UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

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By EMAIL and Mail

June 23, 2000

Robert Durand, Secretary
Executive Office of Environmental Affairs
Attention: MEPA Office
100 Cambridge Street
Boston, MA 02202

Subject: Kendall Square Station Equipment Upgrade Project, Cambridge, MA, Final Environmental Impact Report, EOEA No. 11754.

Dear Secretary Durand:

The US Environmental Protection Agency (EPA) has reviewed the above-referenced final Environmental Impact Report (FEIR) for the Kendall Square Station Equipment Upgrade Project, Cambridge, MA, which was prepared by TRC, on behalf of Southern Energy Kendall, LLC. Since filing the draft Environmental Impact Report (DEIR), Southern Energy has made some modifications to the Project. The primary change includes the option to use all three existing boilers as a backup to the new power generation equipment to supply additional steam sales during periods of high demand and when the new power generation equipment is offline. The original Project, as described in the DEIR, assumed the use of only one boiler as a backup.

The proposed Kendall Square Equipment Upgrade Project (Project) will generate a nominal 234 MW of electricity using combined-cycle technology and natural gas as the primary fuel. Specifically, the upgrade consists of replacing the three (3) existing main power boilers with a combustion turbine generator and a heat recovery steam generator. The upgrade will represent an increase in generating capacity which is currently 64 MW. Low sulfur [0.05%, by weight] Number 2 distillate oil would be used as the backup fuel for up to 30 operating days per year.

The Project proposal includes a once-through cooling system using the Charles River as the source and sink for the non-contact cooling water. The current cooling water intake structure will remain unmodified in the Upgraded Project. However, a fine-mesh barrier net across the cooling water inlet area purportedly to reduce impingement and entrainment effects during the spawning seasons is being proposed. Also as part of the Project, part of the discharge outfall will be extended to the bottom of the lower basin in the Charles River. The extended outfall will be fitted with a diffuser which will be designed to mix and disperse the heated effluent with the receiving water. Anticipated non-contact cooling water (NCCW) intake requirements for the Project are approximately 70 million gallons per day (MGD) on an annual basis and 80 MGD as the daily maximum withdrawn. This can be compared to the currently permitted requirements of 70 MGD as a monthly average and 80 MGD as a daily maximum. The current facility uses

approximately 250,000 gallons per day (gpd) of municipal water for boiler makeup, boiler blowdown and sanitary usage. The facility is proposing to withdraw approximately 0.632 MGD of makeup water (mainly for boiler water makeup) from the Charles River.

EPA-New England commends SE's effort to use the equipment upgrade project as a potential method to benefit the environment. As described in the comments in the DEIR, this project has positive air and land use impacts. The possible improvement of the water quality in the Lower Charles River Basin may facilitate the Clean Charles 2005 goals. While this Project certainly has potential, there are many questions that still need to be answered.

The following benefits associated with the project deserve to be specifically acknowledged:

1. the positive effects of avoiding greenfield development through the redevelopment of an existing industrial site;

2. the beneficial impacts to air quality associated with combined-cycle power technology for energy generating efficiency and emission reductions (notably NOX, SO2); and

3. the separation of storm water drainage from the combined sewer system and improved storm water management on the site.

As was stated in our previous comments on the DEIR, EPA acknowledges certain apparent institutional and infrastructure constraints on plans for improving habitat and water quality in the basin. First, a dam will continue to be in place, drastically altering the lower Charles from its natural march/estuary state and indigenous aquatic populations. Second, neither the former nor the current dam and lock system have precluded the migration of salt water to the lower basin. Third, the probability of one comprehensive project to correct all the water and habitat related problems in the basin is extremely low both financially and because of the uncertainties in predicting all outcomes from large water management approaches. As a result, an iterative approach to basin improvements may be desirable with contingencies for modifications and acknowledgments that each step is not a total and final solution. This project has the potential to be a positive contribution to such an iterative approach.

EPA-New England acknowledges the additional information that Southern Energy (SE) has provided based upon the comments of EPA-New England and others. Some comments were re-iterated if we did not feel an adequate response was given. The comments provided in this letter largely, though not entirely, focus on the proponent's responses to EPA-New England's comments on the Draft Environmental Impact Report (DEIR) that we still have concerns about. Comments are provided on the Alternative Analysis and Water Resources sections of the FEIR. In general, the FEIR addresses our comments pertaining to air quality. Any remaining issues relating to air quality will be addressed through the air permitting process. The majority of our concerns pertain to thermal loading, water quality and fish habitat. Due to time constraints, EPA-New England was not able to comment on everything we would have liked to. We look

forward to continue working with SE on NPDES permit decisions.

ALTERNATIVES ANALYSIS AND MITIGATING MEASURES

In general, the FEIR addresses the request for a more in-depth analysis for alternative cooling water systems. SE has done a more complete analysis of technical feasibility, cost, potential environmental impacts, and benefits. Far more technical information and costing data have been given in the FEIR relative to the alternative cooling water system possibilities.

An exception, however, is the treatment on the use of variable speed pumps. SE makes the misleading statement that ..."Little if any reduction in fisheries impact would occur compared to the current proposal. The current proposal involves shutting down one of the pumps serving any unit not being used for power or steam generation, so as to average no more than 70 MGD of annual withdrawal." First, the current permit calls for an average monthly flow limit of 70 MGD. One can generate significantly higher outputs of electric energy in a given month with a permit limit of 70 MGD, annual average versus monthly average. Secondly, reductions in flow will reduce the potential for entrainment of organisms into the cooling water system on a directly proportional basis. And, if the flow reductions are substantial (e.g., 50%), some decrease in impingement can be expected as a result of the corresponding decrease in the velocity vector. In order to be of maximum potential benefit to "representative important species", however, any flow reductions would need to occur during the spawning season, (usually spring and summer) which would result in a derating of power output during seasons where the demand for electricity is at its peak. It is unlikely that the proponent would defer to this mode of operation unless they were regulated to use variable speed pumps.

Regarding the analysis of alternatives, EPA-New England acknowledges that SE has redesigned the Project so that the permitted average annual discharge flow would not exceed 70 MGD. As indicated above, this still represents a seasonal increase from both current permitted flow of 70 MGD as a monthly average and a significant increase from current operations. EPA-New England would like Southern Energy to continue to assess the feasibility of the following alternatives: (1) maintaining existing permitted monthly average flows and associated thermal loads; and (2) maintained actual plant thermal heat loading (based on recent plant discharge records (past 5 years)). SE should evaluate resultant thermal, entrainment, and impingement impacts on fish and water quality for each of these alternatives.

The DEIR states that the Station currently requires an average of approximately 250,000 gallons per day (gpd) of process water (mainly for boiler water makeup). For the Upgraded Project, the process water requirements are estimated at 0.65 MGD on average, either from the Charles /River (preferably) or less preferably from the City of Cambridge. SE's preferred arrangement calls for diverting a portion of the heated NCCW effluent to a proposed treatment system which will remove total suspended solids (TSS) and total dissolved solids (TDS) such that the effluent from the treatment system can be used for boiler water makeup. SE then plans to discharge the reject water rich in total suspended solids and total dissolved solids with the remainder of the

NCCW. SE is advised, however, that the effluent limitation guidelines (ELGs) as presented in 40 CFR Part 423 (Steam Electric Power Generating Category) set forth permit limits on chemical pollutants such that each individual source of contamination must meet the standards set forth and no benefit can be gained by diluting one source of wastewater with another source of water.

Section 4.3.5 (Air Cooled Condensers) of the FEIR, discusses the applicability of air-cooled condensers as a cooling alternative. However, in the subsection (Section4.3.5.2) (Applicability and Costs) the proponent discusses the life cycle costs for a helper cooling tower with plume abatement. The cost of air-cooled condensers should be included in this subsection.

The FEIR describes a seasonal intake barrier net that is currently being tested and which will "essentially eliminate impingement and significantly reduce entrainment." SE should have tested this concept during the developmental stages of the proposed project and presented field study results in the FEIR. In the future, EPA requests that regulatory agencies are given an opportunity to provide input an review designs of mitigation measures that are to be tested.

As noted previously (December 23, 1999), EPA-New England requests that SE consider other mitigation measures. If, as described, a goal of the project is to improve the water quality of the basin, EPA-New England encourages Southern Energy to consider supporting additional means to this end since the diffuser alternative may be only one piece of an overall solution to improve habitat, water quality and water use opportunities in the basin. These might include:

1) supporting efforts to enhance the migratory passage of fish from the Harbor to the Upper Charles,

2) supporting efforts to preclude the salt water passage into the basin,

3) evaluating other alternatives for preventing salt water intrusion into the basin,

4) actively participating in the Clean Charles Coalition group of businesses, universities and hospitals working to meet the Clean Charles 2005 goals, and

5) performing storm water BMP effectiveness studies and/or demonstration projects to evaluated BMP alternatives for maximizing storm water pollutant removal from urban land uses and to serve as a model for other facilities.

EPA-New England encourages Southern Energy to take all steps to minimize the adverse impacts on fish populations in the lower Charles. While mitigation is not a substitute for operations and technologies directed at minimizing adverse inputs, mitigation is appropriate where adverse impacts occur. Given the potential impacts on migratory and non-migratory fish, EPA-New England strongly encourages Southern Energy to consider mitigating measures that would enhance the presence of populations of indigenous fish, shellfish and wildlife in the lower

basin.

As indicated in our comment letter on the DEIR, EPA-New England encourages SE to support effects to enhance the migratory passage of fish. The fish ladders at the Boston Harbor dam have been in disrepair for a number of years. Mitigation sponsored by SE also should consider improvements in upstream fish ladders at Watertown, Waltham, and beyond.

WATER RESOURCES

EPA-New England is concerned with the long periods of time that elevated temperatures will persist in the Lower Charles River Basin and the effect of this on water quality, algae blooms and fish avoidance. We continue to have several questions concerning model development and calibration including assumptions used in modeling different scenarios (e.g., critical conditions). As a result, it is premature for EPA-New England to fully evaluate the thermal impacts associated with the project. Therefore, we anticipate most of our comments on fisheries impacts will be during the NPDES permitting process when our comments on the modeling, described below, are more fully addressed.

It appears that Massachusetts Water Quality Standards for temperature in the lower Charles River Basin often will be exceeded with the proposed plan. If Southern Energy intends to conduct an analysis of conformance to Water Quality Standards based on Massachusetts Surface Water Standards, Implementation Policy for Mixing Zones this analysis should be provided. It appears that compliance of the proposed project to this mixing zone policy is problematic. If Southern Energy intends to apply for a variance for meeting thermal water quality standards under Section 316(a) of the Clean Water Air, this request and demonstration must be included in the permit re-application under the National Pollutant Discharge Elimination Program (NPDES).

EPA-New England would like more information regarding the improvements to aquatic life due to de-stratification. Table 4-3 is a chart recording impacts on fisheries from the proposed project. There is no clear explanation why the fisheries increase so dramatically from this project. It is not clear that the predicted increases in dissolved oxygen (DO) levels alone will be able to support this increase in aquatic life. Furthermore, EPA-New England requests specific details pertaining to the type of benthic community that would develop in the Lower Charles River Basin.

Dissolved Oxygen

In response to EPA comments, SE developed a water quality model to assess the effects of the proposed project on dissolved oxygen (DO) levels. The water quality model relies on the reaeration and sediment oxygen demand (SOD) terms to simulate the combined affects of all DO sources and sinks, respectively. Calibration was conducted by adjusting these two terms to provide a reasonable agreement between predicted and observed DO data. The model assumes the predominant source of DO is from re-aeration at the river surface/air interface and does not

directly account for oxygen production due to photosynthetic activity from phytoplankton. The lower basin experiences severe algae blooms during the summer months which often results in super-saturated DO levels during daylight hours. Under these conditions oxygen is transferred from the water surface to the atmosphere rather than the atmosphere to the water surface.

Since the model was calibrated to DO data collected during the summer months and daylight hours (possibly under super saturated conditions), it is probable that the re-aeration term overestimates oxygen transfer from the atmosphere. As a result, the model is likely to over predict DO levels in the water column if concentrations of algae are not significant. Since reducing the severity of algae blooms through nutrient reductions is a primary goal for restoring the Charles River, it is important to calibrate the model and predict DO levels, particularly in the bottom waters, without the influence of photsynthetic activity in the surface waters.

If vertical mixing is restored as a result of the proposed project and bottom DO levels are low (less than 2 to 3 mg/L) such that phosphorus fluxing from the sediment is not significantly reduced, then the project could result in an increased flux of phosphorus from bottom waters to surface waters. Increased fluxes of phosphorus from bottom waters to surface waters makes additional phosphorus available for uptake by algae and could counter the benefits of expensive nutrient controls required throughout the watershed. SE should re-calibrate the model to conditions when algae blooms were not occurring. EPA will provide copies of DO and Chlorophyll *a* data collected by EPA from the Charles River which may be helpful to SE in performing this task (see attachment).

The single most important potential water quality benefit of this project, is the potential to increase DO concentrations in the bottom waters of the lower Charles River basin. In their response to the DO comments/questions on the DEIR, SE refers to a memo from Dr. E. Adams which outlines the processes governing reaeration and the expected benefits of the proposed diffuser. This memo briefly describes the general process of reaeration in qualitative terms. SE should provide a more in-depth, quantitative discussion of these processes including fluid-mass transfer, governing rates, and process/time dynamics that describe the overall process of reaeration resulting from the proposed diffuser.

Eutrophication.

The FEIR does not adequately address EPA's concerns regarding potential impacts of the proposed project on eutrophication in the lower basin. The FEIR states that the proposed project may reduce the severity of blooms because of the entrainment of algae to bottom waters and disruption of the blue-green algae community. However, the FEIR does not provide adequate documentation to support these statements. Specifically, we are concerned that with increased temperatures and improved mixing a more extensive and severe algae blooms may result in the lower basin. As indicated previously, the lower basin already experiences severe blooms during the summer season and any worsening of this problem could further impair aesthetic quality and have significant impacts on recreational uses. Relatively small increases in temperature will

result in significant increases in algal growth rates. In addition, higher temperatures can result in shifts in dominance of algae species to less desirable species such as blue-green algae. It is likely that the existing thermal discharge contributes to the severity of algal blooms and the presence of blue-green algae species which adversely affects recreational uses in the lower basin during summers because of reduced transparency and poor aesthetic quality.

As indicated in the FEIR, algae growth is likely to be limited by light due to the high natural color of Charles River water and excessive nutrients that are available. SE should show that the improved mixing will not result in additional algal growth and an increase in the overall plant biomass stimulated by the greater volume of water having access to sunlight. In summary, SE should demonstrate through quantitative modeling or some other scientifically defensible method, that the severity of blooms will lessen or, at a minimum, not be exacerbated as a result of the Project.

We disagree with the assertion in the FEIR that the reduction of phosphorus in bottom waters due to the introduction of oxygen will reduce algae blooms in surface waters. Presently, high nutrient levels contained in the anoxic salt wedge are not migrating into the surface waters and contributing to algal growth due to the relatively impermeable barrier of the pycnocline.

Model Documentation

EPA requires additional supporting documentation and information from SE to assess the adequacy of the hydrodynamic-thermal model to predict thermal impacts resulting from the project.

- It appears that model calibration was conducted in a steady-state mode while much of the critical data used as input to the model were likely to have varied significantly prior to the calibration date. If the model was used in a steady-state mode for calibration, then the input parameters were held constant for the entire simulation which included a 15 day "start -up" period prior to the calibration date. This may explain why the model is over predicting temperature. For example, for the August 18, 1999 calibration date, the maximum plant thermal load of 349 MMBTU/Hour (the highest observed heat load in the last nine years) was assumed constant for the previous 15 days in the model. As a result, the model is likely to over estimate the "residual" heat load available prior to the calibration date. Therefore, we believe it is premature to conclude that the model is over predicting temperatures, since actual conditions prior to the calibration date were not simulated.

- Also, we have concerns with using the "steady-state" approach for computing a constant heat exchange coefficient and using the "equilibrium temperature" to simulate the effects of solar radiation, longwave radiation, conduction, convection, and evaporation. Using the ambient water temperature at Watertown Dam as the "equilibrium temperature" appears problematic considering the vast difference between channel characteristics and

water surface area between the Watertown Dam and the lower basin above the Museum of Science. SE should calibrate the model in a transient mode and use appropriate time series data (solar radiation, cloud cover, wind speed, ambient air temperature, ambient water temperature, plant thermal heat load, and river flow) to develop the model input data set.

- Tables 3-8 and 3-9 of the FEIR, presents comparisons of simulated conditions of dissolved oxygen, salinity and temperature (as predicted by the GLLVHT/EUTRO5 model) with the corresponding observed (field) conditions. EPA suggests that the proponent perform standard quantitative comparisons between model predictions and field observations. These quantitative comparisons between data sets should include: the relative mean error; the root mean square error; the correlation coefficients; and the error coefficient of variation. A useful guidance document on this subject is: McCutcheon, S.C., Z. Dongwei and S. Bird, 1990. Model calibration, validation, and use. Chapter 5 in: Technical Guidance Manual for Performing Waste Load Allocations, Book III: Estuaries. Part 2: Application of Estuarine Waste Load Allocation Models. Edited by: J.L. Martin, R.B. Ambrose, and S.C. McCutcheon. U.S. Environmental Protection Agency, Office of Water,. March 1990.

- SE should provide revised tabulated calibration results for the three calibration dates including predictions and observations of absolute values of river temperatures, salinity, and dissolved oxygen for the same stations and depths shown in the FEIR. In addition, Model calibration results for salinity also should include a comparison of salt mass predicted in the basin to the actual salt mass as measured by USGS.

- SE should provide model documentation that includes tabulated time series for daily wind speed, solar radiation, cloud cover, ambient air temperatures, dew point temperatures, and plant thermal loads for the summer of 1999.

- Section 3.2.5 (Water Resources and Wastewater) of the FEIR, describes the current discharge design as including two (2) single diffuser ports, each with approximately 30 percent of the cross-sectional area of the outfall, to minimize discharge head loss. However in APPENDIX 3.5, where the near-field discharge characteristics are determined using the CORMIX Model, the diffuser is described as consisting of three (3) 1.6 ft diameter ports. SE should resolve this discrepancy prior to submitting the application for the NPDES permit.

- Figure 3-60 provides river flow data for periods preceding two of the three calibration dates, August 19, 1998, and July 19, 1999. SE should also provide a similar plot for the August 18, 1999 calibration date.

- SE uses provisional data from the U.S. Geological Survey in the FEIR to present information and calibrate their model. SE should provide an evaluation of the quality of

the data, and discuss any potential limitations imposed by using these data.

- SE used an upstream ambient river temperature of 72.39 degrees F as a boundary condition in the model for the 7Q10 low-flow scenario. Review of Figure 3-35 indicates that this value is approximately 5 degrees F less than observed data during approximate 7Q10 flow conditions at the BU Bridge station (MP-14) during August, 1999. Since the BU Bridge represent the upstream boundary condition in the model, SE should remodel the 7Q10 scenario using the higher observed temperature at the BU Bridge station.

- Also, for the 7Q10 scenario, EPA questions whether the heat exchange coefficient is representative of critical conditions in the lower basin. For example, we question the use of average monthly wind speed values from Logan Airport in the critical low flow analysis. Daily time series of wind speed and ambient air temperatures should be reviewed to identify critical conditions (low wind velocity and high ambient air temperatures) for this analysis. Hot summer days in August with very low wind velocities are not uncommon in the lower basin. Data from August of 1999 should be useful identifying these critical conditions. SE should justify the selection of critical meteorological data in the supporting documentation. Also, we question the representativeness of the data from Logan Airport station for the lower Charles River Basin. Are there other sources of meteorological data in closer proximity to the basin than Logan Airport?

- SE should provide an assessment of thermal impacts associated with maximum plant thermal loading and peak solar radiation for the 7Q10 low flow scenario. Figure 3-35 shows river temperatures at the BU Bridge station with a diurnal variation of approximately 3 degrees F due to solar radiation. This assessment is particularly important to our evaluation of the project, since the lethal temperatures for Alewife (juveniles), Blueback Herring (juveniles), and Yellow Perch (adults) may be approached during critical conditions (low flow, high ambient air and river temperatures, and extended period of low wind speed) and maximum daily plant thermal loading.

- The sensitivity analysis should include a more thorough evaluation of the effects of wind speed on heat loss in the model, as well.

Fisheries

Concerns have been raised by EPA and others regarding the potential of a thermal barrier forming from bank to bank in the lower Charles which would interrupt the migrations of anadromous fish. This potential for avoidance and/or stress is present for both adults migrating upstream and downstream in the spring, and for juveniles migrating downstream in August and September. Evidence presented by SE that these fish migrations would not be impaired are: 1) the comparison to species specific avoidance and lethal temperatures; 2) comparison to conditions in a once-through-cooling water system discharge in Connecticut; and 3) video and

personal observations of herring in the present thermal plume from the Kendall Station. More direct evidence would increase the persuasiveness of the argument that migrating fish will not be stressed or avoid heated areas. The value of direct evidence would be particularly helpful, since uncertainty remains in the modeled bank-to-bank temperature profile from the proposed increased and sustained heat loads.

It is likely, that there are numerous factors in the lower basin environment that can cause stress, avoidance or otherwise affect upstream and downstream migrations. Radio telemetry studies using migrating fish tagged with radio tags are recommended to generate the most direct information regarding the thermal and other environmental factors which deter or encourage fish to take specific migration routes within the channel. Such radio telemetry studies also will provide a pre-development baseline to compare with post-development migration patterns derived from future studies. EPA also is interested in the results of other river herring radio telemetry studies which might suggest the preferential behavior of migrating fish when encountering thermal plumes.

If a thermal barrier were to form, its effect may be overcome with operational modifications or contingencies that would allow upstream and downstream passage. Such operational modifications or contingencies should be evaluated. One contingency would be to discharge from the wall rather than through the diffuser during periods of peak river herring migration (assuming this removes the bank-to-bank thermal impact). A second contingency to be evaluated is to provide intervals during the periods of migration where the heat load is reduced sufficiently to remove the stress to and avoidance of migrating fish.

In reviewing the fish species population information from the Charles, information on American shad is limited. Is this because of its absence in the Lower Basin? Shad have successfully migrated in many similar New England rivers. In the interest of protecting indigenous populations, EPA is interested in the reasons for either the absence or limited number of shad in the Charles River. In particular, SE should evaluate the current status of American Shad in the Charles River and identify factors that may prevent Shad migrations into the Charles River. SE should assess the sensitivity of this species to thermal impacts and determine if the existing heat load from the plant and other factors related to power plant operations are partially responsible for the apparent absence or low numbers of Shad.

Regarding the migratory information taken from the Connecticut power plant provided by Southern Electric, please clarify whether the information collected was for shad or alewife or blueback herring and comment on the transferability of these data from one species to another.

Additional Comments

In conclusion, EPA-New England sees a number of positive impacts associated with this project including air pollution reductions, avoidance of greenfield development and the potential to destratify the water in the lower Charles Basin. We encourage Southern Energy to develop

controls, operational procedures, mitigation measures and contingencies to ensure that these benefits are not offset by the detrimental effects of the once through cooling water system. We look forward to continue working with Southern Energy to address the Agency's concerns and develop NPDES permit limits and conditions protective of the aquatic habitat and other water uses.

Please do not hesitate to call me at 617-918-1791 or Mark Voorhees at 617-918-1537 if you have any questions.

Sincerely,

David M. Webster, Manager
Massachusetts State Program Office

cc: Arthur Pugsley, MA EOEA
Ed Kunce, MA DEP
Robert Zimmerman, CRWA