DEPARTMENT of the INTERIOR

news release

REMARKS OF UNDER SECRETARY OF THE INTERIOR DAVID S. BLACK, BEFORE NATIONAL SYMPOSIUM ON THERMAL POLLUTION, PORTLAND, OREGON, JUNE 3, 1968

Whenever scientists get together there is bound to be some electricity in the air. My pun is intentional and, I think, quite appropriate for your meetings because I hope the discussions set off some sparks, but, at the same time, create some light as well as heat.

Ironically, the problem before us is to produce more light for America with less heat.

Since industry began its phenomenal growth, the power industry has provided much of the impetus for this development and has grown apace with the increasing demands for commercial and residential power supply. The availability of large amounts of low-cost power has been in many cases the determining factor in choosing a particular site for a new manufacturing plant, and consequently helped set the pattern of economic growth for many areas of the Nation. The industrial development of this great Pacific Northwest is in a major way directly attributable to the power available from the massive hydroelectric system on the Columbia and its tributaries and the vast transmission network operated by the Bonneville Power Administration.

No one can deny the past contributions of the utilities to our growth. No one can doubt the need for the tremendous quantities of new generation required to meet the demands of the future.

Obviously these growing needs must and will be met. How they will be met is another matter. It is no longer simply a technological or economic question. To an increasing extent, it is also a social question. For an entirely new factor has now entered the social consciousness of America. And that factor is the new awareness of man's total environment. There is no ducking the fact that America is faced with massive environmental problems, ranging from urban decay to the clutter and misuse of open space to the contamination of the very resources upon which life depends--the air we breathe and the water we drink. We have, right now, the technological capability of poisoning that environment from the ionosphere to the depths of the oceans.

It is hardly surprising that an operation as vast as the power industry should be caught up in this mounting wave of public concern over what the pressures of growth are doing to our shrinking landscape. In recent years, even a sophisticated new term largely associated with the power industry has found its way

into the environmental lexicon. When power plants were relatively small, no one gave much thought to the problem of waste heat, much less to anything as improbable as "thermal pollution." Today, it is a subject of widespread attention--not just by the scientific community or the electrical engineers--but the popular press, as well, despite the fact that even the experts know all too little what it actually means.

Many in the power industry react to the talk of "thermal pollution" very defensivel with grave warnings of brown-outs and power failures. On the other extreme, the emotions of some conservationists are similarly aroused by the merest suggestion that any body of water might safely absorb any heat whatever from any man-made source.

Part of the blame for the sometimes unreasonable passion with which the subject is treated rests with the term itself. "To pollute", in a dictionary sense means to befoul, to dirty, to taint, to contaminate. These are words that elicit a strongly emotional and negative reaction. Under no circumstances can the befouling, dirtying, tainting, or contaminating of our water be defended. It needs little demonstration to establish that the discharge of raw sewage in our Nation's waterways constitutes pollution in the truest sense of the term. Heat, however, does not befoul the water nor does it cause the water to become dirty. To claim that it taints or contaminates the water is assuming the answer to the real question before the house.

The ecological balance which nature has been able to maintain in the Nation's waters, in spite of natural causes which frequently result in large variations in water temperature on a seasonal and even daily basis, would undoubtedly be upset by substantial and prolonged change of water temperature and our environment would be altered for the worse. I will later refer to some instances, however, in which it is claimed that a changed thermal environment would serve man advantageously. But for the moment the significant fact is that it is not the heat which is the pollutant but rather the effect of the heat upon the ecology of the river basin or water system. The real issue revolves around the determination of the circumstances under which this change in ecology may occur. So much for definition of terms, and I hope you will forgive this somewhat patronizing little lecture by a layman to a technical symposium.

In the days gone by, whatever effects warmed-up water had on fish and plant life was not considered important because the volume of warmed water was relatively small and the effects were not apparent. Today, the situation is entirely different. More and more power plants line our rivers, streams, and lakes drawing on them for ever increasing amounts of cooling water. Not only have the volumes of water used increased tremendously, but the discharge points have moved closer together. On top of that, the same stream flows we had 50 years ago must now serve almost twice as many people and industry on a scale we could scarcely have dreamed of before the second World War.

With these new burdens on our natural resources, the electric utility industry must now generate more power for our increasing needs and it must do this under

many more restrictions. Restrictions, I mean, in the sense of land available for new plants or expansion of existing facilities, air available for exhausting products of combustion and water available for disposing of waste heat.

No longer can a site for a power plant be chosen simply because it is close to an industrial complex or because it might be cheaper to build there.

In this complex age, the utility executive can't put his cane down just anywhere and say "Build here."

Fortunately, utilities are used to taking long looks into the future to keep up with the Nation's electrical appetite. But I suggest that there are new elements to be considered in this long-range forward view.

The American people now expect--indeed, demand--that all industry consider the environmental and esthetic consequences of their actions.

In this, the first session of a national symposium, you are considering one aspect of a complicated problem--the biological effects of heated water added to streams. You have some tough problems to consider and the solutions will determine the point at which we must halt the input of heat into our waters.

This solution cannot be prejudged or anticipated. Very small temperature changes might well be shown to have far-reaching effects.

I am told, for example, that an insect nymph in an artifically warmed stream might emerge for its mating flight too early in the spring and be immobilized by the cold air.

I am told that a fish might hatch too early in the spring to find its natural food organisms because the food chain depends utimately on the plants and these in turn upon day length as well as temperature. Fish, generally, depend on temperature changes in specific amounts to act as a signal for migration and spawning. The entire life cycle of fish may be upset by highly unnatural changes in the temperature cycle.

Trout eggs will not hatch if incubated in too warm water and salmon do not spawn if the temperature is too high. The sensitivity of all aquatic life to toxic substances is heightened at increased temperatures, and toxic effects of chemical substances are increased. Carp, for instance, are reported to be twice as susceptible to carbon dioxide in warm water as in water near the freezing point.

Our experts point out that the oxygen consumption by aquatic vertebrates doubles for every 10 degrees rise in stream temperature. But as those temperatures rise the water can hold less oxygen in solution. Thus, while supplies of dissolved oxygen steadily dwindle with increased temperatures, the demand for oxygen increases. Eventually, all aquatic life would die.

I mention these things to demonstrate that I have some superficial acquaintance with the difficult tasks you face. I believe the problem confronting all of us

in meeting the growing demands for more water for cooling and more concern for the aquatic environment are so intertwined that it is going to take a many-fronted assault to protect all the Nation's interests.

We must not approach our task with the predetermined conclusion that the addition of heat, if properly controlled, to our important waterways will necessarily produce all the dire consequences which have been predicted.

The problem we face with waste heat is, in fact, many problems. From my viewpoint, we must take five basic approaches.

First, better management of waste heat can make it less harmful to the aqatic environment. One way is to increase turbulence in the water to provide aeration and cooling. Another is to introduce the heated effluent into deep portions of the receiving water and allow natural convection to promote mixing. Or it may be better to construct partial dams in the original watercourse to promote stratification so as to permit the withdrawal of the coolest water available for cooling purposes.

The utility could try to schedule plant shutdowns for normal maintenance during the months when the climate and other water uses combine to make additions of heat most hazardous. Water releases from reservoirs should be timed to the extent operating flexibility permits to reduce the temperature rise resulting from the disposal of the heat. The heated effluent can perhaps be sprayed over the top of the stream or discharged from a number of outlets to disperse its full effects.

There are many alternatives, including the choice of site when building a new plant, but the magnitude of waste heat anticipated in the future is so great that stream management alone will not protect water quality. The heat itself must be controlled.

That brings us to our second approach to this problem--improving the efficiency of our thermal electric plants.

It has been said that the efficiency of a power-generating plant is about on the order of efficiency of the Franklin stove. Be that as it may, no one can deny that when 60 percent of the heat input to a coal-fired plant is wasted, we have something to shoot for in the way of improvement.

You are all familiar with the dramatic shift to nuclear power started during the past few years. While 95 percent of the thermally generated electricity is still produced by fossil fuel, the proportion is expected to decline to 65 percent by 1980.

With the advent of the nuclear power age many persons believed the pollution problems were lessened.

But as happens so many times in our close-knit environment, the nuclear power plants did help to alleviate air pollution but added to problems in the water.

Nuclear plants must dispose of more heat through their cooling water thereby creating an even larger burden on the receiving waters.

Although we can't wait for the ultimate system whereby no warm water is created in generating power, scientists are working on the nuclear breeder reactors which could well be a short-run improvement. These reactors will produce steam at temperatures approximating those of coal-fired plants so that amount of waste heat to be dissipated by cooling systems will be reduced accordingly.

In other words, we could keep the air pollution advantages of the nuclear plant and seek ways to improve on its water pollution record.

Our third approach to the problem is to dispose of the excess heat by the construction of cooling towers, cooling ponds or spray ponds. Here, however, we create a whole new environmental problem industry must take into consideration in modern-day operations. That is the esthetic problem. How will the power plant fit into the landscape?

Cooling towers are enormous structures. Modern hyperbolic towers may rise 30 stories high and be more than a city block in diameter. And costs are another factor which tend to limit the use of towers. Wet towers may add $5 to $10 per kilowatt to the cost of plant construction. So-called "dry" towers which waste almost no water and discharge no heat whatever into surrounding bodies of water can add as much as $20 or more per kilowatt of capacity to the construction cost.

I think our next approach to this problem is the one that is the most promising, not only for the power-generating community, but all American industry. That is finding ways of making constructive use of the huge amounts of heat that are now going to waste in power generation. In the case of the electric utility, the productive use of the waste heat would help to make up for the relative thermal inefficiency of the steam electric generating plant as well as reduce the pollution problem.

Many uses of heat are currently being studied by industry and by the government. For example, here in the Pacific Northwest, tests are being conducted to see if the heated water can be used for irrigation. Naturally, there have to be safeguards because waters that are too hot or too cold may effect seedling emergence, plant growth rate, time of maturity and crop yields. But with proper caution--management again--it may be possible to extend the growing season and thus make constructive use of the waste heat.

Warm water cultivation of oysters is being attempted in the East and in the State of Washington. What a treat for oyster lovers if the experiments make it possible for oysters to spawn continuously for 10 months a year and to reach their maturity in two and one-half years.

I cite these examples, not as the only answers, but to show that sometimes unwanted products can be turned into tools to heal or help some other area of our society.

What if we could warm some of the beaches along our northern shores! Just think of the added recreation for our growing population. And just think of the boost to the economy some of these areas would receive if their swimming seasons could be extended.

Utilities have been selling low pressure steam for years to provide heat for buildings. Wider use of heat for this purpose would obviously be beneficial all the way around.

You as scientists can help point the way to new ways of using this excess heat by providing more basic information about the effects of waste heat in our water resources. These more complete data should make it easier to find safe ways of disposing of waste heat or turning it to constructive use.

Finally, our fifth approach to this problem is to develop new methods of power generation which are more efficient and result in less heating of the water or pollution of the atmosphere.

Fuel cells and thermal electrical systems which do not require the use of the steam cycle for power generation may be the answers for tomorrow.

Such far-out concepts as electrogasdynamics, magnetohydrodynamics and thermionic power generation, if they can be developed economically, could help us to reach a pollution-free future.

Joining with industry and other government agencies, the Department of the Interior's Federal Water Pollution Control Administration has assigned its major research emphasis in this field to its Pacific Northwest Water Laboratory at Corvallis, Oregon. They are studying the effects of thermal power generation on water use and quality with specific reference to a study of the effects of temperature change on the Columbia River. It is estimated that the Columbia River study will require two years. When the results are available we hope to have sufficient scientific information regarding the tolerance of the Columbia River to temperature modification so that the differences of opinions existing today can be put to rest on the basis of developed technological information. In the interim, we have approved temperature standards based upon the best information available to us which we believe will preserve the Columbia River for present and future uses. But we recognize that the results of the pending study could require a reappraisal of the standards so as to move them in either direction.

I have tried to suggest some of the ways we can approach the problem of excess heat. It is going to require taking into account manifold economic and social interests to be protected over the decades ahead.

I have previously noted that the problems associated with the discharge of waste heat into the Nation's waterways are not new. However, the magnitude of these discharges which can be foreseen in the immediate future makes the problems acute. It will require constructive and creative thinking--with the objectivity

of the scientific atmosphere--to preserve a productive and satisfying environment for America.

I wish you well with your meetings. We await the results of your discussions with great interest.

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