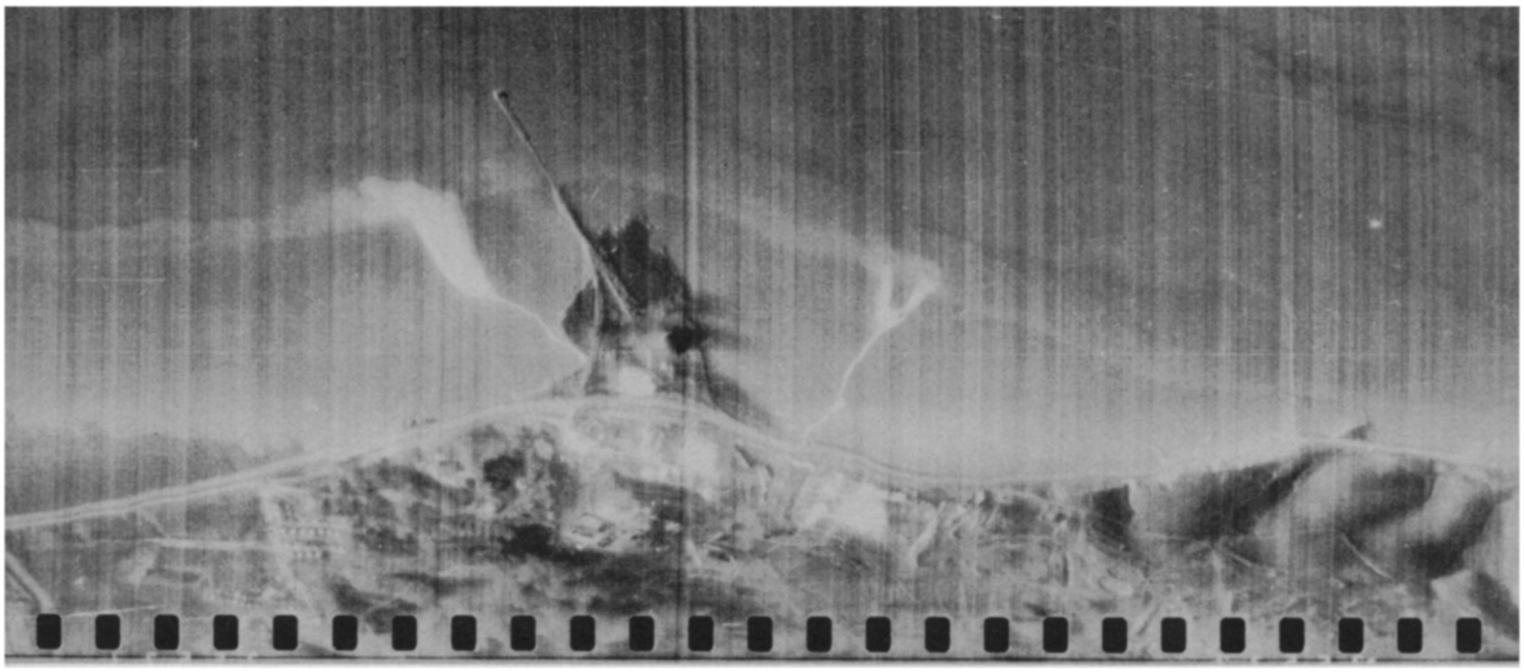


*Oil refinery at Hercules (left) and electric plant at Redwood City, send plumes of hot water into San Francisco Bay,*

ENVIRONMENT

# Hot water: menace and resource

## While the heat given off by power plants grows constantly and is implicated in fish kills, some uses for it are discerned

by William M. Holden

Thermal electric plants discharge 50 trillion gallons of heated water each year into United States waterways, "in some cases with devastating effects," says Dr. J. I. Bregman, Deputy Assistant Secretary of the Interior for water pollution control. By 1980, he predicts, the figure will double, giving rise to "an intolerable increase in thermal pollution if corrective steps are not taken."

Growth of electric power is so rapid, says Wilfred E. Johnson, a member of the Atomic Energy Commission, that more than half of all the country's freshwater runoff will be needed for cooling by 1990, and in some heavily populated areas, 100 percent.

Nuclear thermal plants are a major and growing problem. To compete with conventional plants, they tend to be larger, and require more coolant. Also, they discharge most of their waste heat in the coolant, whereas gas-, coal- or oil-fired plants send a good deal up the stack.

In Portland, Ore., R. F. Poston, regional director of the Federal Water Pollution Control Administration, says: "Nuclear power development presents the greatest single threat to the fisheries —and to the environment—that we face in the Pacific Northwest in the next few years."

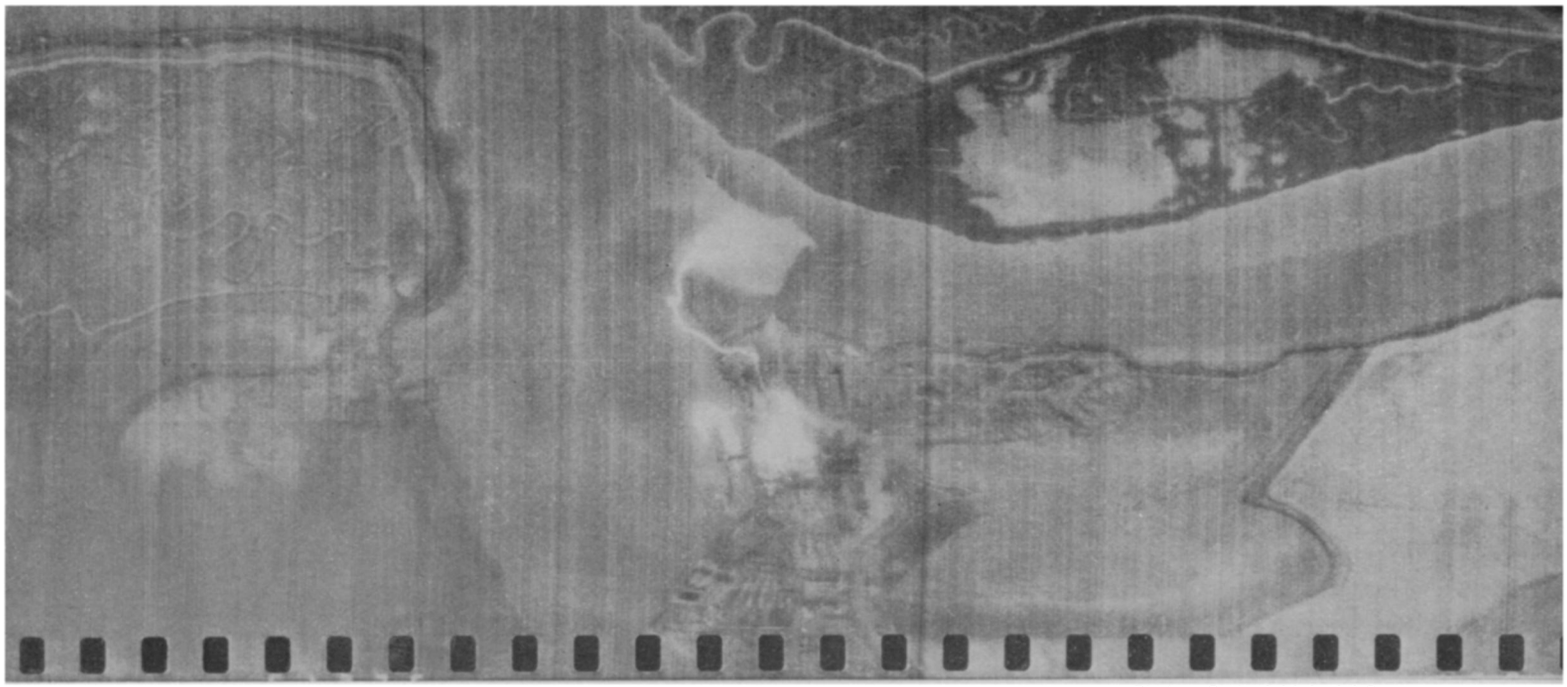
In the East, Senator Joseph D. Tydings (D-Md.), member of the Senate Subcommittee on Air and Water Pollution, says: "Electric power generation poses an immense risk of destruction of the marine life in Chesapeake Bay and on the Potomac."

Many state fish and game departments have blamed the hot water for fish kills. In Lake Michigan, temperature increase and its handmaiden, oxygen starvation, are major suspects in last summer's deaths of hundreds of millions of alewives, the worst fish kill in U.S. history (SN: 2/17, p. 159).

Rising temperatures diminish water's capacity to retain dissolved oxygen and simultaneously foster growth of oxygen-demanding bacteria and algae. Also, dissolved oxygen is needed by bacteria to decay waste matter, so a decrease in oxygen has the same effect as introducing another oxygen-consuming waste. Furthermore, heat intensifies the action of chemical pollutants.

There are techniques for dissipating heat. But beginning to emerge now is another, more attractive possibility: the heat could be a valuable industrial side product.

- Hot discharges from Potomac Electric Power Co. at Dickerson, Md., kept several miles of the Potomac from freezing in the winter of 1960-61 when the rest of the river was frozen over for weeks. The technique might be applied to navigable waters.
- It has been suggested that manatees be imported into Chesapeake Bay, to winter in warm discharges and earn their keep by controlling growth of unwanted aquatic vegetation.
- Offshore hot discharges may attract fish by creating the flora and fauna they feed on. Near Los Angeles, warm water from steam plants reaches half a mile to sea, creating a winter haven for many fish that once swam south for the winter, and a boon for fishermen.
- Waste heat may prevent frost damage to orchards, or extend the growing season of crops that bring premium prices on an early market. In one $3.7 million experiment, normal temperature



Photos: Cartwright Aerial Surveys

*as revealed by infrared photos. The southern bay may become as dead as Lake Erie if thermal pollution continues.*

water from the Columbia will be used to irrigate a square mile of land growing strawberries, asparagus and tomatoes. A similar plot will be irrigated with 90-degree water from a reactor.

• A New York utility will use waste heat to revitalize an oyster hatchery. And the state of Maine plans to expose lobsters to a nuclear plant outfall in an effort to stimulate their growth (SN: 2/17, p. 169).

• Cooling ponds can do double duty as recreation lakes; waste heat could warm frigid ocean beaches for swimmers or stimulate breakdown of sewage.

• In Sweden, reactor coolant warms a village in winter.

Scientists, says Interior Undersecretary David S. Black, have suggested that buoyant hot water released in the depths of Lake Erie would helpfully stir that polluted lake.

An even more fantastic use (is) the suggestion that giant stacks on nuclear plants convey the heat high enough in the southern California heavens to create a ventilation effect and disperse smog from the Los Angeles Basin.

*(continued)*

*Four degree difference between Sacramento and American Rivers in infrared.*

# . . . thermal pollution

Interior

*Fish kill in Oregon's Klamath River: high temperature was partly to blame.*

Despite the promise of easing or using thermal effects, the problem remains one of crisis proportions.

The Columbia, one of the coldest major rivers in the conterminous United States, is warming steadily, partly from Hanford reactor discharges and partly by retention of water by increasing numbers of dams. The warming threatens to destroy the great annual run of salmon and steelhead, the most valuable fish commercial and sport fishermen harvest from the river.

Interior Secretary Stewart L. Udall recently announced a two-year, $600,000 study of biological effects of thermal inputs to the Columbia. One phase of this, the nation's most comprehensive study of thermal pollution, will examine effects on fish of nitrogen supersaturation. Increased temperature is an important cause, Udall says, adding that laboratory evidence indicates the nitrogen-heat combination kills fish in the same manner as the well-known diver's bends.

**High temperatures,** even if not directly lethal, may block spawning salmon, or cause them to lose their spawning urge, or to ripen before reaching spawning areas, or be overcome by disease. Or, they could hamper the downstream migration of the young.

Encircling San Francisco Bay, "many new manufacturing plants, each adding a bit more temperature and pollution, eventually will bring ruin," prophecies Ted Wooster, fishery biologist, California Department of Fish and Game. "The south bay," he says, "is rapidly approaching the condition of Lake Erie, a dead lake, with an oxygen void in which fish can no longer survive."

**Tolerance-level** temperatures are no measure of the optimum for survival. Temperatures that never reach lethal levels may wipe out a species by favoring competitors, predators, parasites or disease. Temperature affects activity.

The Pennsylvania Division of Sanitary Engineering cites an experiment with brook trout. In water at 63 degrees F., the trout were slow in catching live minnows provided as food. At 70 degrees, they were nearly helpless, starving in the midst of plenty.

The Water Quality Control Act of 1965 requires the states to establish enforceable standards. Standards of 37 states have been approved by the Department of the Interior.

But Senator Edmund S. Muskie (D-Me.), chairman of the Senate Subcommittee on Air and Water Pollution, comments: "Little real effort has been made to control waste heat discharges to prevent adverse effects. . . . But it is obvious . . . that we cannot allow this situation to continue."