Jr. of Industrial Pollution Control 38(4)9-10(2022)
www.icontrolpollution.com
Perspective Article

AN OVERVIEW OF THERMAL POLLUTION AND ITS CONTROL

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(**Received**: 27-Jun-2022, Manuscript No. ICP-22-59839; **Editor assigned**: 01-Jul-2022, PreQC No. ICP-22-59839 (PQ); **Reviewed**: 15-Jul-2022, QC No. ICP-22-59839; **Revised**: 20-Jul-2022, Manuscript No. ICP-22-59839 (A); **Published**: 29-Jul-2022) DOI: 10.4172/ 0970-2083.003

ABOUT THE STUDY

Thermal pollution, often known as "thermal enrichment," is the worsening of water quality caused by any process that alters the temperature of the surrounding water. The rise or reduction in temperature of a natural body of water induced by human intervention is known as thermal pollution. Thermal pollution, especially chemical contaminants, alters the physical properties of water. The use of water as a coolant by power plants and industrial enterprises is a frequent source of thermal pollution. Thermal pollution can be caused by urban runoff storm water released to surface waterways from roofs, roadways, parking lots, and reservoirs. Thermal pollution can be caused by the release of very cold water from reservoir bases into warmer rivers.

When cooling water is returned to the natural environment at a higher temperature, the abrupt shift in temperature reduces oxygen delivery and has an impact on ecosystem composition. An abrupt shift in water temperature (either a quick increase or drop) known as "thermal shock" can kill fish and other species acclimated to a specific temperature range. Warm coolant water has a long-term influence on water temperature, raising the total temperature of bodies of water, including deep water. The distribution of these temperature rises throughout the water column is influenced by seasonality. Increased water temperatures reduce oxygen levels, which can kill fish and change the composition of food chains, reduce species biodiversity, and encourage the invasion of new thermophiles species.

Industrial wastewater

Power plants are responsible for 75 to 80 percent of thermal pollution in the United States. The rest comes from industry, including refineries, pulp and paper mills, chemical facilities, steel mills, and smelters.

Cooling ponds are man-made bodies of water that use evaporation, convection, and radiation to cool themselves. Evaporation, convection, and radiation are used to chill man-made waterways. Cooling ponds are cooling towers that use evaporation and heat transfer cogeneration to transport waste heat to

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the atmosphere, a process where waste heat is recycled for domestic or industrial heating purposes, can be used to control heated water from these sources.

Once-Through Cooling (OTC) systems, which do not lower temperature as well as the above methods, are one of the most significant contributors to thermal pollution. A major power plant may extract and export up to 500 million gallons of water each day. On average, these systems create water that is 10°C warmer. The Porter Generating Station in San Francisco, for example, utilized OTC and discharged water to San Francisco Bay at a temperature around 10 degrees Celsius (20 degrees Fahrenheit) above the ambient bay temperature. As of 2014, around 1,200 establishments in the United States were using OTC systems.

Temperatures may be measured using remote sensing techniques to keep track of how polluted plants are. This makes it easier to measure each plant's individual impacts and to regulate thermal pollution more strictly. Converting facilities from once-through cooling to closed-loop systems reduces the amount of thermal pollution released dramatically. These devices emit water at a temperature that is closer to that of the natural world.

The temperature at the bottom of man-made dams lowers substantially when water stratifies. Many dams are built to release the cold water from the depths of the earth into natural systems. This might be reduced by constructing the dam to discharge warmer surface waters rather than the cooler water at the reservoir's bottom.

Urban runoff

Urban runoff may have a considerable thermal influence on minor streams during hot weather. Storm water absorbs part of the heat when it travels over heated rooftops, parking lots, roadways, and walkways, a result of the urban heat island. Storm water management facilities such as bio retention systems and infiltration basins, which absorb runoff or divert it into groundwater, lessen these thermal impacts by giving the water more time to discharge excess heat before entering the aquatic environment. These linked runoff management technologies are part of a growing urban design strategy known as green infrastructure.