NUCLEAR ENERGY INSTITUTE

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March 10, 2010

Ms. Pilar Patterson
Chief, Bureau of Surface Water Permitting
New Jersey Department of Environmental Protection
P.O. Box 029
Trenton, NJ 08625

Dear Ms. Patterson:

My name is Dr. William Skaff. I am Manager of Policy Development at the Nuclear Energy Institute. I testified at the New Jersey Department of Environmental Protection hearing on the Oyster Creek Generating Station draft water discharge permit on February 24. These written comments are submitted to supplement my previous testimony.

During that hearing, Dr. Michael Kennish, of the Institute of Marine and Coastal Sciences at Rutgers University, began his testimony by saying that he needed to correct a mischaracterization of his research on the ecology of Barnegat Bay provided by a previous testimony. He said that he and his colleagues had only studied the effects of nutrient overabundance on aquatic plant life and that their conclusions were not applied to aquatic animal life. Further study would be required, he said, to determine what effects the Bay's nutrient overload is having on its fish populations.

Source of Characterization

As I was the only person who had testified previous to him who had mentioned one of his studies, I can only assume that Dr. Kennish was referring to the characterization of the conclusions of his research in my testimony.

In my testimony, I did not say that Dr. Kennish studied aquatic animal life. I cited the conclusion expressed by Dr. Kennish and other scientists: because aquatic animal life heavily relies on or is negatively affected by the aquatic plant life that he *did* study, the nutrient–laden runoff that he identified as having a major impact on plant life is the major factor in the declining health of the Bay's aquatic animal life populations as well.

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I would like to provide to the Department the passages from his study, to which I referred in my testimony, that provided the basis of my statement of the results of his work:

Michael J. Kennish, et al.
"Barnegat Bay–Little Egg Harbor Estuary: Case Study of a Highly Eutrophic Coastal Bay System"
Ecological Applications, 17(5) Supplement 2007

Abstract. The Barnegat Bay–Little Egg Harbor Estuary is classified here as a highly eutrophic estuary based on application of the National Oceanic and Atmospheric Administration's National Estuarine Eutrophication Assessment model. Because it is shallow, poorly flushed, and bordered by highly developed watershed areas, the estuary is particularly susceptible to the effects of nutrient loading. . . . No point source inputs of nutrients exist in the Barnegat Bay watershed. . . . Eutrophy causes problems in this system, including excessive micro- and macroalgal growth, harmful algal blooms, altered benthic invertebrate communities, impacted harvestable fisheries, and loss of essential habitat (i.e., seagrass and shellfish beds). (p. S3) [emphasis added]

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Of greatest concern are nonpoint source nitrogen inputs that peak in waters of the northern estuary in closest proximity to the most heavily developed adjoining landmasses. (p. S4)

. . . . . .

[T]otal nitrogen loads into Barnegat Bay from the watershed may be nearly five times higher than those that occurred prior to wide-spread development of the watershed. (p. S10)

. . . . . .

Human activities in surrounding coastal watersheds have facilitated the transport of nutrients and sediments to the [mid-Atlantic] bays, leading to the observed degradation of the water and habitat quality, as well as the biotic communities, over the past several decades. (p. S12)

Concurrence with Characterization: Environmental Organization

The Trust for Public Land has published a description of Barnegat Bay's water quality that cites the studies of Dr. Kennish, his colleagues, and other researchers as its sources. This description concurs with my characterization of the results of this research in my testimony:

The Trust for Public Land
Barnegat Bay 2020: A Vision for the Future of Conservation
July 2008

The most visible side effect of development is the harm caused by runoff of fertilizers from lawns and farms, which is carried by streams and rivers into Barnegat Bay (this runoff is an example of what is known as non-point source pollution). High levels of phosphorus and other nutrients from fertilizers create an unnatural boom in plant and algal production, which in turn produces abnormal levels of oxygen in the water of streams and lakes as well as the bay. Conversely, when the plants and algae die, the decay process reduces the amount of oxygen. These wide variations in oxygen levels can cause massive fish kills and make habitats unsuitable for plant and animal life. Similarly, algal blooms caused by nutrient pollution, or eutrophication,

can prevent sunlight from reaching the benthic communities (bottom-dwelling plants and animals) that rely on the sun's energy. This is extremely damaging because benthic communities are the estuary's "backbone," forming a baseline energy source for animals further up the food chain.

Algal blooms also harm the Barnegat Bay estuary by blocking light to eelgrass and other plants. These grasses are in steep decline and are being replaced by invasive species. A host of finfish, shellfish, and waterfowl are dependent on eelgrass and other plants that once thrived in the bay's sunlightrich and brackish waters.

. . . . . .

Eutrophication appears to be directly related to the type and intensity of development within the Barnegat Bay watershed and is worse in the highly developed northern section of the bay around the Metedeconk River than near the southern, less developed section of the watershed. (p. 9)

Corroboration of Characterization: Federal Agency

The characterization in my testimony of the source of the aquatic life problem at Barnegat Bay, drawn from Dr. Kennish's study, is corroborated by the National Oceanic and Atmospheric Administration:

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries
September 1999

Eutrophication refers to a process in which the addition of nutrients to water bodies stimulates algal growth. In recent decades, human activities have greatly accelerated nutrient inputs, causing the excessive growth of algae and leading to degraded water quality and associated impairments of estuarine resources for human use.

. . . . . .

Decaying algae from the blooms uses oxygen that was once available to fish and shellfish. . . . These eutrophic symptoms are indicative of degraded water quality conditions that can adversely affect the use of estuarine resources, including commercial and recreational fishing, boating, swimming, and tourism.

. . . . . .

Recently, the consequences of these symptoms have become more apparent, helping to raise awareness of nutrient-related environmental problems. For instance, extensive losses of submerged aquatic vegetation and the associated loss of fish habitat have occurred, many coastal water bodies have suffered worsening episodes of low dissolved oxygen, and blooms of nuisance and toxic algae have been occurring in new areas. (pp. 1-2)

Corroboration of Characterization: State Environmental Agency

The characterization in my testimony of the source of the aquatic life problem at Barnegat Bay, drawn from Dr. Kennish's study, is also corroborated by the New Jersey Department of Environmental Protection itself:

New Jersey Department of Environmental Protection
Water Monitoring Standards
New Jersey Nutrient Criteria Enhancement Plan
April 2009

Nutrients (i.e., nitrogen and phosphorus), in and of themselves, are not generally harmful to the environment; in fact, they are necessary to promote growth among living things (USEPA, 2007). Under healthy conditions, nutrients exist as part of a balanced natural aquatic system (Smithee, 2007). Excessive concentrations of nitrogen or phosphorus (i.e., over-enrichment of nutrients) can cause adverse ecological impacts to surface waterbodies such as acceleration of or "cultural" eutrophication, an otherwise natural aging condition of such waterbodies, which in turn can cause impairment of existing and designated uses such as aquatic life, drinking water, and recreation. Accelerated eutrophication is characterized by reduced dissolved oxygen, extreme diurnal swings of dissolved oxygen or pH, increased turbidity (or decreased water clarity), loss of beneficial submerged aquatic vegetation, and increase in nuisance vegetation (excessive algae or macrophytes) that occur during the summer. (p. 7)

. . . . . .

All New Jersey waters are designated for aquatic life use, which includes the maintenance, propagation, and migration of natural and established fish, amphibians, reptiles, invertebrates, plants, and algae. Excessive nutrients may cause increases in algal growth. Chronic symptoms of over-enrichment include large diurnal swings in dissolved oxygen or pH, reduced spawning grounds and nursery habitats, fish kills, and the replacement of the natural flora and fauna with nutrient tolerant biota (USEPA, 2007). These problems can exhibit themselves locally or much further downstream leading to degraded estuaries, lakes and reservoirs, and to oxygen-starved hypoxic or "dead" zones where fish and aquatic life can no longer survive. Thus, nutrient overenrichment can cause impairment of aquatic life uses of surface waters (maintenance, migration, and propagation of the natural and established biota). (p. 8)

Conclusion

No one would disagree with Dr. Kennish's suggestion that further studies to determine the impact of nutrient overload on the aquatic animal life of Barnegat Bay would be beneficial. However, given the research and assessments quoted above, we do not need further studies that would quantify the extent of the adverse impacts of nutrient over-abundance on the habitat of aquatic animal life, and on them, to know that such an impact is already occurring and is the real problem at Barnegat Bay, based on the results of studies of plant life already conducted on the Bay.

Thank you for this opportunity to provide further information regarding my testimony.

Sincerely yours,

William Skaff, Ph.D.