POLLUTION IN VISAKHAPATNAM HARBOUR

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VISAKHAPATNAM has a natural harbour, located on the eastern sea board of India, half way between Madras and Calcutta. The topographical features of the harbour include a narrow entrance channel and four navigable arms radiating from a central turning basin. These navigable arms providing berthing facilities for the ships are the Western Arm, the North-Western Arm, the Northern Arm and the Southern Lighter Channel (Fig. 1).

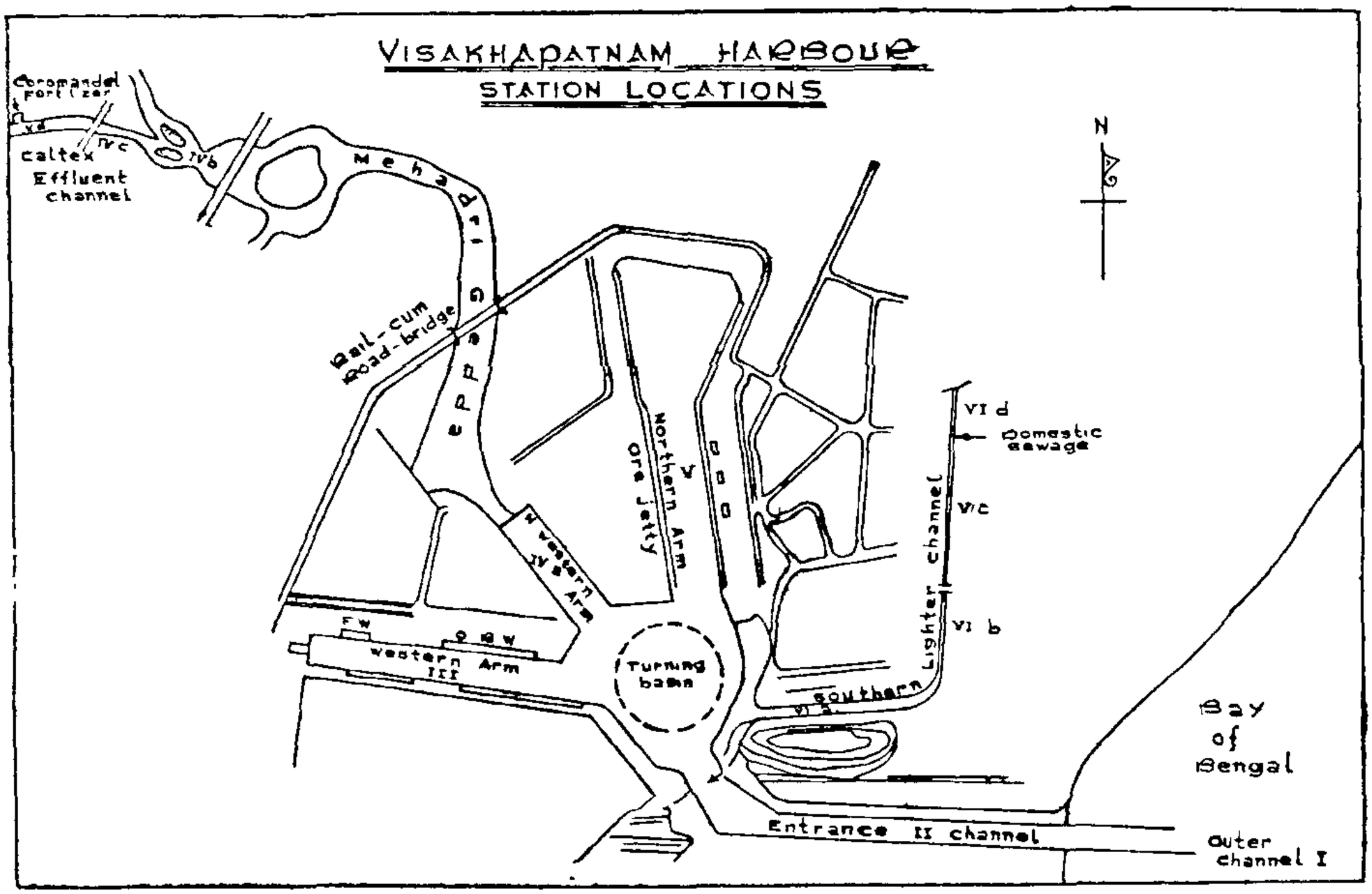

FIG. 1

In recent years many industrial installations have sprung up in the environs of the harbour the most notable of which, from the point of pollution, are the Caltex Oil Refinery, the Coromandel Fertilisers, The Hindustan Polymers, and the Ore Handling Project. The Caltex Oil Refinery and the Coromandel Fertilisers discharge their effluents into a monsoon fed stream, 'Mehadri Gedda', which in its turn opens into the North-West Arm of the harbour. During the rainy season this stream brings appreciable amounts of fresh water into the harbour. The other important sources of pollution are from the oil and the ore jetties located in the West and North Arm of the harbour respectively. Appreciable amounts of oil and ore dust are spilled into the harbour waters during loading and unloading operations. The town's sewage system empties its domestic wastes into the Southern Lighter Channel. Being a closely confined area connected with the open sea by a narrow entrance channel, the harbour waters have no effective means of flushing out the industrial and domestic wastes except tidal action which affect only the surface layers.

With a view to study the different types of pollutants entering the harbour waters and ultimately the nearshore littoral region, stations were located in each of the arms which receives different types of pollutants. As a base line for comparison, another station was located at the 'Outer Buoy'

TABLE I

Post-monsoon period, October 1970	I	II	III	IV	V	VI *a*	VI *b*	VI *c*
pH	8·50	8·40	8·10	8·20	8·40	7·70	7·80	7·60
Chlorinity ‰	12·10	10·91	10·90	6·35	10·77	7·70	6·20	2·20
Dissolved oxygen ml/l	4·00	4·20	3·60	5·60	3·60	1·20	0·44	Nil
Nitrite-nitrogen μg at./l	1·35	28·00	25·00	30·00	18·20	Nil	Nil	Nil
Pre-monsoon period, April 1971								
pH	7·30	6·30	6·20	5·00	6·10	7·20	8·00	8·20
Chlorinity ‰	18·66	18·45	18·50	18·10	18·12	6·60	6·93	5·90
Dissolved oxygen ml/l	3·40	3·30	3·00	3·10	3·50	0·20	Nil	Nil
Nitrite-nitrogen μg at./l	0·70	18·20	..	19·80	27·00	0·40	Nil	Nil

TABLE II

Surface dissolved oxygen, B.O.D. C.O.D. and hydrogen sulphide at the six selected stations of the Visakhapatnam Harbour (Low Tide, 18–7–1971)

Station	I	II	III	IV	V	VI *a*	VI *b*	VI *c*
Dissolved oxygen ml/l	3·98	3·92	3·30	4·54	4·12	1·50	0·00	0·00
B.O.D. mg/l	9·91	13·68	19·20	20·68	28·64	168·17	247·64	304·30
C.O.D. mg/l	3·60	4·16	4·06	4·80	4·78	9·92	38·72	38·72
Hydrogen sulphide mg/l	Nil	Nil	Nil	Nil	Nil	Trace	7·70	9·10

area, which is about 2 Km away from the mouth of the entrance channel.

The preliminary observations on the physico-chemical characteristics of the ambient water in the harbour showed low oxygen values, widely fluctuating chlorinity and high concentration of nutrient salts such as nitrites and phosphates. A summary of the observations recorded during the post-monsoon period in October 1970 and the pre-monsoon period, April 1971 are tabulated in Table I.

The B.O.D. (Biological oxygen demand) and the C.O.D. (Chemical oxygen demand) values in the harbour waters are appreciably higher than in the base line open sea Station I. In the severely polluted Southern Lighter Channel there is practically anoxic condition and emanation of hydrogen sulphide (Table II).

In addition to the collection of data on the above parameters attempts were made to detect, both qualitatively and quantitatively, the presence of heavy metallic ions such as copper, and iron and also fluorides, phosphorus and oils from the industrial effluents. The results are presented in Table III and Fig. 2. Preliminary tests have also shown the presence of other heavy metallic ions such as Lead, Zinc, Nickel, Chromium and Arsenic.

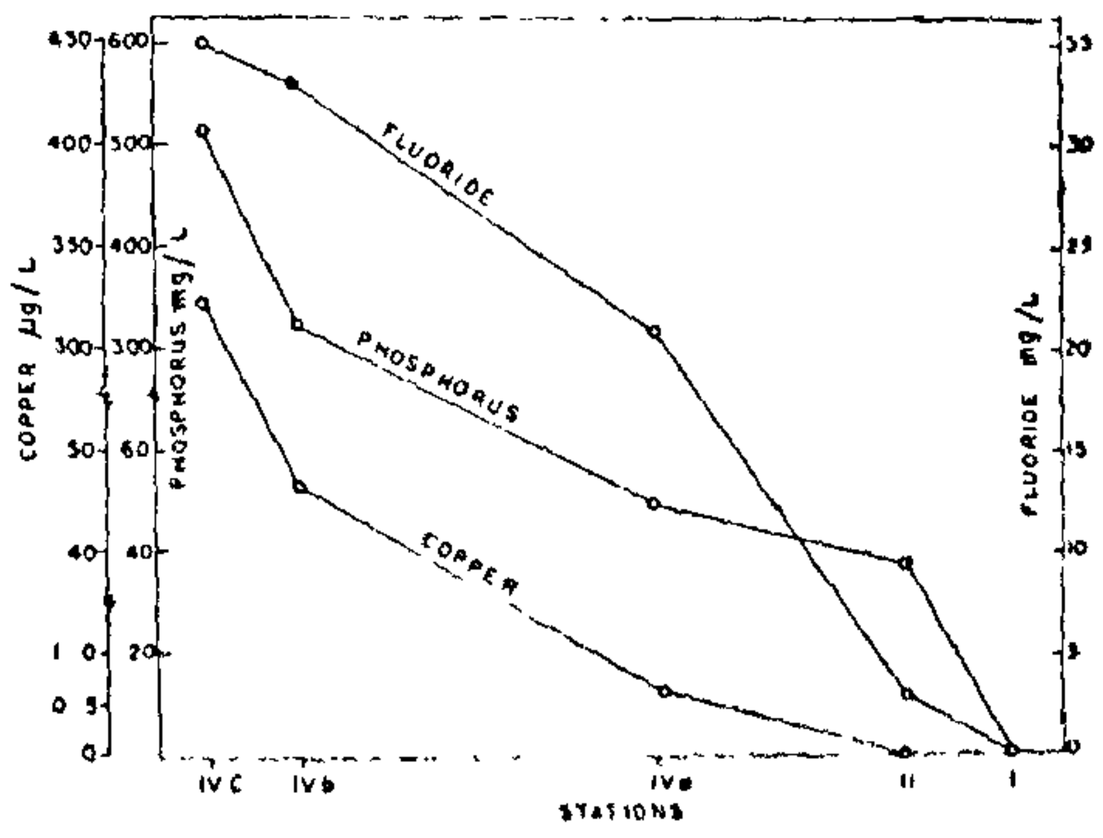

FIG. 2. Surface Dispersion of Copper, Phosphorus and Fluoride from the discharge point towards the sea (Low Tide, 18–7–1971).

TABLE III

Surface concentration of pollutant factors at the selected stations of the Visakhapatnam Harbour (Low Tide, 18–7–1971)

Pollutant factor	I	II	III	IV *a*	IV *b*	IV *c*	V
Copper μg l	Trace †	Trace	..	0·64	46·38	322 78*	
Phosphorus mg/l	Trace †	38·40	..	49·60	324·00	512 [illegible]	
Fluoride mg l	Trace †	3·00	..	21·10	33·00	35 00	..
Iron mg l	Trace †	..	..	..	..	..	1·84*
Oil gm/l	..	..	2·24	..	..	..	..

* Value at the discharge point. † Value at maximum dilution.

Many workers have stressed the importance of pH (Klein, 1962)[1]; chlorinity (Kinne, 1964)[2]; dissolved oxygen, B.O.D. and C.O.D. (Reish, 1959[3]; Mc Nulty, 1961[4] and Bagge, 1969)[5] and nitrite-nitrogen (Braarud and Foyn, 1951)[6] in evaluating the intensity of pollution in any locality. The toxicity of heavy metallic ions such as Copper, Zinc, Mercury and Lead to marine life is well known. Portman and Wilson (1971)[7] have studied the toxicity of 140 substances to the brown shrimp and other marine animals. Manwell has indicated the lethal effects of fluoride on the photosynthetic activity of the alga, *Chlorella* (Crisp, 1970)[8].

Our preliminary investigations have abundantly shown that the local harbour waters are subjected to both industrial and domestic pollution and that some of the well-proved toxic pollutants are present in quantities well above the known tolerance level of marine organisms. The effect of the discharge of domestic wastes into the harbour waters is immediately obvious in the Southern Lighter Channel where conditions are practically anoxic for marine life owing to accumulation of as much as 6·0% of organic carbon in the substrate and emanation of hydrogen sulphide. While the effect of the discharge of industrial wastes in the other arms of the harbour are not immediately so obvious, there are clear indications that the cumulative effect of continued discharge of the industrial effluents may affect the eco-system and marine life of not only the harbour waters but also of the nearshore littoral region.

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