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THE SENATE
STATE OF NEW YORK
ALBANY 12224

LEGISLATIVE OFFICE BUILDING
N. Y. S. CAPITOL
ALBANY, N. Y. 12224
518-472-2027

1019 PARK STREET
PEEKSKILL, N. Y. 10566
TELEPHONE
914-PE 7-1100-1

STATEMENT
BY SENATOR BERNARD G. GORDON
APRIL 19, 1976

At a hearing held by the Nuclear Regulatory Commission last year concerning Indian Point Plant #3 I raised objections to the Commission's plan to require cooling towers at Indian Point. At that time I detailed, and documented, the adverse economic, environmental and aesthetic impact that would result if such towers were built. The draft Environmental Impact Statement prepared by the N. R. C. staff and the Con Edison study showing natural draft towers to be the preferred type of cooling system contained information clearly establishing that the dangers posed by these towers are in fact very real.

Since that time further research has only served to heighten my dismay at the apparent lack of concern for human needs evidenced by the N. R. C. The N. R. C. Environmental Impact Statement in no way answers any of the questions raised in my statement of April, 1975. Rather, important questions are again left unanswered, assumptions are made on the basis of non-existent data, and the health and quality of life of the area's residents given little weight when viewed against the sole focus of protecting the fishlife of the Hudson.

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For your benefit, I enclose a copy of my earlier statement footnoting to the page the information, or lack thereof, which concerns me so greatly. But in order to lend greater substance to the feelings of the area's residents, I have sought, and enclose expert testimony, to support my apprehension as to these towers, These experts, I might add, are not from the threatened area and were unbiased as to what conclusions they would reach after dispassionate review. Their conclusions are frightening.

The "Comment", prepared for me by the Northeastern Legislative Energy Staff, finds the N. R. C. Environmental Statement "sadly deficient". They confirm my fears that the cooling needs of other plants (such as Bowline, less than 5 miles away) are ignored, althought the cumulative environmental impact from these plants could be devastating. In addition, these scientists outline six potential beneficial uses for waste heat and sadly conclude that the N. R. C. 's brief dismissal of this important issue "is reflective of the process by which the United States has been locked into the most energy wasteful industrial infrastructure in the world". The Comment points out that "many other factors are not covered by the N. R. C. report and that the prospect of a better pure cooling solution being developed is also ignored." Further information on these issues should unquestionably be obtained before a decision to mandate these

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towers is made.

In addition, a study prepared for me by the Atmospheric Sciences Research Center of the State University of New York concludes "that once-through cooling will have less detrimental physical impact and less displeasing aesthetic impact than the cooling towers". It also points out, and details, the fact that at the time of theN. R. C. study "not enought data were available to analyze all the environmental impacts of the salt drift from the cooling towers." Dr. Ulrich Czapski, Associate Professor of Atmospheric Science at the State University concludes that," Not only is the use of cooling towers a great economic penalty, but its atmospheric consequences are not sufficiently well known to guarantee a diminished total environmental impact." In outlining the very real dangers to the plant life of the area raised by this salt drift the Atmospheric Sciences report notes "The synergistic effects of salt drifts and drought have not been considered in the Environmental Impact Statement". It concludes that the Statement "contains too little data" to evaluate the potential adverse impact of salt deposits on the area's vegetation.

The N. R. C. studies thus far have contained too little data, have made too many assumptions, and have shown too little concern for the threatened plight

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of thousands of people in a four county area. We bring our fears to your attention and urge that these concerns are justified by the facts. There is a clear obligation on your part to defer the requirement of cooling towers at Indian Point until all environmental questions have been completely and satisfactorily answered. To do less than this would be to condemn the residents of the Hudson Valley to live with the frightening consequences of these monstrous towers before their full impact has been adequately studied.

Bernard G. Gordon
SEP

BERNARD G. GORDON

STATE UNIVERSITY OF NEW YORK AT ALBANY
ATMOSPHERIC SCIENCES RESEARCH CENTER
1400 Washington Avenue
Albany, New York 12222

TO: The Honorable Bernard G. Gordon
LOB - Room 708
Empire State Plaza
Albany, New York

FROM: Ulrich Czapski and Ronald Stewart

DATE: 29 March 1976

RE: Indian Point Cooling Towers

Enclosed please find a short analysis by an ecologist, Mr. Alvin Breisch, concerning the salt discharge from the cooling towers at Indian Point. It simply points out that not enough data were available to analyze all the environmental impacts of the salt drift from the cooling towers.

Once again we are trying to compare the environmental impact of two cooling systems. We believe that once-through cooling will have less detrimental physical impact and less displeasing aesthetic impact than the cooling towers.

The enclosed American Electric Power brochure will provide examples of cooling tower plumes 6-9 miles downwind of the towers. We thought that this analysis might be of interest.

RS:UC:mh
Enclosures

STATEMENT ON COOLING TOWERS

Ulrich Czapski

Cooling towers are being used increasingly in the United States because of environmental concerns and consequent regulations about the direct dissipation of heat in the cooling water by returning it to large water bodies. Not only is the use of cooling towers a great economic penalty, but its atmospheric consequences are not sufficiently well known to guarantee a diminished total environmental impact. Ultimately the heat from thermal effluents into rivers and lakes is transferred to the atmosphere by the same process as in cooling towers - namely by evaporation (about 80%) and by convection (about 20%). The difference for the atmospheric environment lies in the radius (area) and hence concentration, as well as in the elevation where this transfer occurs, causing the different atmospheric consequences. The waste heat in cooling towers and the concomitant amount of water vapor is put into the atmosphere over the exit surface of the cooling towers (ca. 1 acre). Because of the bouyancy of the water vapor and heated air, the plumes of cooling towers can rise to considerable heights, but they almost invariably cause large visible plumes and under the right circumstances can trigger convection activity or reinforce existent instabilities of the surrounding airmass (see Czapski, 1968; AEP Brochure, 1974). Direct heat disposal into river waters will disperse the heat through mean and turbulent transport in the water over a vastly larger area (i.e., a distance of tens of miles down-river under moderate flow velocity) and therefore the concentration of water vapor and heat when entering the atmosphere will be much lower.

On the other hand, because of the low elevation and the lack of appreciable bouyancy of the air above the water in many situations, fog can occur and be augmented over the river. This effect, however, is almost certainly confined to the immediate neighborhood of the river and will occur predominantly only when fog could naturally occur. A meteorological advantage of cooling towers over direct cooling water disposal cannot be easily demonstrated, and it might well be that cooling towers also have a disadvantage from the physical point of view, in addition to their unsightliness and the severe economic penalty. These considerations do not take additional environmental damage into account that may occur from salt spray of the cooling tower plumes.

INDIAN POINT: IMPACT OF SALT WATER COOLING TOWER ON VEGETATION

(Discussion based on Alternative B of Appendix G - Cooling Towers for Units Nos. 2 and 3)

Alvin Breisch

1. Indian Point Environmental Statement on the impact of salt drift from cooling towers is based on a very limited field survey of vegetation communities which does not include the entire area of influence of the towers.

2. The sensitivity of species used in the experiments at Forked River (the basis of comparison to Indian Point) was measured as to the extent of leaf injury. No evaluation was made of the possible effects on such phenologically important events as needle elongation, flowering, and fruit set which are generally considered more sensitive times for injury due to pollutants.

3. The evaluation assumes normal precipitation rates to determine dilution of salt drift from cooling towers for purpose of vegetation impact analysis. Such an analysis fails to consider occurrence of meteorological drought which would combine naturally occurring water stress with additional stress due to salt drift. Drought conditions tend to heighten the effect of salt on sensitive species.

Indian Point Environmental Statement on the impact of salt drift from cooling towers on the terrestrial biota is based on data from low lying plant communities within two miles of the cooling towers. The three terrestrial sample areas described (Indian Point EIS p. II-35) may be sufficient analysis if direct discharge of cooling waters to the Hudson was used, but the analysis is unacceptable if consideration of cooling towers is to be made where an airborne pollutant can be broadcast in potentially large quantities over a much larger area. The upland communities in Blue Mountain Reservation (2½ miles to the east) and Palisade Interstate Park (2½ miles to the west) have not been analyzed although these areas represent the closest plant communities to Indian Point that are protected as parks and contain more natural and undisturbed vegetation than would generally be found in the industrially or residentially zoned low lying area along the Hudson. These areas have not been shown in the EIS to be comprised of salt resistant species or to be similar in species composition to salt spray communities along the coast.

Vegetation impacts are considered no greater than those of Forked River area partly on the assumption that Indian Point cooling towers utilize less salty water (∿12,000 ppm vs. 45,000 ppm) than does Forked River. However, Indian Point deposits more total salt on the surrounding landscape. The maximum at Forked River is approximately 30 $Kg/Km^2/mo$ (Fig. 7 and 8) versus 180 $Kg/Km^2/mo$ at Indian Point (Indian Point EIS Fig. G-3). According to Fig. G-3, salt deposition as great as the maximum from Forked River (∿2 miles) could occur in an area around Indian Point five miles to the west, three miles to the east and over 10 miles north and south. The Forked River report determined their cooling tower emissions to be low by a factor of six for short term effects and a factor of 40 to 100 below average annual near ground air concentrations necessary to effect vigor and plant distribution. The Forked River report also determined the concentration of natural salt spray up to 15 miles inland will exceed that from the cooling towers so that the natural vegetation of the area is already adapted to a salt spray environment and the addition of another small increment of salt from the cooling towers will have no effect. The area and intensity of the influence of the salt deposited from the Indian Point cooling towers (up to six times as high as levels from Forked River) is significantly greater than for the Forked River cooling towers.

Although the vegetation of Indian Point and Forked River contain a number of common species (red and white oak, beech and cherry) there are some differences which are significant in terms of salt tolerance. White pine, maple and hemlock are all less salt tolerant than the oaks and are reported to occur in the Indian Point area but not in the Forked River area. Westing (1969) found that the effects of salt accumulation greatest on those trees he observed with shallow roots (sugar maple, hemlock and white pine) than on trees with deep roots (most oaks). Kotheimer et al. (1967) found salt to be a factor in maple decline. Hall and Hofstra (1970) found red and white pine to be most sensitive to salt of the trees they tested. The Forked River report reported no damage to white pine grown in a greenhouse and sprayed with salt water mist. Observations on salt damage experiments conducted as part of the Forked River environmental assessment were based on extent or presence of foliage damage, whereas air pollution of other types have been found to have greatest effect at phenologically significant times, such as needle expansion in white pine. The experiments of Westing and of Hall and Hofstra are with winter salting of roadways and in general deal with higher concentrations of ions than would be associated with cooling towers but which have a much more local distribution (<400 ft. from highway).

The Indian Point EIS diminishes possible impact on vegetation by concluding (p. XI-23) "The deciduous habit of a major proportion of area vegetation coupled with the large volumes of precipitation (average 43 in.

annually) available for dissolution and transport of saline deposits via percolation and runoff, will serve to further reduce any potential for damage due to impaction or deposition of drift solids." Westing (1969) found that generally woody plants are more sensitive to salt accumulation than non-woody plants which is in agreement with conclusions reached by Woodwell (1970) concerning exposure to increasingly severe environmental stress. No advantage should be attributed to the deciduous habit. The assumption of "large volumes of precipitation" fails to consider impact of drought which tends to heighten effect of salt (Westing, 1969). Drought periods would also be times of generally low fresh water flow in the Hudson and, therefore, higher salt concentrations in cooling water. Occurrence of drought conditions during growing season would, therefore, increase chance of short term effect of salt on vegetation. Drought conditions occurred in the Hudson Valley 20.7% of the time in the 35-year period from 1929 to 1963 (Fieldhouse and Palmer, 1965). During this period, 14 growing seasons were affected by drought of five months' duration or longer. The synergistic effects of salt drift and drought have not been considered in the EIS.

The statement (p. XI-22) that salt concentrations are much less (20 ppm vs. 640-1280 ppm) than water used for supplemental irrigation in eastern United States of plants having low salt tolerance, ignores the potential for timing irrigation to coincide with water need and with periods of plant development not as likely to cause damage. Such a program of timing salt release would be impossible with a cooling tower.

The problem of salt spray affecting an area of natural vegetation not previously subject to a salt spray environment has in the past only been applied to the problem of salting of highways and only after such salting has been underway. The problem of year round application of less concentrated dosages of salt over larger areas, such as from cooling towers, cannot be compared to irrigation of farm land using salt water. Westing (1969) feels that the needs of humans will prove sensitive to the build up of high salt concentrations than will most plant communities, but the fact that many roadside trees have low salt tolerances should be an area of concern since the Indian Point EIS presents little vegetation data.

The Indian Point EIS contains too little data to evaluate the environmental impact of salt drift on the vegetation or to base a study analyzing the effects once cooling towers are in operation.

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Commentary On

"DRAFT ENVIRONMENTAL STATEMENT

for Selection of the Preferred

Closed Cycle Cooling System at

INDIAN POINT UNIT NO. 2"

The Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2 is sadly deficient in two regards. First, analysis of the effects of a cooling system is completed largely without reference to the cooling needs of other large thermal electrical generating plants and other facilities in the area. Second, the economics section is totally deficient in ignoring any aspects of the problem of generator waste heat beyond cooling.

This statement will largely elaborate on the second point, without meaning to detract from the problem of multiple installations.

Cooling towers, or any primarily cooling device for a thermal electrical generator, are a way of disposing of "waste" heat, heat not needed for the generation of electricity, in hopefully the least environmentally damaging fashion. In the case of Indian Point Two, this means dumping heat more than equivalent to the entire power output of the plant, at a cost of over 90 million dollars for the preferred dumping facility, and total costs of 153 million dollars, using the most conservative cost estimate.

Conservatively, the fuel value of recoverable heat dumped to the environment will be between 20 million and 25 million dollars yearly.

This situation of wasting heat which would require over 5.8 million barrels of oil a year to produce at one site alone, is the product of an institutional heritage separating the electricity generating industry from others, brought on in large part by cheap energy, as compared to the cost of capital. However, it has been clear at least since the Arab oil embargo, that such patterns are unwise and counter productive. "Waste" heat from industrial processes, is now one of our largest and cheapest energy resources; its use, including the building of the necessary institutional framework, should be one of the nation's highest priorities.

This point was raised over two years age, in the December, 1973 State of New York Department of Environmental Conservation review of the Draft Environmental Statement related to the operation of Indian Point Nuclear Generating Plant Unit No. 3 (Docket No. 50-286). The department stated, as its second General Comment,"The Commission staff should consider alternate use of the rejected heat from plant operation. In this time of energy crises, the wasteful disposal of heat which could be used for heating homes and businesses, used in the production of food, etc., does not appear to meet those goals of NEPA presented in the Foreward."

In reply, the commission stated that it had examined the problem of the use of waste heat during its (pre-embargo) assessment of Indian Point Unit No. 2, and found such uses incompatible with the existing turbine systems, and that "there are no potential users of waste heat in the quantity available within reasonable proximity to the Indian Point Plant." The commission concluded its two paragraph discussion with "The staff believes it reasonable to assume that recovery of any significant portion of the waste heat from the Indian Point Plants would not be economical at the present time."

This analysis (ignoring its brevity) is reflective of the process by which the United States has been locked into the most energy wasteful industrial infrastructure in the world. The analysis ignores (1) the possibility and desirability of creating adequate uses for some of the heat, and (2) the possibility that recovery will be economic in the near future, or at least shortly after the cooling tower(s) comes on line. Of course, the prospect of a better pure cooling solution being developed is also ignored.

At this point, it whould be made clear that we are talking about immense expenditure to further erode the thermal efficiency of a process, electrical generation from nuclear fission, already quite inefficient, or perhaps deficient (Brookhaven National Laboratory uses a figure of 28% total thermal efficency for the light water nuclear reactor electrical generating process, including fuel cycle).

Onto this cycle, a cooling tower system contributes an added 0.91% drop in thermal efficiency, from the original 31.65% efficiency of the plant itself, ignoring the fuel cycle, or a 2.8% loss of the energy production of the plant. This calculation ignores the energy expended in building the cooling device.

In addition, we are assured that the cooling system for one plant will add only about 1% to the cost of Con-Edison power. Again, the micro picture being focused avoids the generic consideration. Given requirements for cooling towers at Indian Point Unit No. 3, and Bowline and

Roseton facilities, we are talking about a 3 1/2% increase.

Given, on the other hand, the potential benefit in thermal energy, it becomes clear that great expenditures can be justified to utilize the power plants fully. Such utilization would, of course, provide economic benefits, certainly to the area and Consolidated Edison's stockholders, and most probably utility ratepayers. The failure of the "evaluation of proposed action" is that it does not address the loss of the potential use of the waste heat. This may be less than surprising, given that the "evaluation" runs just over one page of print, supplemented by a table.

Value of the waste heat varies, depending on calculations. Based on the 7,350 x 10^6 btu/hr design cooling capacity of the proposed Indian Point No. 2 (and remembering that the Indian Point No. 3 system will be bigger, which will make-up for any overstatement here), a .65 capacity factor, and recovery of .43 of the total thermal capacity of the plant, an 80¢/10^6 btu fuel cost (ignoring totally fuel coversion losses), now unobtainable, yields a foregone annual benefit of over $21 million dollars; a one dollar per 10^6 btu fuel cost raises the value to almost 26.5 million dollars yearly. Multiplying these values by two, for Indian Point Unit No. 3, puts discussion in the 40 to 50 million dollar yearly range at one site without discussing other electrical plants in the area. Fuel conversion losses would further escalate the value discussed, to the 48 to 60 million dollar range.

The above discussion is based on natural gas or coal costs, the former unavailable at the regulated prices, and the later, subject to transportation difficulties in New York and much of the Northeast, possibly available in quantity by water ways. Oil, the dominant Northeastern industrial full, would double the cost, based on controlled prices, which will rise further in the future to the foreign price under recent federal legislation.

Using the same method of calculation as used for cooling tower calculations in the draft environmental statement, we arrive at a present value in the realm of 500 to 600 million dollars. The oil price equivalency would be about three times this figure.

Given over a half billion dollars, what kind of systems can be conjectured to use the heat available for the taking at Indian Point in 1978 or later? Put another way, how close are we to being able to use relatively low grade waste heat?

Most potential uses demand temperature differentials above the 15°F above ambient currently generated as waste by the plants at Indian Point. However, two things may be said that offer some hope to change this. First, as noted above, there is the potential of up to half a billion dollars in benefit that may be used to pay costs. Second, research and development continues on these and other energy problems. To commit almost one hundred million dollars to wasting large quantities of heat only two to three years after energy utilization became a subject of intensive investigation is to improperly continue practices from a by-gone era.

Among possibilities for heat utilization are:

1. Researchers at Gruman Aerospace Corporation have suggested the concept of the wind tower or tornado generator. With a three to one ratio of height to diameter reminescent of cooling towers, and similar size magnitude, the two devices appear to be compatible. What is most interesting is that the researchers have already stated that waste heat from electrical facilities could be used beneficially, calculating that a temperature differential in excess of 19°F will maintain electrical generation in the wind tower in windless conditions.

2. Conventional Rankine cycle heat engines. Bottoming cycles are the subject of extreme interest, and new designs, usually utilizing fluorocarbon working fluids, promise lower and lower operating temperatures. As with

other waste energy development, the lure is the utilization of energy obtained for free. The extreme case of such thinking is the development of the ocean thermal gradients generator, which would work on thermal differences of 50 to 40°F, or less. Utilization of power plants as a heat source would clearly minimize complexity compared with ocean devices planned to operate using the heat differences of water layers 1,000 feet apart.

3. District heating. European systems use heated water down to 80°C, attaining thermal efficiencies for combined generation of electric power and useful heat of better than 85% and over 75% including distribution. This possibility eliminates much of the existing pollution due to decentralized burning of fossil fuels for space heating, and has such incidental benefits as heated streets in wintertime, eliminating snow and ice removal. While electrical generating efficiency would decrease, and plant modification would be necessary, the savings possible make it unreasonable to dispense with the idea out of hand.

4. Process heat uses would entail a similar need for higher temperature ranges as district heating, but probably would provide a more concentrated use, lessening distribution costs, and provide a year-round use for energy. Areas immediately adjacent to the Indian Point complex are industrial.

5. Given the size of the expenditures involved, moving water some distance to cooling ponds, agricultural or aquacultural uses should not be ruled out as rapidly as in the draft impact statement, where cooling ponds are disposed of in one sentence, after a one paragraph description.

6. Although quite wasteful compared to initially designing a plant to provide steam or water at more useful temperatures, waste heat water can be raised to heating quality or steam by heat pumps; in winter the heating advantage over ambient conditions might well be significant.

In closing, it is clear that the "Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling Systems at Indian Point Unit No. 2," does not consider waste heat problems in a generic fashion, in impacts on the area, and most especially does not consider the economic benefits being wasted. The cooling problem is not a last item of the electric business to be disposed of expeditiously, but one part, and a symptom of, a large complex of problems indicative of America's energy problems.

FROM: Bernard G. Gordon
New York State Senator
Albany, N. Y.

TO: NRC

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Statement re objections to the Commission's plan to require cooling towers at Indian Point 2 and 3

Encl: Statement before ASLB 4/1/75

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