like additional details.

Sincerely,

Steve

Steve Fleischli | Senior Attorney, Water Program | Natural Resources Defense Council

Office: 202.289.2394 Cell: 415.577.2206 | 1152 15th Street NW, Suite 300, Washington, DC 20005

sfleischli@nrdc.org | www.nrdc.org | Twitter: @NRDCWater

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To: CN=Nancy Stoner/OU=DC/O=USEPA/C=US@EPA[]
Cc: "Jeff Lape" [lape.jeff@epa.gov]; Ephraim King" [King.Ephraim@epamail.epa.gov]; Maryt Smith" [Smith.Maryt@epamail.epa.gov]
From: CN=Robert Wood/OU=DC/O=USEPA/C=US
Sent: Thur 12/15/2011 1:17:02 AM
Subject: Re: FERC, EPA, and DOE

Yes, I'll follow up and let you know result. Remember we also have Steam Electric Power ELG on track for July NPRM.

Robert Wood, Deputy Director
Engineering and Analysis Division
Office of Science and Technology
Office Water
U.S. EPA
202-566-1822 (w)
202-329-8053 (c)

----- Original Message -----
From: Nancy Stoner
Sent: 12/14/2011 07:37 PM EST
To: Robert Wood
Subject: Fw: FERC, EPA, and DOE

I think for us that is 316b. Not sure who is on point at EPA on this. Can you follow up?
Nancy K. Stoner

----- Original Message -----
From: "Azar, Lauren" [Lauren.Azar@Hq.Doe.Gov]
Sent: 12/14/2011 01:19 PM EST
To: Julia Miller; Joe Bryson; Cynthia Giles-AA; Lawrence Starfield; Lisa Lund; David Hindin; Nancy Stoner; aastanislaus; Joseph Goffman; Gina McCarthy; Maryt Smith; Paul Shriner; Mark Eads; "'joseph.mcclelland@ferc.gov'" <joseph.mcclelland@ferc.gov>; "'michael.bardee@ferc.gov'" <michael.bardee@ferc.gov>; "'james.pederson@ferc.gov'" <james.pederson@ferc.gov>; "'john.carlson@ferc.gov'" <john.carlson@ferc.gov>; "'martin.kirkwood@ferc.gov'" <martin.kirkwood@ferc.gov>; "'christy.walsh@ferc.gov'" <christy.walsh@ferc.gov>; "'jaime.simler@ferc.gov'" <jaime.simler@ferc.gov>; Phillip Brooks; Peter Tsirigotis
Cc: "Smith, Becca" <Becca.Smith@hq.doe.gov>; "Mansueti, Lawrence" <Lawrence.Mansueti@hq.doe.gov>; "Callaghan, Caitlin (CONTR)" <Caitlin.Callaghan@Hq.Doe.Gov>; "Stone, Renee" <Renee.Stone@Hq.Doe.Gov>; "Bindewald, Gilbert" <Gilbert.Bindewald@hq.doe.gov>; "DeCesaro, Jennifer" <Jennifer.Decesaro@hq.doe.gov>; "Richards, John" <John.Richards@Hq.Doe.Gov>; "Hoffman, Patricia" <Pat.Hoffman@hq.doe.gov>
Subject: FERC, EPA, and DOE

Dear EPA and FERC Colleagues:

As a follow-up to the FERC technical conference, I thought it would be helpful if FERC, DOE and EPA would meet to discuss our respective roles and responsibilities as the EPA rules begin to affect the electric generation industry. The rules are expected to come out on or before the 16th, so I would

recommend a meeting next week. Given the importance of this topic, I am willing to clear my calendar for a time that captures as much of this group possible. I propose we consider meeting at DOE next Tuesday, December 20th at 3:00pm (with a call in line).

Please identify a lead contact for your office and have him/her contact Becca Smith at Becca.smith@ee.doe.gov (or 202-586-9788) to rsvp or propose alternative times for your representatives. If there are critical contacts not included on this email, please include them as well. Becca will send a calendar invite for the time that works best by COB tomorrow.

P.S. While we should ultimately include NERC in our discussions, we can invite them after the federal agencies have had an opportunity to discuss this topic among themselves.

Thank you,

Lauren Azar
Senior Advisor to the Secretary
U.S. Department of Energy

To: info@hegerpumps.com[info@hegerpumps.com]
From: "Siegfried Heger"
Sent: Mon 5/14/2012 11:53:50 PM
Subject: Service Water Filter that does not entrain or impinge fish, larvae, fish egg and other biota
Heger Filtrex sf.pdf
Filtrex Backwashable Microfilter HE012009.pdf
info@hegerpumps.com

Are you looking to SCREEN /FILTER large amounts of raw water out of a river, lake or ocean ?

EPA 316 b rule ?

Is the only choice you have right now to “screen” the water ?

Do you have a problem with organisms getting either “stuck” or are not affected by the screen and enter your system ?

Why don’t you go a step further and actually “FILTER” the water with the Filtrex inlet water filter for unlimited amounts of water.

The entrainment and/or impingement of fish, larvae, fish egg, and other biota have been a longstanding problem in the design of intake systems for withdrawal of large quantities of water from surface water sources.

Because of the small size of fish eggs (e.g. 0.5 mm) and larvae (e.g. 0.34 mm), the potential to ingest and destroy eggs and larvae in inlet “SCREENS” is very high.

There is a technology that works - Filtrex -

In an effort to address the above issues and to develop an alternative method of intake screening/filtration that can be environmentally viable, Filtrex Technology was developed as an alternative approach to large scale service intake systems that destroy large amounts of biota.

If you know someone in your organization who could benefit from this information, please forward it to them.

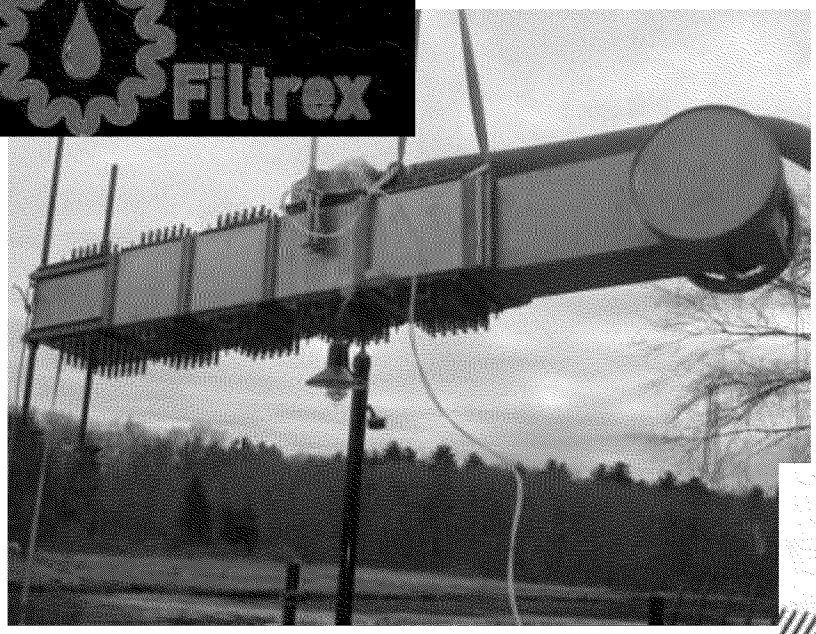
For more information send e-mail to info@hegerpumps.com

We also FILTER the following:

Wastewater
Recreational

Process water
Storm Water
Cooling water
Chemicals
Pharmaceuticals and cosmetics
Fuels and petroleum chemicals
Coatings, paints and ink
RO pre-filtration
Resins and adhesives
Process fluids
Coolants and Oils

Filtrex



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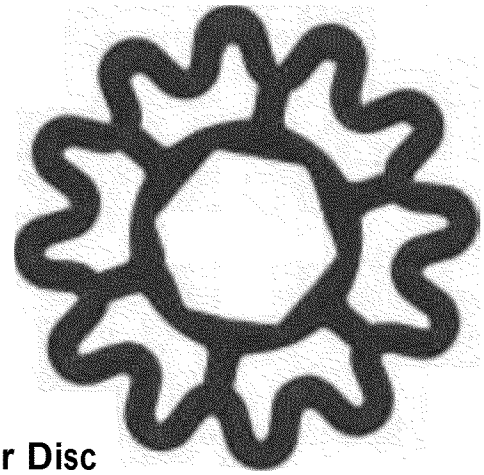
NOT SCREENING

FILTERING !

NO DAMAGE TO LARVEY & FISH EGGS



Filter Disc

Municipal Applications

The entrainment and/or impingement of fish, larvae, fish egg, and other biota have been a longstanding problem in the design of intake systems for withdrawal of large quantities of water from surface water sources.

Because of the small size of fish eggs (eg. 0.5mm) and larvae (eg. 0.34mm), the potential to ingest and destroy eggs and larvae in inlet "SCREENS" is very high. There is a technology that works - Filtrex -

In an effort to address the above issues and to develop an alternative method of intake screening/ filtration that can be environmentally viable, Filtrex Technology was developed as an alternative approach to large scale service intake systems.

For more information on the Filtrex System please contact us at

info@hegerpumps.com

Heger Pumps, Inc. - Filtrex, Long Beach, CA 90807

562-989-5432

Filtrex Backwashable Microfilter

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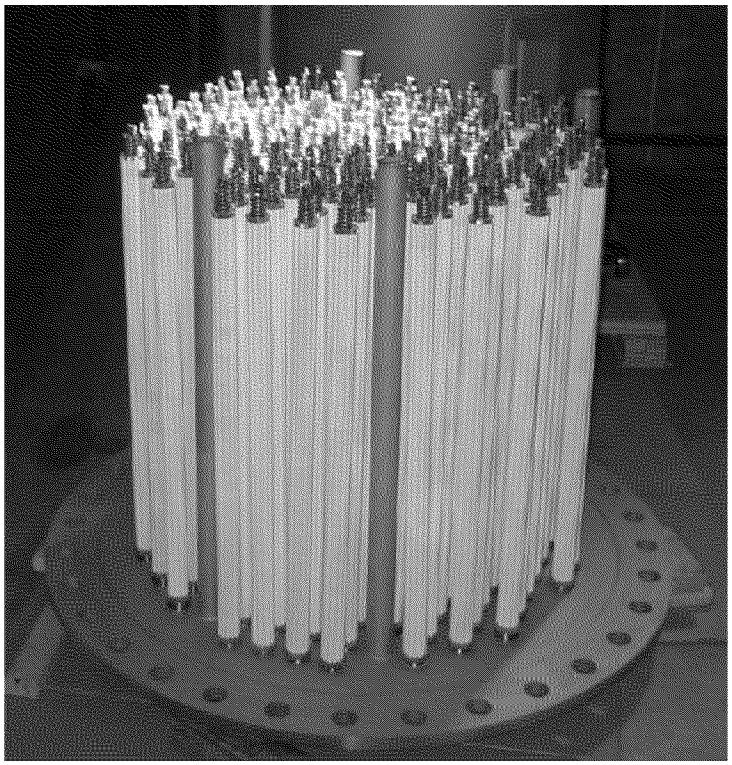
Filtrex Corporation presents the future of industrial fluid treatment

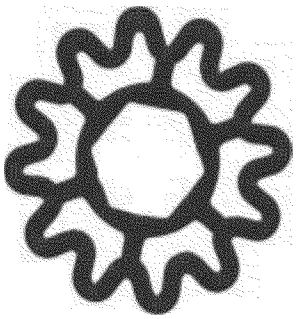
Filtrex's innovative backwashable Micro Filtration System is both cost-effective and environmentally friendly

The key to our systems superior performance is the ingenious Filtrex candle system



Filter Media

Our patented Filtrex wafer is an arcaded design, thermoplastic wafer with micro-grooves precisely etched on each of its arced surfaces. It has integral element cavities which serve as fluid conduits and a center hexagonal cavity which is used to stack the elements in perfect alignment.



The micro-grooves follow a distribution pattern which allows for the maximum utilization of the element's surface area. The number of micro-grooves varies from one element rating to another. For example, a 5-micron rated element will have over 2000 micro-grooves etched on its surface. The construction material of the Filtrex wafer is as varied as the number of engineered injectable thermoplastics.

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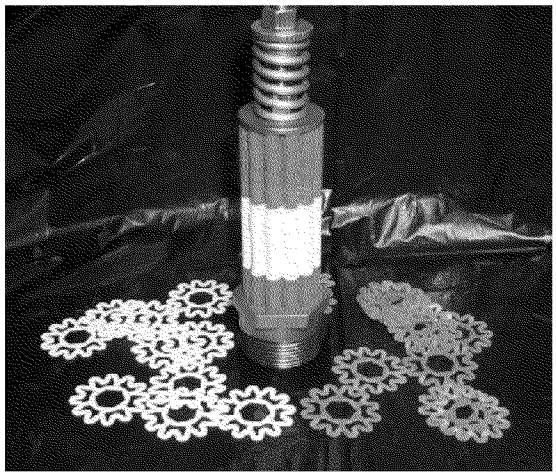
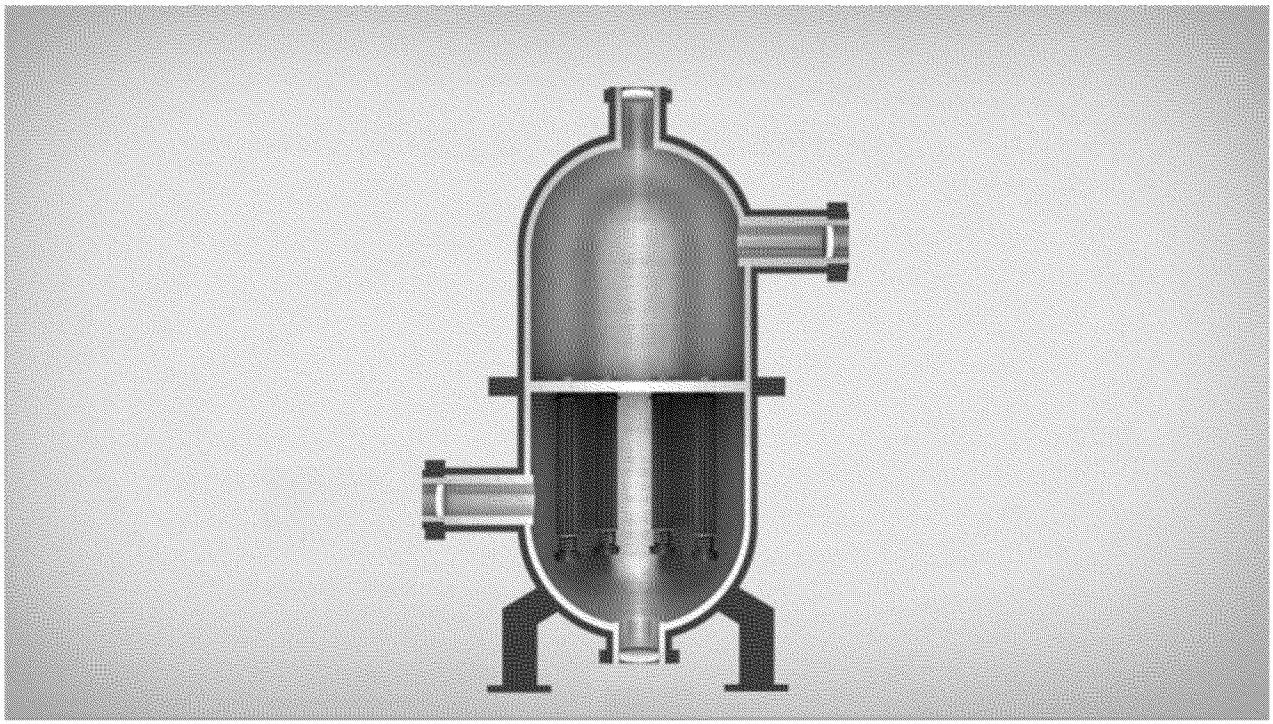
Filter Candle



Barring abnormal applications, the thermoplastic wafers are permanently re-usable, which means no costly throw-away media like cartridges or paper, and no harm done to the environment.

They have the ability to self-clean in the backwashing cycle which minimizes system maintenance.

When stacked in perfect alignment over a hexagonal support core, the wafers form a very tough filter candle which is capable of filtering particulate as small as 5 micron. For even finer filtering capability, a pre-coat of DE can be added to the filter candles making them suitable for even the most demanding conditions.



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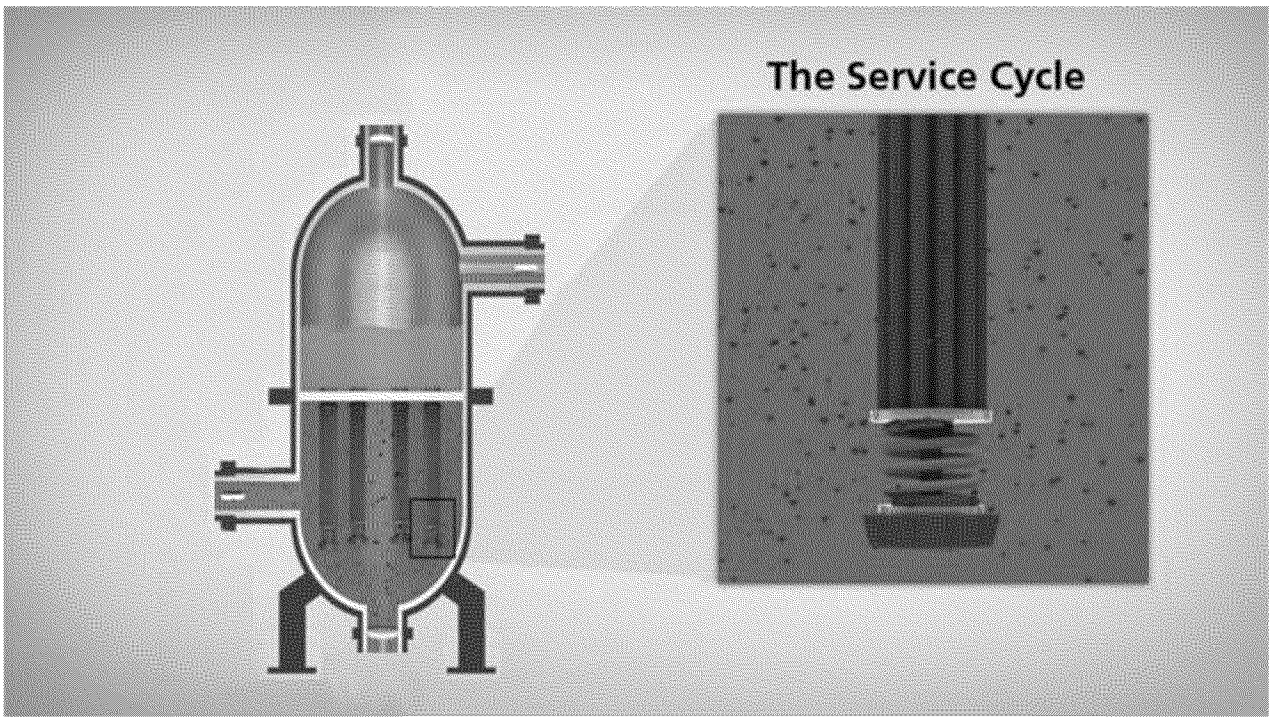
How it works

Depending on the application, the Filtrex candles are grouped into a vessel, which contains anywhere from a single candle to as many as several hundred candles. The vessel consists of an upper and lower chamber. During the Service cycle, the unfiltered fluid enters from the lower chamber, flowing across the candles where filtration will occur. The solid laden fluid enters the candles through the microgrooves where the contaminants are intercepted, and then flows upwards through the cavities in the wafer/candles.

The clean fluid is transported through these cavities into the upper chamber and out to the service connections. As the Service cycle continues, the contaminants will cake on to the candle surface. As the cake thickens, the differential pressure between the clean chamber and the dirty chamber will increase until it reaches a predetermined value, at which point the backwash cycle will be initiated.



Backwash Cycle

Once backwashing is initiated, the contaminated fluid inlet is closed; the clean fluid chamber is pressurized using air, or any other compatible gaseous media, to between 50-120 psi. The drain valve is opened, and the clean pressurized fluid, from the upper chamber, flows through the candles in reverse at high velocity.

Filtrex Backwashable Microfilter

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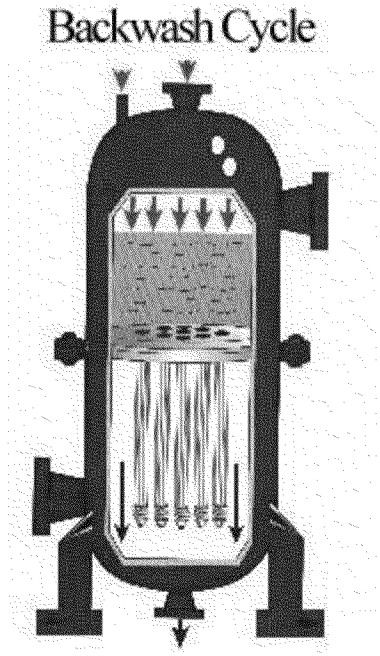

Separation during backwash is achieved by hydraulic and mechanically applied forces. As the fluid flow reverses direction during cleaning, the resulting hydraulic force impacts the compression plate and causes the spring to compress, thus momentarily releasing the compression of the wafer stack and causing their separation. This action breaks up the created filter cake and dislodges any contaminant that would otherwise be extremely difficult to remove. This action takes under a minute using a minimal amount of the clean fluid. (1000 gpm system appr 250 gallons)

Once clean, the Service cycle begins again.

Automated Cycle no down time

Filtrex provides the necessary state-of-the-art technology capable of delivering the ultimate in filtering efficiencies. This high standard of excellence is achieved with the absolute minimum of maintenance and negligible operator interface plus virtually no costly down time.

SAVINGS

Reduced Operational Costs - Savings are quite large in applications where high solid loadings & hazardous waste production is an issue.

Reduced Hazardous Waste Handling & Production - Throw away media such as cartridges, paper and others, normally make up most of the hazardous waste volume; in some cases it exceeds 70% of total volume. In Filtrex Systems the only hazardous waste is the contaminant itself.

Minimum Operator Interface - This reduces cost and exposure to hazardous material.

Permanent Filter Media -The system elements are normally manufactured from materials which are compatible with various chemicals and service conditions, precluding abnormal applications, the service life of the elements could be indefinite.

Backwash Fluid Requirements Are Minimal - If compared with the backwashing of a sand filter. The Filtrex System requires a small fraction of clean fluid for backwashing. Example, for a service flow of 1000 gpm., the sand filter will need 45000 gallons of clean water to backwash. The Filtrex unit will need only 250 gallons.

Custom Design & Engineering - Filtrex will design and supply units to match the exact requirements of any particular application. Almost all systems are field tested and are configured for ease of integration with the end users' existing installations.

APPLICATIONS

Water & Waste Water

Typical Filtrex applications include bottled water, R.O. membrane protection, pond water, cooling tower water, gas & oil drilling make-up water, D.I. water, waste water and dairy wash water.

Process & Chemical Fluids

The Filtrex Systems have produced outstanding results with Processed & Chemical Fluids, such as resins, paints, photographic solutions, ink manufacture, adhesives, herbicides & pesticides, sodium sulfates, cellulose nitrates, sodium chlorides, sulfuric acid and many, many more

Petroleum

Meeting the ever growing demands of the petroleum industry, Filtrex applications include: amine feedstock, reduced crude, fuel & motor oil, injection fluid, synthetic lubricant and completion fluids.

Paper Industry

Filtrex meets the exacting demands of the paper industry. Applications in this field include: Intake water, coolant water, waste water, white water, green & black liquor, mill water, dyes, pump seal water, decker shower water, clay slurry and all wet end additives.

Food & Beverages

Filtrex leads the way in the filtration processes of food & beverage production. Including: corn syrup, dextrose, Caro, jelly, juices, edible oils, milk sugar, city & well water, extracts, chocolates, soybeans, beer & wine production

Municipal and Power Plant Applications

The entrainment and/or impingement of fish, larvae, fish egg, and other biota have been a longstanding problem in the design of intake systems for withdrawal of large quantities of water from surface water sources.

As part of the **Clean Water Act Section 316 (b)** rules, the EPA monitors and regulates "the location, design, construction and capacity of water intake structures" to require that they reflect "the best technology available for minimizing adverse environmental impact(s)."

Because of the small size of fish eggs (e.g. 0.5 mm) and larvae (e.g. 0.34 mm), the potential to ingest and destroy eggs and larvae, when large amounts of water are taken

for cooling towers, water treatment plants and other industrial plants is probably the most significant issue this ruling has to deal with.

In an effort to address the above issues and to develop an alternative method of intake screening/filtration that can be environmentally effective as well as operationally acceptable, an investigation was initiated to analyze the performance and to demonstrate the effectiveness of the Filtrex technology as an alternative approach to large scale service intake systems.

Two major tests were carried out on the Filtrex system. One was done by Alden labs and the other was an actual field test carried out on the Taunton River Desalination Plant.

Please ask for Test Reports.

Typical Filter Applications:

- Wastewater
- Recreational
- Process water
- Storm Water
- Cooling water
- Chemicals
- Pharmaceuticals and cosmetics
- Fuels and petroleum chemicals
- Coatings, paints and ink
- RO pre-filtration
- Resins and adhesives
- Process fluids
- Coolants and Oils
- Service water intakes Power Plants

Filtrex Features:

- Removal down to nominal 5 micron
- Custom engineering solutions for every application
- Instant Backwash Technology
- Patented Filter Element
- Solids removed regardless of specific gravity
- Regenerative DE Filter
- Optional Perforated, mesh or wedge-wire screen elements
- Biota removal without damaging fish eggs and small fish
- unlimited inflow capability