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POWER STATIONS -THERMAL POLLUTION OF WATER BODIES RELEVANT ENVIRONMENTAL LEGISLATION OF ECOLOGICAL SYSTEMS

Dr. Y. HANUMANTHA RAO
Department of chemistry, Andhra Loyola College (Autonomous), Vijayawada

ABSTRACT
water is used as a coolant near a power or industrial plant and then is returned to the aquatic environment at a higher temperature than it was originally. Thermal pollution can lead to a decrease in the dissolved oxygen level in the water while also increasing the biological demand of aquatic organisms for oxygen. The tropical waters have different ecological responses compared with temperate of water. In the tropics, the temperature of receiving rivers or bodies of waters is close to the upper limits of many species and the thermal power stations generally have a higher temp of 4 to 6 °C (Nair, 198546) higher than the normal temperatures. Rivers which act as estuarine type nursery of ocean fish species are badly affected by such polluted water from power plants. There are millions of tiny fish eggs, larvae, and very young fish essentially adrift in the water, and hence extremely vulnerable to power plant cooling water intakes. These small animals are often killed by the passage through a plant's cooling system. In some cases, about 60% mortality of newborn fish stock have been reported due to power plants. Moreover, Adult fish are also trapped and pinned to intake screens by the force of the suction.

KEYWORDS: Thermal pollution, power stations, fish

INTRODUCTION

Due to the substantial increase in the power conception and the availability of large coal and lignite deposits in India, many thermal power stations are being established along the coastal areas. These plants based on the burning of coal are turning to be environmental concern as the flue-gas, sludge, fly ash and waste water produced are polluting environment if proper disposal methods are not adopted. Further, the water bodies receiving waste waters from thermal stations generally have higher temperatures than the normal and these higher temperatures decrease the DO contents in waters and thereby causing 'thermal stratification of water layers' which results in developing strain on the aquatic life and biota and thereby, causing the disappearance of valuable species in water bodies near the thermal power stations. Further, the toxic ions such as heavy metal ions, are leached into the nearby water bodies from ash ponds pertaining to the thermal power stations and are accumulated over a time due to bio-amplification phenomenon to dangerous levels and thereby turn be to be potential health hazard.

Although regulatory agencies are enforcing stringent norms to control and mitigate the potential treats of thermal power stations on environment, the lack of efficiency in implementing the regulatory measures is endangering the peaceful human dwelling in serine laps of nature and moreover threatening the very human survival.In the endeavor of generating the increasing thermal power, bigger pollution problems are being invited. The thermal power stations while generating electricity are contaminating the environment

surrounding it and turning into the sources of hazardous substances. In this context, it is essential to initiate case studies on the assessment of environmental contamination caused by thermal power stations in India in its vicinity with respect, air, water and soil.

Vijayawada Thermal Power Station (VTPS) is established near the sprawling rich city Vijayawada three decades back and there is a public concern that the power station is causing pollution to the environment. In this investigation it is endeavored to assess the impact of VTPS on the quality of waters in the water bodies in its vicinity.

METHOD AND MATERIALS

1. DESCRIPTION OF VIJAYAWADA THERMAL POWER STATION

The Thermal station is located at Ibrahimpatnam, 17 km away from Vijayawada Railway station in A.P. The huge water requirement for the thermal station is meat from the impounded waters from the Prakasham Barrage constructed across Krishna River with stagnating capacity of 2 TMC of water and from where the Krishna river waters are being diverted to three main canals namely Bandar, Eluru and Buckingham Canalsthat runs mile and miles in different directions to cater the drinking and irrigation needs of people of six districts and these "live nerves" bring the prosperity for this areas and turned to be "blessing in disguise" for Telugu people.

The water requirements for the thermal power station are met from the stagnated placid waters of the barrage and after the waters are used for different purposes of the thermal power station, it is let into the same stagnated pool of Krishna River on the up-side of the river. A canal of dimensions 24 m length x 15 m breadth (average) x 3 m depth is being used to take the impounding waters at the barrage from Bhavanipuram intake point 12 K.M. away from the VTPS. The effluent from the VTPS, is being discharged into the impounding waters of the Prakasam Barrage through Bhudameru canal of dimensions of 98 m length x 82m breadth (average) x 4m depth. The distance between Bhavanipuram intake point and the point of merging at Tummalapalem is 12 K.M. and the later is on the upper stream side of the Krishna River. In other words, the water for various purposes of VTP is being taken from the impounding waters at Prakasham Barrage and after use for steam generation and cooling, the effluent waters are being let into the same stagnated waters at the Prakasham barrage. If the effluent waters are contaminated with impurities especially of non-degradable nature, as the time proceeds, the accumulation of impurities in the pond increase and in due course, they may reach threshold values endangering the aquatic life and also the people in five districts who depend upon this Barrage waters.

ESTABLISHMENT OF SAMPLE STATIONS

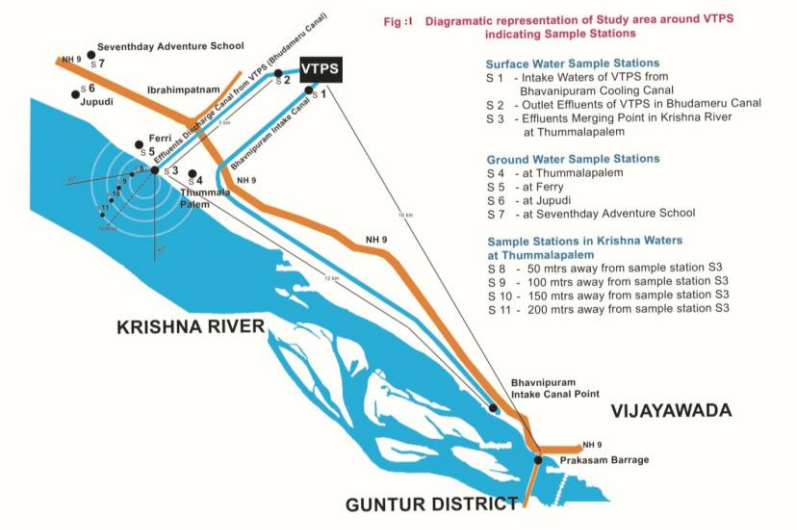

Fig :I Diagramatic representation of Study area around VTPS indicating Sample Stations

As has been depicted in the Fig, seven sample stations were established: 3 surface waters and 3 ground-waters
A: Surface waters:

- *Station No. 1: at Bhavanipuram intake point*
- *Station No.2: at outlet of the VTPS into Budameru canal at Ibrahimpatnam*
- *Station No.3: at Tummalapalem where the outlet water from VTPS is merging with Krishna River*

B: Ground Waters: To understand impact of VTPS ash ponds on the quality of ground waters, four stations have been established:

- *Station No. 4: at Tummalapalem:*
- *Station No.5: at Ferri*
- *Station No. 6: at Jupudi village*
- *Station No. 7 : at Seventh Day Adventure School*

Further, for studying the temperature variations, four more sample station Nos. 8, 9, 10 and 11 were established at equidistant points on the sectors at 50 meters, 100 meters, 150 meters and 200 meters respectively from the point of merging of effluents from VTPS in Krishna River waters at Tummalapalem in Krishna River waters (Lake) as shown in the Fig No.1 .By rowing into the waters of Krishna with the help of a country boat, the temperature measurements were made at three chosen points on each Sectors; one normal to the Krishna river bank and other two at an angle of $45^{\cdot O}$ in clock wise and anticlockwise directions to the normal or bank. The averages of the measured temperatures were noted.

ANALYSIS

Collection of Samples:***(i) Surface waters:***By using 'sample thief' of capacity 2 lit, the samples were collected at the top, bottom and middle depths at the two opposite bank sides and also in the middle of the canal. The waters at the middle of the stream were collected by rowing in a boat. Thus collected waters were mixed and thus obtained samples were used for analysis. The same method of collection was adopted at sample Station Nos. 1, 2 and 3.

(ii) Ground Waters:At sample stations 4, 5, 6 and 7 ground waters were collected from bore wells which were laid at depth of nearly 60 ft.

THERMAL POLLUTION

When the hot effluents from thermal stations are discharged into nearby water bodies, aquatic life is destroyed due to the thermal shocks and this is termed as Thermal pollution..

Hence, in this work a systematic study is made to understand the temperature variations with respects to season and at different stations. The temperature measurements were made in the surface Station Nos. 1, 2 and 3 and also at four more sampling stations Nos.8, 9, 10 and 11 established at four points on the sectors at 50 meters, 100 meters, 150 meters and 200 meters respectively from the point of merging of out letting hot water with Krishna river water as shown in the Fig .The data obtained at various stations waspresented .

The data indicates:

a. At any time, the temp. of the out let (effluent) waters from VTPS either at station No.2 or at station No. 3 are always 7oC to 12oC more than the temp of in taking waters at Station No 1 .
b. Even gushing waters of Krishna River are not decreasing the content of heat in the waste waters of VTPS quickly and it is due to the fact that waste waters are huge in quantity and so, the temperatures are not coming to the normal quickly. For example, at the sectors at 50, 100, 150 and 200 meters away from merging point, the average temps. of mixed Krishna waters were 49.00C, 44.90C,42.40C and 41.60C respectively in the month of April.; 54.20C, 52.6 0C 51.20C and 48.3 0C in the month of May; 48.50C, 46.50C , 44.50C and 43.50C in the month of June; 47.5C 0, 48.30C, 43.5 0C and 40.00C in the month July; 45.50, 42.50, 40.30, and 37.50C in the month of August; 45.00C, 40.00C, 35.50C

and 33.00C in the month of Sept.; 38.00C, 34.50C, 31.30C and 28.00C in the month of Oct.; 35.00C, 32.00C, 29.00C, and 27.00C in the month of Nov.; 34.00C , 31.00C, 28.00C and 25.00C in the month of Dec. 14. (Vide Table No.11: Sample station Nos. 8,9,10 and 11).

c. On comparison of the data at Station No.1 with Station No.11, it was inferred that the temperatures are not coming to the normal even at 200 meters away from the mixing point of hot waters.

d. It is an interesting observation that in the surrounding area of water column around the Station No. 3 extending to about 200 meter scanty is the aquatic life found.

Thus the VTPS effluents are causing thermal pollution especially in a sector of water column around the Tummalapalem discharging point which extends to about 200 meters from the Station No. 3in the lake resulting 'stratification' of layers and subsequent loss of pond ecological balance and thereby endangering the aquatic life. The increase in temperatures in water bodies, decreases the content of DO in waters but causes the increase in the biological demand of oxygen for aquatic organisms and this results in the stress on the organisms leading to the loss of biota and organisms especially valuable species of fish and it is a common feature especially in summer season to see dead fish floating bally up in water bodies and getting washed to the banks.

Hence, adequate measures are to be taken by VTPS in sufficiently cooling the discharging waters from the thermal stations such that the aquatic life and other biota is allowed to be sustained in the nearby water bodies.

CONCLUSSIONS

In the present study, the quality of water in the water bodies in the vicinity of VTPS has been assessed continuously for a period of 9 months with respect to thermal pollution caused by the effluents from the VTPS in the nearby water bodies has also been monitored in the said period. The present study indicates that the surface and ground waters are being polluted by the effluents from VTPS endangering the people dwelling in the nearby areas. It is very surprising to note that the effluents from the VTPS are being discharged into the up-side stream (and not down-side) of Krishna river from the Prakasham Barrage and thereby polluting the stagnated lake waters of the barrage, which is severing the water requirements of six districts through three major canals, viz., Eluru, Bandar and Bahimhang canals and for which the prosperity in this area is attributed. The contamination waters is effecting the "health and wealth" of the people dwelling in these areas. Generally power station effluents are merged either into sea, or into the down waters of stream or river and not in lakes serving the drinking needs of habitations.

If the receiving water bodies of the effluent are reservoirs or lakes as that of VTPS,, water environment is intensively affected due to the stagnation of waters in the reservoir or lakes and it will turn to be a proverbial "bowel" collecting impurities to "hand-over" them to the habitations which depends upon the gift of nature, "Water" and thereby the so called "sign posts" of human development, thermal power stations, turn into the "dangerous signals" directing to "human graves". The Power Plants should be "boon" to the people" and not "bane".

So, the effluent waters from VTPS are to be sufficiently treated before discharging into the water bodies because the impurities entered into the waters get accumulated during the course of time through the processes such as 'bio-amplification', especially with respect to the non-degradable ions and further, the effluents are to be sufficiently cooled to avoid thermal pollution.

REFERENCES

[1]. Janez Oman, Andrej Seneganik, and Boris Dejanovi , Influence of lignite composition on thermal power plant performance: Part 1: Theoretical survey, Energy Conversion and Management Volume 42, Issue 3, February 2001, Pages 251-263

[2]. D'YAKOV A. F. ; GORDIN I. V. ; BERSENEV A. P. ; FEDOSEEV B. S. ; The environmental control activities of thermal power stations in protecting reservoirs Journal Title: Thermal engineering ISSN 0040-6015 1997, vol. 44, pp. 967-973 (8 ref. in it)

[3]. Subhes C. Bhattacharyya, An Estimation of Environmental Costs of Coa-based Thermal PowerGeneration in India, International Jouranl of Energy Research,1997, vol. 21, pp. 289-298 (21 ref. in it)

[4]. KYAKK V. A,. Thermal pollution of water bodies by the circulating water of power stations and relevant environmental legislation, Journal Thermal Engineering, 2002, vol. 49, pp. 306-310 (6 ref in it.)

[5]. Thermal power plant water treatment process: United States Patent 4347704