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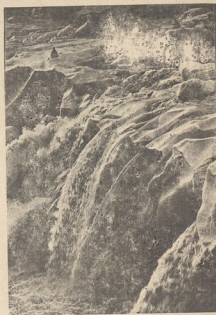
"Ganga Maiya"

THANKS TO unregulated industrialisation and urbanisation, Ganga, the world's best river, is, today, in the worst shape. When you go to Ganga's tributary Jamuna at Delhi, to immerse ashes, you wonder if its waters are not too dirty to receive the last remains of your near and dear ones. It is some comfort that Government has at long last woken up to the need to clean up the river. However, at the end of the 5-year, Rs. 250-crore scheme, the people will not be content with just the money spent (money can often go down the drain !) but with the actual cleaning done.

Nor need it begin and end as only an official operation. Let the people be invited to cooperate in the holy enterprise. Let them not throw any more bodies of man and cattle into the river. And let the ritual holy bathing come *after* a cleansing bath at home.

The current issue of *Manthan* carries the Proceedings and Papers of a Seminar we organised on the subject. You will particularly profit by the Toynbee-Ikeda dialogue on the deeper causes of pollution—and the philosophical basis necessary for the integrity of our natural environment.

ON MARCH 1-2-3 we had held a Workshop on "Strengthening the Movement for Constructive Work in India". The Proceedings of this Workshop were published in our issue of April 1985. The participants constituted themselves into a "Follow-up Group for Constructive Work" under the leadership of Shri Tarlok Singh. It was also decided that activities of constructive organisations may be publicised in *Manthan* for the information of all. We are happy to carry the first reports on four such organisations in this issue. We hope to make this section a regular feature of *Manthan*.



*Sadhus meditating in Padmasana at Gangotri
(Courtesy Raghubir Singh)*

O Holy Mother Ganga !

Srotasaamasmi Jaahnavee

Among the streams, I am the Ganga (Jahnavi)

Sri Krishna in Gita :10:31

Ganga Gangeti Yo Bruyat Yojananam Satairapi

Sarvapaapa Vinirmukto Vishnulokam Sa Gacchati

He who utters "Gange, Gange" even from a distance of hundreds of miles, becomes purified from all sins and attains Vaikuntha, the world of Vishnu.

(Devi Bhagavotam)

Shareere Jarjareebhute Vyadhighraste Kalebare

Aushadham Jahnavi Thoyam Vaidyo Narayano Harih

When the body is afflicted by senility and diseases, the Holy water of Mother Ganga is the medicine, and Lord Narayana (Hari), from whose feet Ganga emanates, is the Great Physician.

(Lord Dhanwantari)

Bhagavad Gita Kinchidodheeta Ganga Jala Lava Kamika Peeta

Sakridapi Yena Murarisamarcha Kriyate Tasya Yamen Na Charcha

Even a little study of Gita, or the drinking of a little Ganga water, and the worship even once of Murari, will make one immune to Yama !

(Sri Sankaracharya)

Ganga Cha Yamuna Chaiva

Godavari Saraswati

Narmada Sindhu Kaveri

Jale Asmin Sannidhim Kuru

O Holy Mother Ganga ! Yamuna ! Godavari ! Saraswati ! Narmada ! Sindhu ! Kaveri ! May you all be pleased to manifest in these waters (with which I shall purify myself).

(Morning Bath Prayer)

Mysterious Powers of the Ganges water

By : SWAMI SIVANANDA

THE WATER OF the Ganges is extremely pure and sanctifying. No germs can flourish in this. This has been tested by various scientists in the laboratory. Rich in minerals, this water cures almost all kinds of diseases.

The Ganges is saturated with antiseptic minerals. Even in the West doctors prescribe Ganga water for rubbing in the treatment of diseases of the skin. Ganges is not merely a river. It is a sacred Tirtha. It is possessed of mysterious powers which are not found in any other river of the world. Even scientists have admitted the efficacy of the Ganges water.

Dr. F.C. Harrison of McGill University, Canada, writes : "A peculiar fact which has never been satisfactorily explained is the quick death in three or five hours, of the cholera vibrio in the waters of Ganges. When one remembers sewage by numerous corpses of natives, often cholera casualties, and by the bathing of thousands of natives, it seems remarkable that the belief of the Hindus, that the water of this river is pure and cannot be defiled, and that they can safely drink it and bathe in it, should be confirmed by means of modern bacteriological research."

A well-known French physician, Dr. D. Herelle, made similar investigations into the mystery of the Ganges. He observed some of the floating corpses of men dead of dysentery and cholera, and was surprised to find "that only a few feet below the bodies where one would expect to find millions of these dysentery and cholera germs, there were no germs at all". He then grew germs from patients having the disease, and to these cultures added water from the Ganges. When he incubated the mixture for a period, much to his surprise, the germs were completely destroyed.

A British physician, Dr. C.E. Nelson, F.R.C.S., tells us of another striking fact. He says that "ships leaving Calcutta for England take their water from the Hooghly river which is one of the mouths of the filthy Ganges and this Ganges water will remain fresh all the way to England. On the other hand ships leaving England for India find that the water they take on in London will not stay fresh till they reach Bombay, the nearest Indian port, which is a week closer to England than Calcutta. They must replenish their water-supply at Port Said, Suez or at Aden on the Red sea". It is no wonder that the Indian people should hold that the Ganges is very sacred and possessed of mysterious powers."

(By courtesy from Swamiji's book "Mother Ganges".)

DRI Seminar on Ganga

August 11, 1985

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Pollution of the Ganga: The nature of the Problem and its Dimensions

THERE ARE not many days in London when you can sit out in the sun. But even on such rare days, British Members of Parliament could not sit out because of the stench from the River Thames flowing by.

That was a hundred years ago.

The main worry of Londoners at the time was not that milkmen were mixing water with milk, but that they were mixing the noxious Thames water ("the London blue") with milk.

Today Thames is clear as crystal.

Only a few decades back the river Mosca (which has given its name to Moscow) was so polluted with all kind of acids and alkalis, that it would not freeze even in the Russian winter! Today the purity of Mosca is the pride of Muscovites.

We in this country have been fortunate in a river like Ganga. It not only had the unique distinction of being brought down to the plains by the engineering skill of a Bhagirath ages ago; its high Radon content (is it due to the electro-chemical quality of Gangotri area?) destroys 75% bacteria within 24 hours. Also its right degree of Iodine content is a guarantee against Goitre and many other ailments. And yet over the last hundred years or so, we have poured so much filth and poison into it that today, over long stretches, the Ganga is more a sewer than a river.

All this is apart from the havoc played with the Ganga by deforestation in the Himalaya and consequent erosion and floods. Hillary, who found the Himalaya lush green only thirty years ago when he climbed the Everest with Tensing, is shocked to find it "brown and barren" today. Says Father Gene Watrin, ecologist, so much soil is being washed into the sea that if another country occupied that much land, we would go to war with it! The unscientific construction of roads, railways, barrages and bridges has also contributed to floods and erosion. As a result, the Himalaya is slowly, but literally, slipping away into the sea!

Kanpur makes a criminal assault on the Ganga

The sources of pollution proper are many : most of the cities along its banks discharge their raw sewage into the river, without first treating it chemically. Although industries discharge a lower percentage of effluents than urban sewage, these industrial discharges are very much more toxic and even lethal. The increasing use of fertilizers, herbicides and pesticides is poisoning the river. Over-irrigation in certain areas, is causing many alkalis and acids in the soil to come up and find their way into the river.

The mischief begins right where the Ganga first enters the plains. The I.D.P.L. factory in Rishikesh and the Bharat Heavy Electricals Ltd. at Hardwar, release their wastes into the Ganga.

When the Ganga reaches Hardwar, sixty percent of its water is diverted into the Ganga Canal. This not only very much dries up the Ganga for the next fifty miles and more, the over-irrigation of the areas fed by this canal has raised the salinity and alkalinity of the soil in the surrounding area.

However, the worst damage to the Ganga is done at Kanpur. It is nothing short of criminal assault on the river. This biggest city of UP not only discharges its sewage water into the river, its numerous textile mills and hundreds of tanneries give the river water a thick brown shade. It takes ten miles of wind, water, sun and soil action, to give this devil's brew a semblance of water once again.

The Fertilizer factory at Phulpur near Allahabad is another major polluter of Ganga water.

More assault awaits the river in Varanasi, where 120 million litres of raw sewage are discharged into the river day in and day out. Since Varanasi is a preferred place for dying, 400 bodies are cremated here every day. In many cases, half-burnt bodies are consigned to the river—since fuel for a proper cremation costs more than Rs. 500. (The electric crematorium charges an obviously subsidised Rs 10, but custom prefers an open cremation. Also the crematorium takes more than two hours to incinerate one body, and so it cannot handle more than eight bodies a day.)

On top of this, 9000 animal carcasses are consigned to the river every year.

Varanasi is famous for its silk saris. But these too contribute their share of dyes and chemicals. And then there is the public sector Diesel Loco Works, releasing its oily wastes into the river.

Since land values are going up, old ponds have been filled up, levelled and built over. The cattle, formerly kept at these ponds, have been moved to the river-front, where they contribute to the filth with their excreta.

The worst part of the Varanasi situation is that while the city sewage is discharged at Assi Ghat, the city's water supply is pumped just 60 metres down-stream at Tulsi Ghat. So the holy city of Varanasi drinks just chlorinated gutter water ! No wonder Varanasi has an infant mortality rate of 13.74 per one thousand live births, against the national average of 94. Skin diseases and intestinal disorders are rampant. No wonder, too, that 80% diseases in India are water-borne.

Only 80 km further down, at Ghazipur, the government factory making morphine out of opium, discharges so much opium in its effluents that nonkeys in the area have become addicted to this "opium-water", and they spend their life in a dazed and drugged state!

As the Ganga flows through Bihar, it only gets worse. Fortunately Patna does not have much industry to talk of. All it has is a group of brick kilns, which welcome the river silt as good raw material. But Patna has the dubious distinction of having two sewage treatment plants (STP)—and of not using either of them!

The Britishers installed an STP with 4 million gallon capacity at Saidpur, way back in 1939. However, when world war II broke out in that year, the plant was left unused. In 1956, the state government upgraded its capacity to 6.2 million gallons, and handed it over to the Patna Corporation which, however, never used it. In 1962, GOI sanctioned Rs. 44.5 lakhs to operate the STP. But the state government sat on it until 1965, in which year the Corporation used the money to pay staff salaries !

Simultaneously the State Government built another STP at Beur, —but it could not find the money to lay the pipelines which bring the sewage to the plant ! And there the matters rest for the present, with

*What Varanasi drinks is only
chlorinated gutter water*

Jamuna is even more misused than the Ganga

40 million litres of untreated Patna sewage water merrily flowing into the Ganga day after day.

Matters are made much worse as the Ganga proceeds from Bhagalpur to Barauni. In this 112-km stretch, the Ganga receives the water of Bata Shoe factory, McDowell distillery, the malasses overflow of sugar factories, the Barauni oil refinery, a thermal power station and a fertilizer factory. Fish survives only 48 hours near Bata Shoe factory; and it dies within five hours at the distillery point. The situation is worst at Mokameh Bridge. The Barauni refinery discharges so much oil waste that, in 1968, the Ganga actually caught fire at Monghyr and this fire raged for sixteen long hours.

The oily discharges at Barauni prevent fish from moving up or down. And the Farakka Barrage, further down, prevents the sea fish from coming up, which earlier used to go as far upstream as Hardwar, for spawning purposes.

Things get still worse at Calcutta. Mercifully, the city does not pour its sewers, carrying 120 million gallons of waste waters, into the river; it diverts them to grow vegetables at Dhapa. It is another matter that Dhapa vegetables at times have worms, some of which do not die even after being cooked. However, the industrial effluents from Tribeni to Batanagar, make the river a very toxic stream. Since the bigger fish live on smaller fish, the poison content in fish gets biologically magnified. In 1982, even arsenic was detected in Calcutta fish. Arthritis, bone diseases and foetus deformation have registered a significant increase in the area.

West Bengal has 7000 big and small factories. Only 40 of them have been persuaded to instal effluent treatment equipment, and only six of the rest have been prosecuted for non-compliance.

While this is the condition of Ganga, that of Jamuna, its biggest tributary, is, if anything, even worse.

The Tajewala works just above Delhi, take away more water for irrigation, than is good either for Delhi or for the over-irrigated land. The city discharges 120 million gallons of sewage—more than half (53.6%) of it raw—into the river. The city's 16 large and 500 medium factories pour their wastes of sodium, dyes, acids, phenols into 17 open drains.

The various electroplating units even discharge their cyanide waste into the drainage system. As against a maximum 0.2 milligram of cyanide per litre considered safe, Delhi water shows an unconscionable 2.0 mg. per litre. No wonder a few years back all fish in Okhla were found dead. At the same time Hindon river carries all the sewage and industrial wastes of Ghaziabad into the Jamuna.

Between Delhi and Agra, Jamuna water is unfit not only for drinking, but also for bathing! Between Wazirabad and Okhla, the upstream and downstream points of Delhi, Jamuna is not fit even for irrigation!!

Inspectors, in Delhi at least, are not interested in stopping pollution; many of them are interested only in collecting bribes for not reporting pollution. In other words, they have a vested interest in the continuation of pollution.

A yet another but unconventional threat to the Ganga is the establishment of a nuclear power station at Narora on the banks of the Ganga in Western U.P. Narora falls in a highly active seismic zone—and experts had strongly advised against this site, and recommended the non-seismic locations of Rawatbhata and Matatila in Madhya Pradesh. Any earthquake in the Narora area, and damage to the nuclear plant, could lead to the nuclearisation of the Ganga basin.

But even apart from this possible grave danger, the Ganga is in serious peril. According to international standards, if bacterial count of faecal coliform exceeds 500 per cubic metre the water should be considered as polluted. In both, the Ganga and the Jamuna, the bacterial count at several places, is forty to fifty times that!

There are 29 class I cities (with more than one lakh population) on its banks. Only 5 of them have sewage pumps and only 10 of them have even partial STP. Of the 23 class II cities (pop. between 50,000-100,000) not one has a proper sewerage system. And of the 48 towns (population between 10,000 and 50,000) only five have a sewage system. All this raw, untreated sewage is poisoning the river with a high coliform count and a high Biochemical Oxygen Demand (BOD). The coliform count evaluates the extent of harmful bacteria in water, while BOD is a general scale of organic pollution in water.

The Ganga water is superior to any other river water; but even that

*Narora can make the Ganga
dangerously radioactive*

The Delhi Cloth Mills complied : the Delhi Milk Supply defied !

cannot handle the load of filth and poison poured into it day and night, day after day, night after night.

The industrial units continue to pollute the river with impunity. Five years after Bata factory and McDowell distillery were prosecuted in Bihar, the cases were still pending.

In Delhi, private sector Delhi Cloth Mill and public sector Delhi Milk Scheme were prosecuted for pollution. While DCM put up plant to treat its toxic and non-toxic wastes, DMS is yet to do so. And when there are fines, they are so small, nobody cares.

Meanwhile in the name of more food production, chemical fertilizers, herbicides and pesticides are being used with reckless abandon. All these poisons are finding their way into our soil, our water, into the very marrow of our bones. The Ganga basin is using 1.15 million tons of fertilizer a year; full 15% of this escapes into the river!

The Indian Standards Institute has laid down that arsenic in pesticides must not be allowed to escape into our water system at all; but in 1982, arsenic was detected in Calcutta fish.

It is to meet this grave situation that GOI has set up a Central Ganga Authority to clear up the Ganga at a cost of Rs. 250 crores, over a period of five years. After a few weeks, came the news that the Planning Commission was sanctioning only Rs.80 crores for the purpose. Ironically enough, the PM is Chairman of both bodies. And he of course gave the assurance that the Ganga waters would not be allowed to suffer for want of funds. However, only the pressure of enlightened public opinion can effect the right results in a complex matter like this.

Out of evil cometh good. And, fortunately, the Bhopal tragedy has made the country quite conscious of the dangers of environmental pollution and industrial poisoning. It has strengthened the hands of people's movements like "Swatchha Ganga" launched by Prof. Veerbhadra Mishra of BHU, and the Ganga Mukti Andolan of Bihar.

First and foremost, the Ganga Authority must see to it that all cities on the Ganga, big and small, install STPs. This need not be difficult, since STPs are now manufactured in India. Also, STPs are quite a paying proposition. Sewage water can be treated to produce methane gas for

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fuel—as also algae and fish. It has been computed by the Department of Environment, Government of India, that while the cost of treatment of effluents per head of population will be Rs. 23 a year, the production of gas etc. will be worth Rs. 37 over the same period (*vide* Report "Prevention of Pollution of the Ganga"). If necessary, the Ganga Authority can install the STPs and charge the same to local authorities. Or it could advance loans to the various municipal committees and require installation of STPs within, say, one year—on pain of heavy fines. Persistent pollution of river waters could be made a cognisable offence against the concerned civic authorities.

The industrial units need to be tackled with even greater firmness. The Indian Factories Act, Rule 18, requiring chemical treatment of effluents, is too vague to be effective. It needs to be made more specific—and more stringent. There can even be special courts to try offenders against river waters. No new plant should be allowed to be set up unless it first has a proper treatment plant.

There is also a suggestion that clear water should be provided to domestic users, treated, and then served for industrial uses, then again treated and released in the river. This would call for aerobic and anaerobic treatment. It is pointed out that water in London is re-cycled as many as nine times.

A comprehensive study must be made to assess the damage that various fertilizers and pesticides do to the environment—and the use of harmful ones banned. It has been found that even one gram of detergent can ruin 10,000 gallons of water. All this playing with the health of the people, needs to be stopped.

The task of cleaning up the Ganga—and then keeping it clean—cannot be left to the mercy of the states. This responsibility shall have to be shouldered by the Central Ganga Authority for good. And even this Ganga Authority will not be able to overcome all-round inertia and ignorance, unless public-spirited individuals and institutions make the integrity of the environment a cardinal credo of their life.

(K R.M.)

*"All good things in the world
can be traced to
the holy banks of the Ganga".*

—SCHOPENHAUER
German Philosopher

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Studying the Ganga catchment area through large-scale models

By Dr. H.L. Uppal,

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LUDHIANA

GANGA is the most sacred river of India. Through the ages it has been called Gange Maiya, meaning mother Ganga. Its scenic catchment areas, inspiring landscape, attractive green verdure and forest belt trees laden with fruits, have held the heart of millions of people captive. Several eminent explorers for centuries have made attempts to reach the source of Ganga and many have lost their lives in this attempt. Such has been the great charm and romance associated with the name of Ganga. The Ganga river created such an inspiring environment that if a complicated problem defied solution, the persons concerned retired to Rishikesh, took a temporary abode over there and attempted to solve the problem. Satisfactory solutions were invariably found.

Over the centuries, with the development of civilisation, things have changed materially everywhere on this earth and so have the Ganga catchment and course. The precious sacred water of this river has been polluted by the harmful effluents from the various factories of large industrial cities established on the bank of the Ganga. The effluents with their solid wastes choke the flow of the river in certain seasons. The toxic chemicals discharged into the river make it unsafe for drinking. There are many large industrial cities, including the metropolitan city of Calcutta, established on the bank of Ganga. It is gratifying to learn that the government is now seized of this problem and have undertaken to solve it.

Besides this pollution, there is another equally, if not more, important aspect of the problem of Ganga river i.e. the serious degradation taking place in the catchment area and lower down in the valleys, along the river course. The Himalayas, which are the source of the Ganga and its tributaries, are high-energy environment ranges. The hills have high altitude and steep slopes, and they are composed of incoherent material. In the past, the eco-system of the Himalayan ranges had not been disturbed, and the environment maintained. The few needs of the people inhabiting the area were met with, without disturbing the eco-system. With the development of the catchment, and of the area below,

Bhagirathi and Alaknanda Join at Devprayag and become the Ganga

and especially with the ingress of contractors and their staff from the plains, the eco-system has changed considerably. There has been ruthless cutting of trees, removal of vegetation and cultivation on steep slopes—with the result that a very large part of the rainfall is converted into runoff. Besides the heavy soil erosion in the catchment area, the high bank erosion and cliff collapse add huge amounts of detritus load to the stream which chokes its channels and silts up tanks, reservoirs and dams constructed on its waters. Ganga discharges 560 million tonnes of detritus load annually. This degradation of the catchment and impoverishment of the rich soil, is equally serious—if not more so than the pollution lower down from industrial units. While considering the problem of pollution, the serious degradation taking place in the catchment and the area lower down, has not been given the attention that this serious matter deserves. If not checked, the Himalayan environment would degenerate beyond the point of recovery. It is, therefore, essential that immediate measures should be taken to stop degradation, restore the catchment to its original healthy condition and further develop the same for the benefit of the inhabitants of the area, so that they do not migrate from there.

The Ganga river consists of several streams, the two major ones being the Bhagirathi and the Alaknanda, each of which has a number of tributary channels. The Bhagirathi rises at an elevation of 3000m above M.S.L., from Glacier Goumukh. Its tributaries are Asi Ganga, Balganga, Bhilaganga and Dharm Ganga. The Alaknanda rises at the foot of Nanda Devi near Kamet, at an elevation of 7817m above M.S.L. Its tributaries are Mandakini, Rishi Ganga and Saraswati, having their source at a very high altitude. Alaknanda (Nanda Devi to Devprayag) is a steep channel, with a slope of 33.5 mt./km. It is much steeper than Bhagirathi (Gangotri to Tehri), which has a slope of only 14.18 mt./km. It has several important towns on its banks such as Chamauli, Karan Prayag, Rudra Prayag, Hemkunt, etc. Alaknanda is given to occasional very heavy discharges, in which the water level rises very high, submerging important places on its banks. The catastrophic floods in Alaknanda in 1893 and 1974 are still remembered with awe. Bhagirathi, on the other hand, carries more discharge but it has a less steep gradient than the Alaknanda. The two streams, Bhagirathi and Alaknanda, join at Dev Prayag. From there onwards, the river is known as Ganga.

The catchment of Bhagirathi and Alaknanda, and the sub-catch-

ment of their tributaries, are extensive, varying in physiography and high mountain ranges with precipitous valleys. In many respects this is a unique mountain area. It requires an indepth study. Its hydrology, hydraulics of the stream channels, sedimentology, soil, vegetation and plants need to be thoroughly studied. In order to understand the degraded eco-system and environment, it is essential to know which parts of the catchment are more prone to degradation than the others; also, which stream is subject to greater bank erosion and cliff collapse than others. For an evaluation of the measures to control the catchment and the channel bank erosion, an in-depth study regarding the situation of the catchment and the effect of the measures is required to be examined in detail. For complicated studies like these recourse is generally taken to model tests. Accordingly a model of the whole of the Ganga river system, all the Himalayan ranges and sub-ranges, together with adjoining rivers was constructed at the Punjab Agricultural University in 1977-78. The model is 270 ft. x 120 ft. from Karnali to Indus. The Ganga model proper, however, covers an area of 258 ft. x 150 ft. and has been built on the following scales.

Horizontal model to prototype	1 : 20,000
Vertical model to prototype	1 : 3000
Exaggeration	6.6

Here detailed observations in the catchment on the eco-systems and also performance of the hydro-electric and hydel-works already constructed and proposed to be constructed, such as Tehri dam, are being tested. This model will help to a large extent in studying the behavior of the oforu system under different hydrological and meteorological conditions and the effect of measures such as prevention of soil erosion in the catchment stream-bed bank erosion lower down, the sediment control. It will also provide knowledge of which stream brings more sediment discharge than the others, and the effect of proposed dams on the Ganga system. ●

*The Mughal Kings
used to drink
only Ganga-jal,
wherever they were!*

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**Cleaning up the Ganga:
Some Newer Approaches**

By

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ACCORDING to a recent write up from the Central Water Pollution Control Board, the worst kind of pollution of the river Ganga is due to chemicals and organic wastes whose proportions have increased due to rapid industrialization without recourse to proper waste treatment systems. It is estimated that the worst affected stretch of the river is around 600 km long. The following are considered as the main sources of pollution.

- (a) urban liquid waste
- (b) industrial liquid waste
- (c) wallowing of cattle
- (d) throwing of dead bodies
- (e) surface run-off carrying pesticides and fertilizers
- (f) ground water run-off from underneath the dumps; and
- (g) "cultural pollution" due to bathing of a vast number of devotees on various auspicious occasions.

The Central Ganga Authority aims at cleaning the river mainly by diverting the inflow of sewage and treating it through advanced systems. This exercise, when completed, will be able to remove more than 80% of the pollution load of the river. However, even through this technology, it might not be possible to remove all the metals that get into the effluents, such as cadmium, chromium, nickel as also other xenobiotics and recalcitrant biomolecules whose number is increasing at a rapid pace.

In a long range plan of the clean-up operation of this sacred river, the problem has to be looked upon in a wider perspective and newer approaches have to be considered for solutions. Environmental biotechnological methodologies of today, especially those based on microbial systems, can provide answers to such problems. A few of such approaches are discussed here-

Modern microbial methodologies are Superior cleaners of waste water

I. Removal of Xenobiotic and recalcitrant molecules :

While the list of such molecules is very large, agro-chemicals are considered today as problematic compounds due to their increased use in the environment. Other such molecules are present in the wastes of industries or they enter the water system through agricultural run-off.

The removal of such non-biodegradable molecules can be approached through use of immobilized microbial cells. In a recent study, removal of lindane has been effected through use of live or dead microbial cells immobilized on magnetite. This is based on sorption of pollutant molecules by microbial cells and since no degradation occurs, subsequent pollution due to metabolites is avoided. However, careful choice of a suitable microbe, and the immobilization support, is critical in developing this technology. In the case of lindane, *Rhodospseudomonas sphaeroides* was able to remove 90% of the pesticide from a test solution. During a contact period of 1 hour, *Alcaligenes eutrophus* could remove 81% of 2,4-D, whereas a mixture of these two bacteria removed 76.4% of 2,4-D and 33% lindane from a water sample.

It appears that for removal of pesticides at least, immobilized microbial system is superior to coagulation, filtration and oxidation by chlorine or ozone. However, it is not as effective as activated carbon. But the ease of settling and regeneration of magnetite or other similar support and absorbed microorganism as compared to activated carbon makes it a suitable alternative. Furthermore, relatively short mixing time required for sorption of pesticides makes immobilization system a more effective, economical and attractive biological process.

II. Removal of heavy metals :

Effluents from tanneries, refineries and electroplating industries enter this river at various points, resulting in heavy pollution due to cadmium, nickel and chromium. A recent report of five year study from Patna speaks of this problem at some length.

Microbial technology can be utilized for removal of these heavy metals which are otherwise difficult to approach through conventional treatment systems. A variety of microbial species, specially mycelial moulds, are capable of accumulating high concentrations of heavy metals in their system. For example, *Rhizopus* has been used in removing uranium and thorium from industrial effluents. filamentous bacterium *Sphaerotilus*, on the other hand is known to accumulate chromium.

Besides searching for bioaccumulating microbes elsewhere, it will be highly likely to recover effective strains from natural surroundings of effluents which would provide an ideal enrichment through available heavy metals.

The above two are very new areas of environmental biotechnology but are ideal ones for exploration leading to commercialization. Research on both such technologies should be an integral component of projects already under operation but it would need participation of experts in microbial genetics, immobilized cell technology and engineers.

—Hitler on the Ganga—

Hitler, in his Table-Talk (1941-44) used to be obsessed with India. He said that Britain was great only because it held India—and that Germany could become great only by occupying India—or Southern Russia.

On August 22, 1942, the dictator told his dinner guests :

"If the British are ever driven out of India, the repercussions will be swift and terrible. In the end, the Russians will reap the benefit.

"If we were to occupy India, the very first preoccupation of our administrators would be to set up countless commissions to enquire into the conditions of every aspect of human activity with a view to their amelioration; our Universities, full of solicitude for the welfare of the natives, would immediately open sister organisations all over the country; and we should finish up by quickly proving that India has a civilisation older than our own !

"The Indians can think themselves lucky that we do not rule India. We should make their lives a misery ! Just think of it ! Two hundred yards downstream of the place where they pitch the half-burned bodies of their dead into the Ganges, they drink the river-water ! Nobody ever takes any harm from it. But would we stand for a thing like that ?"

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Ganga Water is worst at old Kanpur Bridge

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RIGHT FROM GANGOTRI glacier to its merger in the Bay of Bengal, millions of devotees take daily dips on different religious occasions along its entire stretch. Whereas upto Haridwar Ganga water is pure, unadulterated and unpolluted, it changes in the lower stretches as distributaries are taken out of it and tributaries added. In addition, with increasing urbanisation and industrialization, waste waters, both municipal and industrial, are discharged into it, bringing about a change in its physico-chemical characteristics.

Between Haridwar and Kanpur there is no major city on its stretch. At Kanpur, however, a large volume of municipal discharges along with industrial effluents, are inducted, thus bringing about a considerable change for the worse in the river water quality. Such a change is of significance not only for the citizens of Kanpur but also for our rural population on the banks of the river downstream. These rural folk have to largely depend on the use of river water and they are, therefore, exposed to a variety of health hazards.

Study sites :- In order to have a fairly comprehensive picture of the intensity of pollution, nine sampling stations covering a total stretch of about 19 kms were fixed in 1981-83. These sampling stations are briefly described as under:-

Sampling site 1. (Bhaironghat) :- This is a point from where raw water is drawn from the dredge channel, taken out from the river and is sent for the supply to the city after treatment. It represents clear water zone. Since the main current of the river has shifted away from the city, it is pertinent to mention here that the dredged channel brings in the river water and it is on this channel that this station is located.

Sampling Station 2 (Parmat Ghat) :- This sampling station is also located on the dredged channel and is about 2 kms down stream of sampling station 1. Between sampling station 1 and 2, three major and one minor wastewater outfalls join the channel.

It is best at Bhaironghat and worst at Guptarghat

Sampling Station 3 (Sarsaiya Ghat) :- This sampling station is also located on the dredged channel and is about 4 kms from station 1. Between this station and station No. 2, there are only minor drains opening into the channel.

Sampling Station 4 (Near Old Kanpur Bridge) :- This station is located at a point where the dredge channel is about to meet the main stream and is about 5.5 kms. downstream from station No. 1. Between this station and station No. 3, two major outfalls join the channel. These outfalls are (i) Guptar Ghat Nala which brings sullage water from Guptar Ghat sewage pumping station and (ii) Lower Ganges canal which passes through the heart of the city, collects domestic washings and waste waters from Ordnance and Equipment Factory.

Sampling Station 5 (Nana Rao Ghat) :- This sampling station is located on the main stream after the dredge channel has joined it. It is about 9.5 kms. from sampling station No. 1. Between this station and the previous one a sewage outfall bringing in sullage water from Cantonment area, joins the river. It is important to mention that mixing of channel water with that of main water stream at this station is not complete. Therefore, two distinct strips of current, one representing the polluted water of dredge channel and the other of clear water representing the main stream, can be clearly seen.

Sampling Station 6 (Near New Kanpur-Lucknow Road Bridge-Trans Bridge side) :- This sampling station was fixed on the clean water strip side of the main stream.

Sampling Station 7 (Near New Kanpur-Lucknow Road Bridge-Cis Bridge side) :- This station represents the polluted strip of the river confined towards the Kanpur side. Between station No. 5 and 7 a large number of tanneries are located which discharge their waste water into the River.

Sampling Station 8 (Kishanpur village) :- This station is located in the rural zone at a distance of about 17.5 kms. from station No. 1. Between station 7 and 8 the discharge from Jajmau sewage pumping station joins the river. At station No. 8, the two strips of polluted and clean water disappear, indicating that the mixing is more or less complete.

Sampling Station 9 (Dhori Ghat) :- This is a bathing ghat of

considerable importance for rural folk. It is located about 19 kms. from station No. 1. The main objective of selecting this station was to determine the quality of river water available to the villagers.

Collection of water samples :

Water from all the sampling stations was collected in glass bottles, and was analysed for D.O., BOD and different forms of nitrogen by the procedure given in Standard Methods for the examination of water and wastewater.

1. Temperature, D.O. and BOD profile : The water temperature was found to be low at station 1 and it increased consistently from station 1 to station 4 and then decreased gradually upto station 9.

The value for D.O. was maximum at sampling station 1. It decreased gradually, reaching to the lowest value on station 4, and increased thereafter upto station 9.

The BOD was found to be lowest at station 1 which represents unpolluted clean water. The BOD increased gradually, reaching a peak value at station No. 4. A steep fall in the BOD was recorded from station 4 to station 5. The BOD values did not fluctuate from station 5 to station 9.

2. Different forms of nitrogen : The values for all forms of nitrogen were low at sampling station 1. With the release of waste-waters in the river, all forms of nitrogen have shown a steep rise, followed by their decline as the river water travelled downstream. Despite the progressive decline, the value for nitrogen at the last sampling station i.e. station No. 9, is greater than its respective value at station 1. This is a pointer of fresh pollution and suggests that the organic pollution has not fully stabilized and mineralized.

3. Suggestions to protect the river from pollution : On the basis of the above study, following recommendations are made to protect river Ganga from pollution:

1. The industrial waste-water from different industries should be treated to the maximum possible extent. Only treated effluents should be diverted to sewers.

*Defecation by roadside
and ablutions in raw water*

2. The sewage from the city, in conjunction with the partially treated industrial effluents, should be processed in a sewage treatment plant. Thus industrial effluents and sewage, both should be taken care of. A study should be undertaken regarding the disposal and utilization of domestic and industrial sewage sludge on Agro-ecosystem.

3. To avoid the release of night soil in the city drain which joins the river, the unsewered areas should be sewerd forthwith.

4. Defecation by the road-side and abluition in the raw water channels, should be made punishable by law so that contamination of raw water by pathogens can be avoided. A typical example of such a situation is the canal used as a raw water source at Kanpur treatment plant.

5. Existing laws for the prevention and control of water pollution need to be implemented—and any type of interference in the enforcement of such laws should be firmly curbed.

6. Consciousness should be created among the public, to resist any effort to pollute river Ganges. □

Cleaning the Chambal & Kshipra

Prof L.P. Mall

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It is well known that natural rivers have a good system to purify themselves, unless some serious interference is there by human agencies. Due to the development of big towns along great rivers, with huge populations, and also due to our intention of improving the quality of our life through heavy industrialisation, we are producing a large quantity of secondary wastes. It is the disposal of these wastes which has made our river system dirty, because in them we are finding very easy source for disposal. Therefore, we have to first have the information about the quality and quantity of waste matter reaching the river system. Only after assessing that, we can plan to get rid of them. Now there are good many ways to treat the wastes before allowing it into the river system. I find a good example of saving the river Chambal at Nagda where there is a huge complex of Rayon and caustic soda plants. The wastes proved very harmful to flora and fauna and irrigation system. Now these factories have a very good treating plant and waste water has become very clean. For river Kshipra, there is a plan to divert its small tributary, laden with industrial wastes from Indore.

Preventing Pollution at Prayag : Big challenge to Ganga Authority

By

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THE GANGA as an entity, is inseparable from its environment—the Himalayas where it originates, the plains through which it flows, and the delta where it meets the sea. The hills, the plains, the ocean and the river represent different systems within the frame work of a major system, the ecosystem. The different systems are interlinked. They are interrelated and interdependent. Our knowledge of environmental science has taught us that even minor changes in one system may lead to major changes elsewhere. Today our whole environment is polluted: the Himalayas are polluted the lakes and rivers are polluted, and the seas are polluted. Today, the Ganga is 'sick' due to an array of pollutants. It can be cured only by applying ecological principles to the ecosystem as a whole. The Ganga can be cleansed temporarily and only to some extent, with the aid of advanced technology as described below.

The addition of undesirable foreign matter pollutes the water and lowers its quality. The impurities may be in the form of dissolved matter, colloidal or suspended particles.

Deforestation of the Himalayan foot hills, the main catchment area of the Ganga, is responsible for bringing worsening floods to the plains each year. The Ganga has been reported to carry 10% of the world's annual soil loss to the sea.

Due to loss of plant cover, the run off water in the catchment area rushes into the river with silt, salts and what not. The discharge of sewage and agricultural and industrial wastes hastens the process greatly and this accelerated process is termed **cultural eutrophication**. Beyond a point, the highly eutrophic water body is characterised as "dead", since the situation is irreversible.

Water-borne wastes from sources such as homes, hospitals, schools, etc., contain food residues, human excrement, paper, soap, detergents, dirt, clothing, other miscellaneous debris, micro-organisms. This is called sanitary or domestic sewage.

New Technology: new Odours: new Smells: new Pollutants

Wastes from commercial buildings, industrial plants, run-off from rain, flow through a network of sewer pipes. Pulp and paper production, tanneries, food processing, chemical manufacturing generate a wide variety of waste products that are discharged into the flowing waters. Some of these are poisonous. New type of wastes continue to appear as new technology develops. They carry unpleasant odours and tastes along the water course for considerable distance. If they react with chlorine compounds, cancer producing agents may be formed. The metals corrode in water and the oxidation products become pollutants. Lead acts as cumulative poison.

Professor Dharendra Sharma of JNU has warned that the Narora Atomic Project situated in an active earthquake zone, on the banks of the Ganga, poses a serious threat to millions in Uttar Pradesh, Bihar and West Bengal. According to him there is no fail-safe system which can ensure absolute safety at the plant. The release of radiation in the normal course of operation of the plant demands serious consideration of radiation effects upon population density, pisciculture, agriculture, dairy farming and other social aspects of the environment.

Large amounts of heat are added to the aquatic system from industrial effluents and burning ghats. This causes ecological disruption—and the term thermal pollution is used to describe these effects.

The rates of chemical reactions are very sensitive to changes in temperature. The processes of life involve chemical reactions. The rate doubles for every rise in temp. of 10 degrees Centigrade. The non-mammalian aquatic organisms, e.g. fish, are cold-blooded. They are unable to regulate their body temperature. Their rate of respiration rises. The increased need for oxygen is serious, since hot water has a smaller capacity for dissolved oxygen, than cold water. It may upset their reproductive cycle.

In general, not only the fish but the entire aquatic ecosystem is seriously affected by temperature changes. If there is any disruption of the food chain, the entire system may be upset. If a change of temperature shifts the seasonal variations in the types and abundance of lower organisms, the fish may not get the right food at the right time. On the other hand the higher temperature often proves more hospitable to pathogenic organisms.

The aquatic systems near factories are subject not only to the

effects of an elevated temp., but also to the thermal shocks of unnaturally rapid temp. changes. If the city sewage is dumped in such places, its decomposition is hindered due to reduced oxygen content. Therefore hot rivers are less able to cleanse themselves than cold ones.

The combination of thermal pollution with increased nutrients leads to a rapid and excessive algal growth and eutrophication. Therefore thermal pollution imposes the unhappy choice of dirtier rivers or more expensive sewage treatment plants.

Irrigation also leads to some environmental problems. In the process of flowing into the river, especially through the deforested zones, the water dissolves various mineral salts present in the rock and soil. In using such water for irrigation, we bring slightly salty water to the field; when the water evaporates, the salt remains. Over the years, the salt content of the soil increases and the fertility of the soil goes down.

The processes of aerobiosis and nitrification require oxygen and nutrients. These actions stop when any one of the essentials is depleted. When the run-off of sewage or agricultural fertilizers makes waters so rich in nutrients that oxygen becomes the limiting factor, the denitrification bacteria, the sludge worms and some protozoa become more plentiful, while the fish decline in population. The quality of water deteriorates, and nutrients become pollutants.

In the absence of oxygen, anaerobiosis takes place. Fermentation of carbohydrates and putrefaction of proteins produces methane which is insoluble in water and smells like rotten eggs. Putrefaction makes water bubble with foul smells and renders it uninhabitable for fish and other oxygen breathing animals.

The amount of oxygen consumed per litre of contaminated water is called Biochemical Oxygen Demand (B.O.D.).

In unpolluted water the dissolved oxygen may be 8 mg/l and the BOD 2 mg/l. When the sewage is discharged into stream, there is instantaneous increase in B.O.D. but the dissolved oxygen falls off gradually. When the concentration of oxygen falls below 4 mg/l, at a distance of about 25 km., the fish begin to die.

As the river continues its flow, it recovers oxygen from the atmosphere and from photosynthesis by its vegetation. It repurifies itself. If

*While worms and bacteria multiply,
the fish population falls*

Detergents are food for algae and Soap multiplies bacteria

additional sewage is discharged before recovery—by closely spaced cities, the pollution becomes continuous. The river supports no fish. The bacterial content, including pathogenic organisms, becomes high. Such waters appear muddily blue-green from choking algae, and they stink from putrefaction and fermentation.

At many places, on account of lavish nutrient supply, the algae grow rapidly and cover the surface of water as thick shiny mats. Water beneath the shiny surface cut, off from sun and air, becomes deficient in oxygen. It is then unable to support the forms of life people value most. Detergents overfeed algae, and soap serves as nutrient for bacteria. The matal ions render the soap insoluble. If the detergents are not biodegradable, they persist in rivers right upto the drinking stage. The phosphate detergents promote rapid growth of algae. The aquatic weeds multiply vigorously and the water hyacinth makes catastrophic infestations.

Polluted water causes more sickness than any other environmental influence. Diseases are transmitted through micro-organisms and parasites. The incidence of ailments such as gastric disorders, tuberculosis, jaundice etc. has, from all accounts, risen alarmingly as a result of pollution.

Prayag has been called the cradle of Indian Culture. It is sung in literature and legend, immortalised in history and tradition. But today Allahabad is a city of pot-holes, pitfalls and pollution. The sanitary conditions are awful. The city remains dotted with garbage heaps. At many places the roads have sunk dangerously, giving rise to perpetual cesspools. Dirty sewage waters ooze out from underground drains—and open drains also overflow, for want of proper maintenance.

The Jamuna atis at Prayas is polluted by sullage at five points :

Ghaghār nala from Shaukat Ali Marg Atala; Chachār nala that meets the river near Baluaghat; Gaughtat pumping station's emergency drain that releases into the river the overflow of the city's sullage; Kyd-ganj nala and sullage from Allahabad Fort and Drain leading to Mori Gate that runs parallel to the bund and joins the river near the Fort.

The sources of pollution to the Ganga are also many :

The Muir Road drain that takes sullage of Rajapur and Katra areas and joins the river near Rasoolabad Ghat;

Today Prayag is a city of pot-holes, pitfalls and pollution

Mumfordganj drain;

Allenganj drain;

Drain from Nagbasuki Temple and

Daraganj drain.

During the eight to nine dry months, the rivers remain highly polluted by these drains.

The Baluaghat pumping station installed in 1910 is the only point from where sewage water is drained across the Jamuna to the Naini sullage farm. The capacity of this station is limited. As such, it has been provided with an emergency drain to release the overflow of sullage directly into the Jamuna. It is used when there is a power failure.

The quantity of sewage water drained out at the Naini sullage farm, depends on crop requirement. As such, at times the excess sullage is released into the Ganga at a point near Arail. Thus the efforts and money invested for stopping pollution, go waste.

A review of the work done so far for stopping pollution of the Ganga and the Jamuna at Prayag, and a close look into the dimensions of the problem, reveal a situation in which the success of the anti-pollution scheme appears very doubtful.

The topography of the city, which is bound by the two rivers on three sides, is such as to frustrate any half-hearted attempt at stopping pollution of these rivers. The civic body gets hardly any return for what it invests in the sewage system. Consequently, a number of city localities do not have any proper sewage system. Thus if any attempt at stopping river pollution is to be made, the requirement would be to extend the sewage network so that it covers the entire city.

Secondly, whether the sewage is discharged into the rivers at Phaphamau or Jhusi or Naini, the situation is such that it must pass through the Sangam, where millions collect the water sample as Holy Ganga water to their homes far and wide.

The magnitude is a big challenge to the Ganga Action Plan so far as Allahabad is concerned. Any ill-planned or half-hearted approach to it is bound to prove inadequate.

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A Scientific Report on Ganga Water at Varanasi

By Dr. J.N. MISRA

Principal Investigator

A 'MAN AND THE BIOSPHERE' research programme, sponsored by the Department of Science and Technology (DST), Government of India, the author acting as the Principal Investigator, carried out the "Investigation on the River Ganga to determine the Biological Indicators of the River water-quality".

The area of investigations is the district of Varanasi. The defined area is constituted by a 40 km. stretch of the River. The investigative period covers 3 years, commencing from September 1976 and ending June 1978.

Part of the River serves as drinking water-supply for the city of Varanasi. Being sacred, the River is being constantly used for water contact concerns of the citizenry and the pilgrim-visitors to the holy city of Varanasi. The River also functions as recipient of the sewage effluents and waste residuals.

Thus, the Ganga River water in Varanasi, as elsewhere, is subjected to inputs of organic waste pollutants.

The approach of the research objective has been maintained on the basis of ecology, and in particular on the basis of limnology.

The scope of the research project pertains to: (1) Qualitative evaluations of the physico-chemical parameters; (2) Determination of the biological parameters. The latter pertain to bacteriological, floristic and faunistic aspects.

The complementary and convergent conclusions, derived from the evaluation of the physico-chemical and biological parameters, are stated below:

The aforementioned part of the River has greater stretch under biological control. So that the stretch area, untouched by man, maintains the natural fresh water qualities. A limited area, concerned with the human activities, comes under physical control. The replacement of the fresh-water is brought about by unchecked human factors.

Significantly, Ganga water is never under total deoxygenation

The details of the investigations are dealt within an exhaustive report of the Deptt. of S & T. Presently this communication is a summary of the project research Report.

The Ganga River water quality in respect to:

1. Physico-chemical parameters : The River water-temperature, ranging from 17.5°C to 32.5°C., is seasonably acclimatised. The lower temperatures pertain to the period of winter. No significant difference between the temperature of the fresh-water and polluted water are evinced. The photic or the transparency depth (a most important factor in limnological investigations), is practically nullified during flood inundation of the river. Varying concomitant with the seasonal variations, the river water attains the normal depth of transparency. In overall variations the photic depth ranges from 0.0 cms. to 89.0 cms.

2. Chemical parameters : The following group of chemical constituents have been evaluated :

The salinity concentration of the Ganga water, ranging from 156.4 to 210.7 mg./l., closely corresponds with the salinity concentration of other rivers water. In lower concentrations the salinity of the Ganga water characterises the presence of fresh water.

The Hydrogen-ion concentration (pH—8.0-9.0 mg./l.) has indicated that the River-water is alkaline, with insignificant difference between the alkalinity of the fresh-water and the alkalinity of the polluted waters. The River water in Varanasi is moderately hard. The hardness concentration varies from 103.0 to 185.0 mg./l. The difference between the fresh-water and the polluted waters is indicated by higher concentration of the hardness of polluted water quality.

The river water contains large quantity of **total solids** varying from 500.0 to 3325.0 mg. l., and comparatively the total solids quantitatively exceed in polluted water. The related **suspended matter**, ranging from 225.0 to 915.0 mg. l., and the **dissolved solids** varying from 260.0 to 1725.0 mg. l. behave alike to the total solids.

It is of great interest and importance that the Ganga water is never under a total deoxygenation. The variations in the concentration of the **dissolved oxygen** vary from 1.3 to 13.5 mg./l. As such the presence of oxygen provides a convincing indication of the water quality, unpolluted

or polluted. The distribution of the oxygen, among the qualities of the water or over the investigated part of the river, is of great significance. Because the supplement of oxygen by photosynthetic oxygen is the major factor in keeping the river water clean. The process of supplement of oxygen is the most efficient means of the abatement of pollution.

Besides, by biological degradation, the **BOD**(=4.3-9.0 mg./l) and the **CCD**(=7.2-235.0 mg./l.) closely correspond to the quantitative variations of the dissolved oxygen.

The investigations have also evaluated a group of chemicals, such as **Calcium** (=12.5-31.5 mg. l.), **Magnesium** (=10.2-33.6 mg./l.), **Iron** (=0.02-1.45 mg. l.). The other radicals are **Chlorides** (=36.5-396.0 mg./l.), **Sulfates** (=1.5-26.0 mg. l.), **Phosphates** (=0.9-8.0 mg. l.), **Nitrates** (=0.001-0.430 mg. l.), **Nitrites** (=0.016-0.322 mg./l.), **Ammonia** (=0.0025-0.70 mg. l.), **Albuminoid Ammonia** (9=0.045-0.499 mg. l.), **Organic matter** (=0.01-0.893 mg. l.), dissolved **carbon dioxide** (2.5-11.0 mg./l.). On the comparative basis the presence of higher concentrations of the above stated chemicals, barring the concentration of oxygen and silicates, segregates the limited area of pollution in the regional Ganga water.

2. Biological parameters : In any aquatic ecosystem, the presence of the biological organisms is inevitable. The population organisation is principally made up of the ubiquitous bacteria, the photosynthetic phytoplanktons, and the consumer community of animals, especially the zooplanktons.

Among the various communities inhabiting the Ganga River water, the population density of the bacteria varies from 0.333×10^4 to 82.0×10^7 MPN. Periodically during the monsoonic floods, the density of the bacteria undergoes unprecedented increase. In succeeding winter and summer the bacterial density rapidly declines. So that periodically, the river water is rendered saturated with bacterial organism in the period of the monsoon. And in winter and summer the viability of the bacteria results in maximum reduction of the organisms. Among the fresh-water and polluted waters, the bacterial contents of the polluted water are in great density.

The Floristic community : The principal organisms are the algal phytoplanktons. Floristically the River water is richly provided with planktonic algae. In composition the phytoplanktons are represented by 8 classes, 122 genera, and 317 species of the algae. The information ob-

At Varanasi Ganga flows north; these hydrological dynamics also purify water

tained from the species diversity indicates river water quality. Varying from 1.35 to a 4.16, the lower species diversity indices confirm the presence of the extremely polluted quality of the River water. The higher indices confirm the presence of the fresh-water quality of the Ganga water.

The faunistic community : Taxonomically the zooplanktonic part of the faunistic community is represented by 9 classes, 101 genera and 290 species. The resultant species diversity of zooplanktons ranges from 1.5 to 4.0, of which the lowest and the highest values, respectively, confirm the extremely polluted and unpolluted water quality areas of the Ganga River in Varanasi.

The acceptability of the river water : Obviously the River Ganga in Varanasi is differentiable into a stretch of the polluted water and a stretch of the unpolluted water. The water of the latter is unhesitantly acceptable, since according to "established water quality standards" the River water is acceptable for the water needs of man.

Self devices of the River to recover the pollution : The River Ganga is one of the largest rivers of the world. The River has efficient ability for the management of water and waste, one of the devices being the flow of water and the swiftly running current. So that the movement of the water creates turbulence: determines the distribution of the vital gases; and brings about the dissolution of the chemicals: and thereby establishes the chemical equilibrium. Also, the River is provided with the rich population of biological organisms. These trophic activities decompose the pollutants: consume the waste residuals: and by photosynthetic functions, the biological organisms maintain the well oxygenated water.

The River Ganga in Varanasi is designated as "Uttar vahini". The change in normal flow-direction is an unique feature of the hydrological dynamics, which, to a large extent, is responsible for maintaining the purity of the gangetic water. □

*I want nothing more than to live in a
hut on the banks of the Ganga.*

SVETLANA
daughter of Stalin

The Health of River Ganga from Patna to Farakka

By
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and

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CONCLUSIONS drawn by us are based on our study of river Ganga (Patna-Farakka) during the last eight years (1976-84). This is a floodprone segment of the river: therefore, for any successful ecological management, the impact of floods is to be taken into consideration. This region is the most productive range of Ganga and three major tributaries (Gandak, Burhi-Gandak and Kosi) join the river in this zone. Population dynamics of migratory fishes and other aquatic animals is being influenced by the Farakka barrage, the water quality at Patna/Bhagalpur and Mokameh due to discharge of liquid civic and industrial wastes, respectively. The impact of the proposed Super Thermal Power Station at Kahalgaon on the ecology of the river has to be assessed from all possible angles.

Vast areas of land get inundated every year due to the floods from July to September, which result in deposition of fresh layers of silt and organic matter. After the water level recedes, these lands (Diara land) become the centres of brisk human activity with main emphasis on agriculture, fishery and dairy farming. The soil is usually rich in potash and organic carbon. These lands are highly productive and many 'Rabi' crops, including pulses, oil-seeds and cereals are extensively cultivated. During the summers the Diara lands are used for growing cucurbitaceous fruits and vegetables which give very high yield without any substantial input in terms of irrigation and fertilizers. In our opinion the ecology of Diara land should constitute an integral part of co-ordinated study of Ganga basin.

Biological degradation of quality is reflected by high concentration of coliform and other bacteria and also by frequent outbreak of water-borne diseases. We have every hope that with the setting up of the Ganga Authority, it should not be difficult to improve the existing sewerage

Close relationship between water chemistry and aquatic biotas

rage systems and install treatment plants for proper channelization of industrial and urban wastes. Strict enforcement of Water Prevention and Control of Pollution Act of 1974 is absolutely essential for upgrading the biological quality of Ganga water.

By and large the Ganga water is capable of supporting a wide and varied range of plant and animal life. Except near the points of discharge of urban and industrial effluents the temperature, PH, dissolved oxygen, alkalinity, hardness, conductivity, level of nutrients are quite suitable for growth and regeneration of floral and faunal organisms.

The tributaries have only a marginal influence on the physicochemical quality of Ganga water. In general, their nutritional status is poorer. In Kosi the DO₂ level is comparatively lower than that of Ganga and its other two tributaries.

On the basis of the work conducted in our laboratory, we feel that sensitive species of microbial organisms can be successfully employed for biomonitoring of the physico-chemical quality of the water. The task will become easier if we are able to build up and establish a correct relationship between bacteriaphyto and zooplankton. It would be advantageous, if instead of an individual organism, a group of organisms are selected as indicators of a particular physico-chemical environment. In heavily polluted segments, if the concentration of indicator species is high, the colonies can be identified on basis of colour and/or by microscopic examination of the water samples. Confirmatory tests can be made by calculating the species diversity index of the plankton and by performing bio-chemical tests for different types of bacteria. Monitoring is an essential component of environmental management programme and we can profitably exploit the close relationship which exists between water chemistry and aquatic biota. Extreme precaution is, however, needed for such studies because of the highly sensitive nature of the indicator organisms. Biomonitoring, besides being quick and convenient, can serve as a fairly accurate tool for determining the water quality. Useful information on this aspect can be generated if the Universities engaged in the study of Ganga basin give adequate attention to selection of indicator species.

The main objective of improving the water quality of Ganga is to reduce the load of pathogenic bacteria and to improve the primary and secondary productivity of the river. Productivity can be increased only

if floral and faunal organisms are ecologically secure and normal food chain is not disturbed. Any change in species dynamics due to direct or indirect human activity poses a threat to many of the ecologically important forms. (Public support is to be elicited for conservation of the threatened species.) There are two main threats to proper conservation of fauna. The first is the mass scale killing of some of the aquatic animals, including the juveniles of the carps. This is entirely a man-made problem and if there is a ban on killing of the fingerlings, the protein status of the river can be substantially enhanced. Besides the juveniles of carps, there is also indiscriminate killing of *Dasyatis sephen* (Sting Ray) in Sahibganj-Farakka range, where these fishes are killed in thousands. This fish is the sole representative of the genus *Dasyatis* which was originally a marine form and has now adapted itself to Ganga system. Proper conservation of turtles and tortoises also needs immediate attention as their number is fast declining in this region. These are mainly killed for flesh.

The only mammalian representative in Ganga i.e. *Platanista Gangetica* (Ganges Dolphin) is also under great threat due to its frequent killing by fishermen for flesh and fat. Its oil is used for a variety of purposes including as an attractant for the capture of silurid fish, *Clupeoides garua*. Ganga is one of the major dolphin resources in India; this species is listed as a threatened species by the Department of Environment. These are considered to be highly evolved social animals. A study of their relationships with one another may be a highly fascinating and rewarding aspect of aquatic biology. Every effort should be made to protect and conserve this highly intelligent aquatic mammal which is well distributed in this region. It would be proper if an intensive programme on captive breeding of Ganges dolphin is undertaken for rehabilitation of this endangered and rare animal. Bhagalpur seems to be ideally suited for establishment of a Dolphin research centre for studying psychology, physiology and behaviour of this fast dwindling species.

The second major threat to aquatic biota in this region is because of the Farakka barrage which seems to be a great barrier for to-and-fro migration of species like *Hilsa ilisha*. Fish landing data collected by us distinctly reflects that possibly the fish passes in the barrage are not functioning well. It is absolutely essential to rehabilitate *Hilsa ilisha* (Ham) in the upper reaches of Ganga. This clupeid fish ascends for breeding in shoals from the sea to Ganga and may reach up to Haridwar. After breeding in fresh water they return to estuary, which is their natural

*Wanted a Ganga Dolphin
Research Centre at Bhagalpur*

Migratory Siberian birds can also be studied in Ganga Basin

home. We suggest that an intensive programme for their breeding and rehabilitation is taken up in order to save this important fish from extinction. We have also noted, the fish landing at Farakka is much higher than the upstream centres like Rajmahal, Sahibganj and Bhagalpur.

The faunal wealth of Ganga basin comprises a wide variety of birds also, including the ducks, pelicans, geese, cormorant and darter etc. which utilise the extensive wet lands for nesting, roosting, breeding and feeding. The area is also a big stopover for the migratory Siberian birds. This range can, therefore, be utilized for ornithological studies which should be helpful in determining the community structure, seasonality, indicator species and migration pattern of different varieties of birds.

Our studies on temperature profile of Ganga water have shown that river biota is adversely affected in Mokama range due to discharge of hot water from McDowell distillery. We therefore suggest that necessary preventive measures should be undertaken by the authorities of Super Thermal Power Station, Kahalgaon, to ensure that water is not discharged in Ganga or any of its tributaries, and an extensive green belt is raised to minimize the fall-out effects of flyash.

Ganga basin, being the most fertile region of the country, is very thickly populated, but occupationally it is only the fishermen who are solely dependent on the river and its potential faunal wealth. They are mainly engaged in spawn collection and fishing, but the trade is in the hands of middlemen (Water Lords or Panidars). Therefore the fishermen are paid very meagre wages for their hard work. This situation has resulted in a great social problem, specially in Kahalgaon and Farakka regions. Due to economic insecurity, a large majority of fishermen are addicted to drinking and gambling and many of them have switched over to criminality. Such fears also exist regarding the ecological hazards of the proposed Super Thermal Power Station, Kahalgaon. It would be appropriate if the Super Thermal Power Corporation authorities take immediate steps to make it publicly known that the proposed thermal power station will not have any adverse effect on the yield of fish, and on public health in the Kahalgaon region.

It is necessary to prepare definite guidelines and identify the zonal problems. We also suggest the establishment of at least three floating laboratories (one in each segment) which may be made available to the workers on being requisitioned. There is also need for attaining perfection in methodology and water technology/biology.

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The Cleaning of Ganga and the Greening of India must go hand in hand

By : B.B. VOHRA

Chairman
Advisory Board on Energy
Government of India

IT HAS BEEN ANNOUNCED that a sum of Rs. 250 crores will be spent during the 7th Plan period on preventing the untreated sewage of 27 major cities—from Haridwar at one end to Calcutta at the other—from draining directly into the Ganga. Even after these 27 cities have been dealt with, there will still remain 71 other towns which are situated on the banks of the Ganga and empty their untreated wastes directly into it. Besides, the construction of sewers and the treatment of sullage constitutes only a part of the total problem of improving the sanitation of human settlements. Even if it is assumed for the moment that money will be forthcoming for all the sewage works involved, the task will not be completed. There is always a great deal of garbage and solid wastes which must be collected and disposed of otherwise than through sewage systems.

We must also of course remember that all Government projects have certain built-in elements of inefficiency and dilatoriness which, if not guarded against, can make a mockery of the best of intentions over a period of time. This is particularly so in the case of engineering works, regardless of whether these concern roads and buildings or irrigation or public health projects. We must therefore view these recent developments in their correct perspective and welcome them as an earnest of Government's resolve to improve sanitation in all parts of the country, rather than as an end in themselves.

The task of cleaning the Ganga at Varanasi was taken up as far back as the early seventies when a scheme for preventing the flow of untreated sewage into the river was implemented at a considerable cost by the U.P. Government. However, this effort ended in complete failure. Let an official document on the subject, prepared in May 1985, speak for itself ;

Let BHU and Diesel Loco Workshop treat their own sullage

"The U.P. Jal Nigam established 7 pumping stations at different river front points in Varanasi during 1970-74. The process of handing over these pumping stations to the Varanasi Jal Sansthan involved a number of inter-departmental complications. Prescribed staffing pattern was not followed by the Varanasi Jal Sansthan. Due to mechanical failures, the pumping stations did not work for a long time and had been lying in a state of disuse for 10 years."

The U.P. Government has set up a State Level Task Force headed by the Chief Secretary for the control of pollution and the improvement of the ghats in Varanasi. This Committee has been able to draw up a realistic work plan aimed at putting the disused pumping stations back to work, preventing the discharge of untreated sewage into the river and for reducing the present unmanageably big load on the main sewage system. This latter purpose is sought to be achieved by insisting that the Diesel Locomotive Workshop of the Railways, the Banaras Hindu University and all new housing colonies should treat their own sullage in future on a decentralized basis. It has also drawn up plans for the construction of an electric crematorium as well as a large number of community toilets. Efforts have also been initiated to clean up the extraordinarily filthy roads, streets and open spaces of the city by energising the local municipal services, however impossible this task may appear to be in the prevailing circumstances.

However, it needs to be mentioned in the clearest possible terms that all these schemes have yet to be implemented in their entirety and that it will require an extraordinary amount of political will as well as sustained administrative effort to see that they are. The fear must also be expressed that since both these elements have been conspicuous by their absence for years, they are not likely to reappear on the scene in a hurry. However, even after implementation has been achieved, it will require a great deal of vigilance to ensure that these schemes are properly maintained and operated and do not meet the same fate as the pumping stations mentioned earlier.

It would be prudent not to sit back and imagine that the sanctioning of the Rs. 250 crore project will by itself somehow solve all the problems of pollution of the Ganga and its tributaries. On the other hand, only a thorough-going revitalization of sanitary arrangements—not only in the 27 cities which have been selected for sewage treatment but also in

the remaining 71 towns situated along the Ganga and, in fact, in all the human settlements in the entire basin, which, incidentally, accounts for 25% of the country's total land surface and nearly 33% of its population—will have to be ultimately achieved before the Ganga can be restored to a state of pristine purity.

Municipal authorities must not be allowed to plead their inability to keep their towns clean for lack of resources. The generation of organic fertilisers and energy through the treatment of wastes can also be an important source of income.

Problems of urban sanitation are to a large extent caused by the continued influx of the rural unemployed into cities and, in the long run, can be tackled only by preventing such migrations. This, however, cannot be done so long as a third of our land resources are lying almost entirely unproductive and another third are only partially productive. We must, therefore, start paying greater attention to the neglected hinterlands of our cities if we want them to survive. Such attention will help to revitalise our villages and smaller towns and put an end to the endemic poverty from which a large part of our people suffer. Equally importantly, the greening of the countryside and particularly of our denuded watersheds, will save the country from the terrible effects of water shortages caused by the excessive run off—as flood waters—of our precious monsoon rains.

Such an approach will, incidentally, also do a world of good to the Ganga and its tributaries. For the holy Ganga is today a mere trickle in the dry season and acts more as a drain than a river in the non-monsoon months. On the other hand, swollen with silt and precious to p-soll, it overflows its banks in the monsoons in a frenzy of destruction. If the Ganga is to be restored to its pristine glory, it must not only be rid of pollution but also fed with crystal clear water by its tributaries all the year round. And this can be done only if the cleaning and the greening of Mother India are attempted side by side in a supreme effort to ensure our future while there is still time.

SHRI B.B. VOHRA ADDS :

Chlorinated water can cause cancer!

Till 1975, chlorination was the worldwide accepted, cheapest and best method for the treatment of raw water and for drinking water supplies. But in 1975 occurrence of some organic substances in chlorinated water supplies which were not present in the raw water, raised an issue about the validity of chlorination and its safety for consumer. These

substances are termed as trihalomethanes. The most common trihalomethanes present in drinking water are chloroform, Bromoform, Chlorodibromoform and dichlorobromoform of these, chloroform is a confirmed carcinogen and is responsible for inducing liver tumors in experimental animals. Besides, other trihalomethanes at high doses have also been known to produce cancerous growths in experimental animals. Their mutagenic behaviour and immuno suppressive action has been shown by some workers. Maximum tolerance limit of these total THMS in water is 100mg lit. (USEPA, M78). In a few surveys in USA, it has been shown that people receiving chlorinated water supplies had a greater incidence of cancer of oesophagus, bladder, colon and other sites, as compared to those receiving untreated supplies.

The precursors of these trihalomethanes are humic and fulvic acids which are present in natural waters, specially in surface water. The easiest way to detect the concentration of these substances is UV spectrophotometry. Because the other ways of water treatment are quite expensive and not quite practical, removal of these substances prior to chlorination using KMNO₄ oxidation is being practised in some parts of USA.

As River Ganga passes through a large area, it gets polluted by a wide variety of sources. Besides, the treated water is used by a large number of people for drinking purposes. Presence of trihalomethanes in water supplies may prove to be a great public health hazard to exposed population.

In order to find out the extent of the problem, and to check the consequences, following recommendations are made:

1. Study of the level of trihalomethanes in Ganga water, specially from the points from where the water is pumped for public water supplies;
2. Assessment of their mutagenicity, using *Salmonella typhimurium* system.
3. Making an epidemiological investigation to evaluate the role of these trihalomethanes in producing cancers in exposed population and,
4. If the level of the substances is high, implementation of pretreatment to remove the precursors before chlorination.

(Chairman, Advisory Board of Energy, Sardar Patel Bhawan, New Delhi-110061)



Poisoning the Waters of Life

By SAHDEV KUMAR

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O Waters, you are verily the sources of bliss. Grant us nourishment, beautiful minds and visions. Like affectionate mothers, feed us with your most auspicious essence. Raise us to your celestial abode; and on earth, generate for us waters of life and bliss.

—Taittiriya Samhita IV .1.5

IT HAS BEEN OFTEN SAID that if there is magic on this planet it must be in the water. For growth and sustenance of all life, for cleaning and bathing, for transportation and irrigation, for watermills and hydro-electric power; and for the first and last rites of life, for baptism and purification, the magic of water is evident in all life on this earth. But today, alas, water is as much a harbinger of death as it is the sustainer of life. One study after another, whether in Brazil or Nigeria or India, shows that over 70 per cent of all prevailing diseases in the world are water-borne. In India, such diseases as typhoid, cholera, diarrhoea, infective hepatitis and dysentery—all often assuming epidemic proportions—are invariably related to the unacceptable quality of drinking water.

According to a study of the National Environmental Engineering and Research Institute in Nagpur, over 70 per cent of all available water in India today is polluted. It has been estimated that every day over two lakh people have to absent themselves from work due to water-related diseases. The cost of treatment, and the loss of production is estimated to be about 00 crore rupees a year. Admits the Planning Commission:

"From the Dal lake in the North to the Periyar and the Chaliyar rivers in the South, from the Damodar and the Hooghly in the East to the Thana creek in the West, the picture of water pollution is uniformly gloomy."

What happens in the far-flung towns and cities of India can be temporarily forgotten; one can examine Delhi itself, seemingly the most glamorous capital in the Third World. The pollution of river Yamuna near Delhi is shocking: Before the river enters the city, the pollution level is 7500 coliform organisms per 100ml. But after the river has re-

Yamuna River is literally "Delhi's Open Sewer"

ceived the wastes of the city, 48kms later at Okhla, the pollutant level shoots up from 7500 to 24,000,000. Yamuna has been called "Delhi's open sewer"; yet two-thirds of the city's water comes from this "sewer", and 80 per cent of that returned to it as waste. As much as 96 per cent of this waste is domestic sewage, and more than half of it is returned to the river untreated.

THE PROBLEM of water and water pollution, in numerous ways, is at the very heart of development in India. This problem touches not only upon the nature and quality of health care but also on the growth and design of Indian cities and villages. In fact it touches upon the fragile experiment of Indian democracy itself, for water is the most precious natural resource and it cannot be used undemocratically, for the use of one section of the society at the expense of the other.

The span 1981-90 has been declared by UNO as the International Drinking Water Supply and Sanitation Decade. All countries—including India—have set up their target to provide "clean water and sanitation for all by 1990". By the end of the decade, India also aims to provide 80 per cent of the urban and 25 per cent of her rural population with some form of sanitary latrine system. As of now, however, one person in three lacking safe drinking water in the world, is an Indian. No more than 30 per cent of the rural population in the country has adequate safe drinking water supply; the excreta disposal system serves less than 2 per cent. Of the 3119 towns and cities in India, only 217 urban centres have sewage facilities, and that too only for part of the population. At least 50 million people in towns and cities—a third of India's urban population—have no access to latrines. Another third are served by bucket latrines that are cleaned and dumped on the outskirts of the cities by human hands. In most small and medium towns—many of them otherwise quite well to do—excreta is just flushed into the open *nallahs* along the street.

It seems ironic that five thousand years of Indian civilisation has not been able to create a humanly dignified and ecologically sound system of excreta disposal. The expensive toilet system that has been borrowed from the West for urban use, is not only wasteful and expensive but also polluting; it can never be available to the people at large except for a small minority of the well-off in the cities. The piped sewerage system is far too expensive for the municipalities to instal and for the householders to use. Even in places where the system exists, it is highly underutilized.

The waste and leakage of water, too, is a serious problem. In many cities of India, upto a third of all pumped water is estimated to leak from the corroded, ill-maintained and ancient water mains. In Bombay and Calcutta, many water mains cannot be traced, some having disintegrated altogether. In some cases it is feared that water supply is mixed with sewers. "What the people of Bhopal drink is gutter water", insists the former state governor. Also, when the water pressure is lowered, as when the water supply is intermittent (which is now the case in all cities in India) or when the water is stolen by high-rise buildings in places like Bombay through booster pumps, the water pipes are more likely to draw in sewage and faecal material from nearby sewerage pipes. The dramatic resurgence of jaundice in most Indian cities in 1970's can be directly traced to extensive contamination of drinking water with human excreta.

It is now somewhat of a truism but it needs to be said again, that clean drinking water and sanitary management of wells, ponds, canals and other water-system could do wonders for the health of a people. According to UN calculations, through a daily expenditure of some \$80 millions for the next ten years, adequate sanitation and clean drinking water can be provided for everyone in the world. This amount is obviously much too large for the world to afford. Yet, by contrast, the world spends over \$2500 million on weapons every day and \$250 million on cigarettes. Closer to home, in Delhi in 1980, the Rs 46.60 crores urban sewage system scheme, urgently needed for water supply and drainage, was postponed indefinitely due to "lack of resources". This amount was lower than what was spent on seven flyovers for the much-heralded Asian Games in the Capital.

This neglect of the basic elements of life (that obviously affect the life of the poor more than of the well-to-do) in preference for the glamorous is a malaise that runs deep in the Indian 'development'. This is as much evident in India's health planning as in other areas. As more and more hospitals have been built in the country, the overall health-care has deteriorated. It is because more fundamental concerns such as environmental sanitation, clean drinking water and nutrition have generally been neglected. WHO director general, Dr Halfdan Mahler asserts that as indicator of the health of a nation, the number of water-taps per head is more important than the number of hospitals or doctors.

*Delhi has huge fly-overs
but no decent drains!*

We need water-taps more than hospital beds

FOR CENTURIES when the first stirrings of Indian consciousness woke in the people of this land, the rivers have been deemed as sacred. Myths and legends about them became part of the essential folklore of India. In life and in death, the rivers were an integral part of the great civilizations that originated and blossomed here. But today, as everyone is sadly beginning to discover, these sacred rivers are dying. The Ganga for instance !

Above all other rivers in the country, as Jawaharlal Nehru wrote in *The Discovery of India*, the "Ganga has held India's heart captive and has drawn uncounted millions to her banks since the dawn of history....The story of Ganga is the story of adventure of man..." Apart from the cremation of some 3500 human bodies on the two ghats on the Ganga every year in Varanasi (in which well over 10,000 half-burned bodies are thrown into the river), paper and pulp mills, DDT and rubber factories, tanneries, petro-chemical and fertiliser complexes in such large cities as Kanpur, Allahabad, Varanasi and Patna treat Mother Ganga as one large drain. They all dump their untreated sewage into the river every hour of the day and night. The sacred Ganga is believed to cleanse all those who come to it. That it could itself be polluted, is difficult to believe for most Indians, even for a Union Cabinet Minister who once boldly declared in the Parliament that the Ganga could never be polluted!

The Ganga river system is more than 8000 kms long and it drains a quarter of India's land; over 250 million people, a third of India's population, depends on it for drinking water. Because of untreated excreta, garbage, muck and industrial wastes, this river system has degenerated into a network of drains and cesspools. And thus in spite of its enormous capacity for self-purification, the Ganga is one of the most polluted rivers in the world. Once Lord Shiva had to protect the earth from the torrents of the Ganga; but today, as *A Citizens' Report on India's Environment* puts it, "the Ganga itself requires protection from the violence of the people". The Central Ganga Authority is expected to respond to this "violence" to Ganga over the next few years. However, what is true of Ganga is no less true of other rivers in the country: the Cauvery in Tamil Nadu; the Krishna river system; the Godavari at Rajahmundry; the Periyar in Kerala; the Rushikulya in Orissa—all bear tell-tale scars of massive desecration of the very life-blood of the country.

In the early 1970s, the infamous disease of Minimata became the war-cry of environmentalists all over the world. The residents of a small

fishing village of Minimata in Japan in the 1950s became victims of mercury poisoning after consuming fish that had been contaminated by the wastes of a factory nearby. Paralysis, impairment of speech and vision, and partial madness were the symptoms of this ghastly disease that had killed 300 Japanese. And now, on the outskirts of Bombay, the spectre of Minimata looms large amongst villagers who consume fish and food from the river Kalu, which receives effluents from some 150 industrial units in and around Bombay. "The water at the point of discharge of effluents in the Kalu river", writes B.C. Halder, Chairman of the investigating team, "has a mercury content equal to that at the centre of Minimata Bay."

As in most industrialised societies, all across India now, increasing use of pesticides is making toxic substances an integral part of the food-chain, thus poisoning infants, mothers and even adults. In India every year some 60,000 tons of pesticides are poured into the fields. Many of these pesticides—DDT, BHC, DT-4—are banned altogether in many countries, or their use severely restricted. Yet their use is increasing in India at the rate of 12% per year! As early as 1965, a study revealed that the accumulation of DDT in the body tissues of an Indian is the highest in the world. According to a conservative estimate, as a result of indiscriminate use and careless handling of pesticides, at least 3.5 million people suffer from poisoning in the Third World; Oxfam estimates the number to be much higher. The long-term and short-term damage to the ecology is literally incalculable.

As most of the actual users of pesticides—peasants and horticulturists—in poor countries are illiterate, and are more easily taken in by the razzle-dazzle of packaging and promises—they are more vulnerable than their counterparts elsewhere. In a mad rush to keep up with the Joneses in the West, development pundits in the Third World are promoting ways and means of increasing productivity with utter disregard for the eco-system and the poor, who are the inevitable victims. The pesticide contamination in India, for instance, is 300 gms per hectare as compared to 1.79 gm in the Western countries, where substantially larger quantities of agrochemicals are used. In India, in recent years, there has been a three-fold increase in the use of pesticide poisoning; on the average each Indian consumes 0.27mg of DDT with his meals every day. DDT has been banned in the USA for several years now. Even then it is being manufactured there for export to Third World countries to the order of 2000 tons every year. The problem of chemicals being injected into the life-support system of the earth is far more complex than is generally belie-

*Of the six lakh chemicals,
only 1178 have been certified safe!*

ved. Some 6,00,000 chemicals are being produced in the world; of these only 1178 have passed standards of safety. In the US alone, to check 48,000 chemicals in use, would take well over 80 years, by which time there may well be another 40,000 chemicals. It costs some \$500,000 for each product to be tested and about three years of time to test it. And thus the march of "progress" continues unabated and we are all its bloated guinea pigs.

The Bhopal Gas Tragedy is occurring in the developing countries every day, though of course not as dramatically. In the name of "progress" and "development", all our life-support systems, in which water is the most crucial, is being slowly poisoned.

Ganga is sacred for us, of course. But in fact, all rivers and all water on this planet is sacred, in the most comprehensive sense of that word. As modern people, we rightly feel a certain revulsion at the sight of half-burnt bodies in the Ganga at Varanasi. However, a far greater issue awaits the attention of us moderns: That no one has the right to pollute our rivers, or destroy our forests, or waste our meagre resources, or contaminate and erode our soil in the name of progress and development, and for the glamour and the greed of a few.

(The author wishes to acknowledge the use of many facts and figures from *The State of India's Environment; A Citizens Report*.)

□

Masnavi Chirag-e-Daur : Ghalib's Ode to Kashi

I once asked a knowledgeable person, who knows the secrets of the universe:

"Virtue is passing out of the world; loyalty and friendship are forsaking mankind;

Religion remains only for show sake—and that too only in misleading form;

Sons have become sworn enemies of fathers and fathers are after the blood of sons; brother is lifting his arm against brother;

Truth is not visible anywhere in any of the six directions; with all these indications of doom,

Why is Qiamat (end of the world) not coming yet? Why is the bugle of Qiamat not blowing yet?"

That wise man pointed at Kashi, smiled, and said: "It is because of that structure, that doom has been stayed."

Impact of Human Settlement & Developmental Activities on the Ganga River System

Recently the Department of Botany, the Institute of Science, 15 Madam Cama Road, Bombay-400032, published a report on the above subject.

The 268-page Report was prepared by Dr. S.B. Chaphekar, Project Director, and Dr. G.N. Mhatre, Scientific Adviser. We reproduce below the "Conclusions and Summary" of the Report for the convenience of all those interested in the purity of the Ganga.

GANGA is one of the oldest rivers to have supported early human settlements in the world. The river has been the place of development of human civilization to a great extent. However, the occupation over the years is now having its ill effects on the river, slowly but surely destroying the river in time and space. The symptoms of degradation have started showing and are getting more severe every day. An urgent need to assess the damage caused by the human settlements and their numerous activities to the great river is being felt. The Planning Commission has hence taken steps to introduce efforts for large-scale investigations of this river, from origin to the mouth, with the help of a large number of Universities and other institutions in the region.

This Report is the first attempt in the country to compile all available information on the river, especially with respect to the human settlements and their activities and their impact on the Ganga river. The Report aims at identifying the areas of concern in different zones of the Ganga.

Human settlements along the river :

The Ganga Basin has shown an annual increase of 2.5% in its population in the decade 1971-81 with an average density of 464 persons per km in 1981. Urban population of the region showed an annual increase of 7.3% in the same period, reflecting the increasing magnitude of urbanization taking place in the region. The percentage of urban population to total population (18%), however, shows that the region is still mainly rural.

Urbanisation & industrialization: severe strains on the Ganga

The mode of urbanization is very uneven. It is mainly found in the form of dense pockets in certain regions of the Plains, creating acute problems of population explosion and consequent degradation of the local river quality. There are altogether twenty urban agglomerations situated along, or in the vicinity of, the Ganga river all along its course. The distribution of these agglomerations in different zones of the great Gangetic Plains is as follows; one in Zone above Upper Ganga Plain, eight in Upper Ganga Plain, Seven in Middle Ganga Plain and four in Lower Ganga Plain. Increasing growth of these, has often led to increased uses of the river, many a times causing degradation of the quality of the river.

The total region is still agrarian in nature. About 70% of the work force is still engaged in pastoral pursuits. However, a net annual shift of 0.34% from agricultural work-force to industrial work-force has taken place in the last decade, showing the positive increase in industrialization leading to increased urbanization.

Environmental problem caused due to human settlements, developmental activities and identification of areas of concern in different zones of the region:

The problems are of two kinds—

(i) caused by nature and (ii) caused by man.

The ill-effects of nature-induced problems are often aggravated by human beings. The problems are discussed below zone-wise.

Zone Above Upper Ganga Plain :

The region is endowed with vast resources of forests, scenic beauty, agricultural and horticultural products and livestock. Such a natural wealth is endangered by the recent increase in human populations and their activities.

Due to hilly terrain and undulating topography the distribution of industries is uneven. At the same time, their scattering has resulted in no obvious instances of pollution, an offshoot of industrialization.

However, the region faces the peril of urbanization due to an increase in human population (2.7% per year during the last decade) causing stress on the forests, especially in the catchments of Bhagirathi, Yamuna and Bhilangana, which are getting depleted at a faster rate. An in-

crease in the rate of deforestation has created a great impact on the stability of the region. The Ganga has flooded every year during the last decade, affecting the regions situated downstream viz., Upper and Middle Ganga Plain. The floods have caused immense loss of human lives, property, agriculture and livestock, amounting to several crores of rupees. Excessive felling of trees taking place in the region has been the main cause of 'CHIPKO' movement started by the natives in the area. The movement has gained momentum and world-wide attention for the region.

Upper Ganga Plain

Though the Upper Ganga Plain is relatively more developed, it has its own problems.

The land has been subjected to misuse, leading to several land and associated problems. For instance overgrazing and deforestation in most areas have led to soil erosion and ravine formations on the one hand and accentuated flooding on the other. The traditional pastoralism of the Braj Plain, a critical rainfall zone, could not maintain the ecosystem partly due to over-grazing and partly due to the encroachment of desertic conditions. Likewise, the vigorous activity in recent years in the use of the Tarai resources, has accentuated the processes of flood, water-logging and soil erosion.

Due to an increase in exploitation of forests in the zone above the Upper Ganga Plain, there is recurrence of floods in the regions situated downstream. Every year, there is an increase in damage caused by floods, which have led to large-scale destruction of property, crops, public utilities, etc., running into several crores of rupees. A Press report (Times of India dated 11.10.82) has stated that flood fury in 1982 has cost 183 lives and 57,718 homes in Uttar Pradesh alone.

Besides floods, the region also faces the grave danger of water pollution, especially of the Ganga river, due to increased urbanization though, paradoxically, the region itself is still mainly rural. Due to industrial development of cities at an unusually rapid rate, the local pollution problems keep occurring, which sometimes take very acute form. In this region two urban agglomerations, especially Kanpur and Allahabad, are the ones where attention is needed, as their growth and industrial development has been very rapid. Kanpur is the largest city of U.P. and is one of the most important industrial towns of northern India. Many industries of different types are situated there and establish-

*Deforestation & over-grazing
have led to erosion & ravines*

An AMU study shows high metal contamination

ment of new ones is also rapid. As a result, the industrial pollution problem is also high. The effluents from industries as well as the untreated domestic waste, enter the stream of river Ganga at several points during its course at Kanpur. The problems of suspended and dissolved solids, oxygen demand and presence of heavy metals are expected to be severe in the region, though hardly any data is available. According to a recent press report a survey by a team of scientists led by Dr. Mohammad Ajmal of the Aligarh Muslim University has revealed high metal contamination of the Ganga at Kanpur, Allahabad and Varanasi. The metals detected were cadmium, manganese and cobalt. According to the report, fish samples at Allahabad were also found to have very high levels of metal pollutants.

Allahabad, the other urban agglomeration in the region, is comparatively less industrialized as also less urbanized. Even so, the city has not escaped from the pollution problems, especially degeneration of the quality of the Ganga and Yamuna rivers along the banks of which the city is situated. Though the pollution load gets distributed along the two rivers, the problem of pollution does not disappear from the region. It would prove educative to examine the different treatment methods for rendering the wastes, industrial or domestic, innocuous, before their release into the river at different places.

Another problem of concern is that of mass bathing by millions of pilgrims, especially on auspicious days, in the river Ganga. As many as ten millions people had a holy dip in the 3 km long bathing stretch on a single day of Mauni Amavasya on January 25, 1983. On another important bathing day, Makar Sankranti on January 14, the number was estimated to be over one million. During the almost one month-long Kumbh Mela, the number of bathers was 50,000 to 60,000 every day, against about 4,000 to 5,000 on non-festival days.

The Central Board for the Prevention and Control of Water Pollution in a preliminary report, expressed that such a large number of people entering a rather limited body of water within a short time exerts pollutional loads on the water stream far beyond its capacity. This increases the danger of water-borne diseases to the bathing community and to the people downstream. The study during the Ardh-Kumbh Mela revealed that the water in the Ganga 10 km upstream of 'Sangam' was satisfactory while 8 km upstream of 'Sangam', the Yamuna waters were good for bathing. The water at the holy sangam remained at the satisfactory level on normal days, when there is not too much of mass dip-

ping, but become totally unsatisfactory, especially on crowded days. This persisted even 15 km downstream of the 'Sangam' on the following day of the Kumbh Mela. The study suggested chlorination of the water for bathers' safety.

Middle Ganga Plain

This region is richly fed by rivers. As a consequence, it has to face the ugly side of the well-developed riverine system i.e. floods and erosion. The land in the region has borne a great burden of these. There are almost no forests, grass-lands or pastures or grazing lands, and proper soil management is lacking. As a result, recurrent floods is a permanent feature in the region. In the floods of 1982 Bihar State which comprises the entire Middle Ganga Plain, suffered extensive damage to houses (56,617) and to crops in 12.06 lakh hectares. Extensive afforestation programmes in the catchments of the rivers and all along their course is worth trying if the fury of the floods is to be abated.

The densely populated region also faces the enormous problem of population explosion with all its fall-out—shortage of food, malnutrition, diseases, health, education, employment etc. There is also the problem of diminishing land-holdings or per capita land that gets more acute every day, due to lack of alternative channels of livelihood.

The region, though mainly rural, has shown slow but definite positive trend of urbanization and industrialization, creating problems of pollution. Presently, detection of the problem of pollution is mostly confined to the urban agglomerations and class I cities which are more industrialized but the presence of the problem in smaller cities is also possible. The centres of environmental concern in the area are—Varanasi, Patna, Barauni, Monghyr, Sultanganj, Bhagalpur, Sahebganj, Rajmahal and Farakka. There are very few reports about the quality of Ganga river at these places. These show that the industries of these cities and towns dump their wastes in an untreated form into the river. As a result, the problems of biological pollution and industrial pollution are inevitable, affecting the quality of water to a great extent. The number of bathers is substantially high all along the course of the river in this region also, during festive occasions, retarding the water quality. Cremation of dead bodies and dumping of the ash and partially burnt bodies in the Ganga is a common feature in this region. There is urgent need to discourage these activities in order to retain the physico-chemical, biological as well as aesthetic quality of the river.

*Mass bathing by millions
also pollutes the river*

Superiority of Ganga water contributes to complacency

Lower Ganga Plain

This region endowed with rich alluvial soil, abundant basic raw materials, numerous perennial streams and a sea-face, attracts a large number of people in search of their livelihood. As a consequence, it is now confronted with certain problems of both natural and man-aided types.

The region, similar to the preceding one upstream, also has to face the brunt of floods from the Ganga and the other rivers.

The factors which induced rapid economic development in the Hooghly region have themselves generated a chain of complex problems in the very wake of the vigour of development. On the regional level, development was so lop-sided and uncontrolled that even in the exceptionally developed areas (Calcutta), the attendant problems could not be resolved. The most affected area of the lot is the Hooghly estuary which has been the life line of the region for its growth and development so far. Various studies have been carried out along the Hooghly estuary as regards the impact caused by industrialization on the estuarine ecosystem as a whole. Salient features of these studies stress the need for immediate attention to the Hooghly estuary for its restoration. Some recommendations made on the basis of the data collected by Ray and Laha (1981), are worth trying for restoration of the dying estuary.

On the whole, the Ganga river system, one of the oldest civilization-supporting systems in the world, requires immediate attention, if it is to continue to be the holy river of the masses. The huge quantum of water flowing in the river, is capable of diluting most of the impurities added to it according to some scientists who claim to assign some exceptional self-purifying properties to the river. Such a claim, however, may contribute to the perpetuation of complacency on the part of the people who should know better. It is, as a matter of fact, an indication of how little we know about the river we revere most. In spite of a large number of educational and other institutions, both old and new, located along the length of the river, very little data on the quality of the river has been generated to arrive at definite conclusions regarding the accurate status of the quality of water. Number of human settlements, density of human populations and variety of human occupations stress the need for generation of this data on a large scale and on taking corrective measures, ensuring that the river continues to be the life-line of a large body of humanity.



But can the Ganga be Purified? Ten Pertinent Questions to GOI

By Dr Sudhendra Sharma

Centre for Policy Research
New Delhi

THE FORMAL ANNOUNCEMENT of the setting-up of a Central Ganga Authority by the Central Government represents the commitment of the government towards purity of the primary river as well as its commitment towards cleaner environment. While this step has brought appreciation from many quarters, there are several aspects that need to be looked into. Many questions have been raised which need to be discussed in national forums of this kind.

1. Can the Rs 250 crore project cleanse the Ganga, when the state Pollution Control Boards and the Central Board for Pollution control (formerly Central Board for the Prevention and Control of Water Pollution) could not do so with the help of a legal weapon called the Water Pollution Control Act, 1974?
2. If the existence of Pollution Boards and the Act during the past decade is a testimony to an increase in the levels of pollution, is there something wrong with the functioning of the Boards and the implementation of the Act?
3. While providing sewerage treatment facilities to 29 Class I cities along the Ganga may not reduce pollution to even 50 per cent, how is the complete check on waste disposal to be achieved?
4. It is believed that 25 per cent of the pollution in the Ganga is caused by 132 major industries along its 2000 km. route from Har-ki-Pauri near Hardwar, to Howrah. Out of these units, 66 are on the banks of the river at Kanpur alone. Whereas providing sewerage and sewage treatment facilities is a government responsibility, industrial units are supposed to have their own treatment facilities for the wastes. But none of the industries have a fool-proof waste treatment facility,

Political Interference, Business Lobbies and lack of technical manpower

though, under Sections 2, 25 and 26 of the Water Pollution Control Act, the municipalities and industries cannot dispose their untreated effluents into the natural water courses.

5. On the other hand, Section 33 of the Act has provided the Boards with legal powers of punishment and imprisonment to erring authorities. Also, under certain conditions, the Boards can purify the effluents for the industry and recover the expenditure incurred. What, then, prevented these boards from implementing the Act?

6. Political interference, business lobbies and lack of technical manpower curtailed the functioning of most of the state Pollution Boards, but it has not indicated any measures to strengthen their functioning. If, alongwith these boards and the Act, a separate Ganga Authority is required to clean the river, then what will be the future role and status of these boards?

7. The Project on paper seems alright and there is a possibility of treating sewage and sullage, provided funds are available. (So far, only a third of the total budget has been sanctioned by the Planning Commission). But, can all the population along the Ganga—or whose excreta reaches the Ganga—be covered under the sewerage schemes of municipalities?

8. The Ganga plan indicates a net profit of Rs 14/-per person by way of gas/manure on an investment of Rs 23/-per capita per year towards expenditure on pumping and treatment of waste. Had this idea been told to the state Pollution Boards, they would have earned a significant profit to the States?

9. It is rightly said, "The poor simply defecate into the river, the rich dispose of industrial wastes and the religious throw their dead bodies into it". Sewage is the major culprit, for which a massive awareness drive needs to be launched and, shockingly, this doesn't form part of the Ganga Plan. Why?

10. When Ganga is mother to millions of Indians, let this Ganga plan be a people's plan. Let's inculcate into millions of Indians the spirit of saving the mother, by awareness and education. Why not?



Text of Government's Action Plan for Prevention of Pullution of the Ganga

by The Department of Environment

Government of India
(Revised July 1985)

THE Ganga drains eight States—Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, West Bengal and the Union Territory of Delhi. It is also the most important river of India and has served as the cradle of Indian Civilization. Several major pilgrim centres have existed on its banks for centuries and millions of people come to bathe in the river during religious festivals, especially the Kumbhs of Haridwar and Allahabad. Many towns on the Ganga e.g. Kanpur, Allahabad, Patna and Calcutta have very large populations and the river also serves as the source of water supply for these towns. The Ganga is, however, being grossly polluted especially near the towns situated on its banks. Urgent steps need to be taken to prevent this pollution and restore the purity of river water.

Sources of Pollution

The main sources of pollution of the Ganga are the following :—

Urban liquid waste:
(sewage, storm drainage mixed with sewage, human, cattle and kitchen wastes carried by drains etc.)

Industrial liquid waste:
Surface run-off of cultivated land where cultivators use chemical fertilisers, pesticides, insecticides and such manures the mixing of which may make the river water unsafe for drinking and bathing

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The Ganga, in its 2,525 km. length, starting from Gangotri in the Himalayas to its meeting point with the sea at Ganga Sagar in the Bay of Bengal, passes along 29 Class-I cities (population over 1,00,000), 23 Class-II cities (population between 50,000 and 1,00,000) and about 48 towns having less than 50,000 population. In those towns where there is no sewerage system or the coverage is only partial, the waste water flows through open drains and finally finds its way into the river. Unfortunately, even in some of the sewered towns, similar situation arises when the pumping stations are non-functional due to lack of maintenance or non-availability of power.

Since the scale of pollution also depends on the degree of dilution and velocity of the flow of water, it is necessary to maintain a minimum discharge in the river, especially at critical points, e.g. urban settlement and locations of large industrial units producing substantial quantities of obnoxious liquid wastes. Unfortunately, this is not kept in view while tapping a river for irrigation. The intensity of irrigation in the Ganga Basin is very high. About 43 per cent of the total irrigated area in the country is located in the Ganga Basin. Practically the entire dry-weather flow is diverted to the Upper Ganga Canal at Haridwar and whatever flow is regenerated between Haridwar and Aligarh is again diverted to the lower Ganga Canal near Aligarh. As a result of this, there is very little dry-weather flow in the Ganga at Kannauj and Kanpur where there is a heavy inflow of pollutants in the river. The Ganga receives over 60 per cent of its water from Yamuna, Ghaghra, Kosi and Ghandak, all joining the main river at, or points below, Allahabad. The Haridwar-Allahabad stretch is, therefore, particularly vulnerable.

Steps for Prevention of Pollution

Stoppage of discharge of sewage/sullage into the river should reduce the pollution by almost 75 per cent. Fortunately, in most of the major urban settlements on the banks of the Ganga, trunk-sewers have already been laid along the riverside to intercept the drains/sewers coming from the inhabited areas. Most of the dry-weather discharge of sewage/sullage (which at times also contains liquid waters of minor industrial units) can be intercepted and carried by these sewers to such down-stream points where sewage can be pumped above the ground level and applied on land for cultivation. But, as mentioned earlier, often the pumping plants installed for this purpose are not properly operated and maintained, with the result that sewage overflows from the sewers and finds its way to the river. At many places, these plants have been lying out of

*Trunk sewers laid parallel to
river to intercept drains*

Non-conventional STPs can be cheaper and safer

commission for many years. The main reason generally given is the lack of funds for operating and maintaining the pumping plants. In some cases the sewer networks connecting to the treatment plant may be incomplete and in some others, connections are not adequate. In some cities, the power bills for these pumping stations are not paid for many years and the power supply agencies are compelled to disconnect the power connections. Whatever the reasons, these non-functioning treatment plants give no benefit from the investment. The problem has to be solved and it should be possible to do it in the following manner.

Sewage is a very rich source of energy (through the production of biogas) and manurial matter. Utilisation of this manurial matter can increase the crop yield substantially. On the basis of Nitrogen, Phosphorous and Potassium content (NPK), the per capita contribution of manurial matter can be taken as almost Rs. 3/- per year. As regards energy, the per capita contribution of biogas (in terms of equivalent energy from kerosene oil) can be taken as Rs. 2/- per year. The production of energy from sewage will also ensure a regular supply of power to run the sewage pumping and treatment plants. Given the overall scarcity of power, the provision of energy atleast for operating the treatment plant by such recycling should be a critical consideration. In some cases some surplus power may still be available for other uses. Ways and means for an optimum use of this power can be worked out after considering the local condition at each place.

As regards the best utilisation of the rich manurial components of sewage, i.e. the digested sludge and effluent produced by the sewage treatment plants, it should be recognised that these are marketable products and the authorities should be able to arrange for their sale at reasonable rates on the basis of NPK contents. At present, raw sewage is generally allowed to be used by farmers at very low prices that have no bearing on the manurial value of sewage. The use of untreated sewage for irrigation is also inadvisable because its handling by the farmers and eating of the produce from these farms pose serious health hazards.

A non-conventional sewage treatment plant, much cheaper and more compact than the conventional plants, is quite feasible. Raw sewage is led to a settling process where solids are separated from liquid. The solids go to digester to produce methane gas and digested solid. The methane gas is fed to gas turbine to generate electrical power for running

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Two Goals: immediate reduction of pollution & self-sustaining STPs.

the factory as well as to sell the surplus to other consumers. The digested solid is sold as manure. The liquid from the settling process goes to biological aerator where more solids are produced and separated to be fed to digester. The liquid or water from the biological aerator is clean enough to be used for aquaculture where algae and fishes are grown. Algae is harvested as poultry feed and fishes are marketed. The water from aquaculture flows out as irrigation water. Thus, each sewage treatment plant functions as a resource recycling unit producing energy, manure, poultry feed, fish and irrigant. Hence efficient marketing of these products is also conceived as an integral part of resource recycling unit. A conceptual model based on the treatment plant developed by the National Botanical Research Institute, Lucknow, is presented (on opposite page).

ACTION PLAN

The immediate reduction of pollution load (leading eventually to total prevention) on the river and the establishment of self-sustaining treatment plant systems thus emerge as the two objectives of the Action Plan in the first phase. Accordingly, the following have been identified as the components of the Action Plan :-

Renovation (cleaning/desilting/repairing) of existing trunk sewers and outfalls to prevent the overflow of sewage into Ganga;

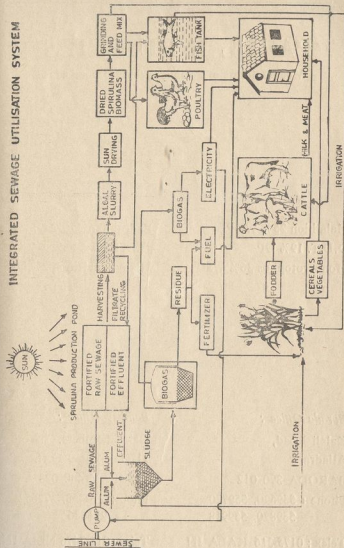
Construction of interceptors to divert flow of sewage and other liquid wastes into Ganga;

Renovation of existing sewage pumping stations and sewage treatment plants and installation of new sewage treatment plants to recover the maximum possible resources, specially energy, to operate the pumping and treatment plants and derive the maximum possible revenue to cover at least the operation and maintenance cost of these plants;

Arrangement for bringing human and animal wastes from locations proximate to the sewage/sullage digesters for sanitary disposal, production of energy and manure;

Providing sullage or sewage pumping stations at the outfall points, to divert the discharge from the river into the nearest sewers and treatment plants;

Alternative arrangements to prevent discharge of animal and human wastes from cattle sheds located on the river banks;



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OCTOBER 1985

Low cost sanitation schemes in areas adjoining the river to reduce or prevent the flow of human wastes into the river;

Biological conservation measures based on proven techniques for purification of streams;

Pilot projects to establish cost effective systems for diversion of wastes now flowing into the river, their treatment and resource recovery;

Pilot projects to establish feasibility of technology applications in the treatment of wastes and resources/energy recovery.

Depending on feasibility, circumstances and availability of funds certain other components will need to be taken up in the present or subsequent phases, such as the following :

—Extending the existing sewerage system in the towns to cover the unserved areas;

Construction of large cattle sheds in the fringe of urban areas to facilitate collection of animal and human waste at suitable places and generating biogas (energy) and manurial matter at these points. This will also prevent the rainfall run-off from the urban area washing and bringing all the muck to the river during the rainy season and grossly polluting it. Keeping the cattle at such sheds instead of built up areas will also improve the urban environment.

Prevention of throwing of dead bodies in river;

Regulation of the use of pesticides and insecticides for agriculture in such a way that surface run-off from the cultivated area does not carry excessive quantities of these materials to the rivers.

Cost Estimates and Phasing

A tentative assessment of cost for several works that may be taken up for execution during the Seventh Five Year Plan period is presented in Appendix-B amounting to about Rs. 250 crores. These estimates are for only those Class-I towns which are situated on the banks of the river. Similar works for the other towns situated on the Ganga may be taken up subsequently. In some cases, river characteristics, nature of the pollution faced and proximity of its sources may require contiguous urban areas to be taken up. In such cases, the type classification of cities may not be insisted upon.

*Biological conservation measures
for purification of streams*

Parameters for preparation of feasibility reports under the action plan

The principal thrust of the Ganga Action Plan in the first phase is immediate reduction of the pollution load on the river Ganga and establishment of treatment systems which are technically self-sustaining. From this point of view, Class-I cities are proposed to be taken up first because population in Class-I cities cover 82.3 per cent of the total urban population living in the urban settlements on the river bank. The volume of sewage produced in these Class-I cities constitutes 88.5 per cent of the total volume of sewage produced. Furthermore, 15 of the 29 Class-I cities have sewage treatment systems, though the coverage in some is only partial. There is an urgent need to optimise the benefits from these existing systems.

It would be worthwhile to take a look into the scene of pollution in these cities. In Patna of Bihar and Varanasi of Uttar Pradesh, for instance, the sewage systems cover 25 and 50 per cent of population, respectively. In both the locations the city sewage is flowing into the river at more than 5 points. In both the places, sumps and pumps have been installed to trap the sewage at the outfalls. However, in Patna the pumps push the sewage directly into the river because there is no intercepting sewer. In Varanasi the sewage is pumped into the intercepting sewer (locally called ghat sewer) which runs parallel to the river bank. No sewage in Varanasi would have flowed back into the river if all the components were in operation. Supplementing or providing the missing links and ensuring the performance of existing systems thus become important requirements under the Ganga Action Plan.

The Ganga Action Plan comprises several components. In preparing Feasibility Reports for different schemes falling under one or more of these various components, the following parameters should be adhered to.

Renovation of existing sewers :-

The objective here is to prevent the overflowing of sewage from silted or broken sewers into the open drains and river. To begin with only the outfalls and trunk lines should be considered rather than the branches or laterals. Though cleaning and repairing of sewer lines is an important element in any sewerage system, this is a time consuming and lengthy process. The cost involved in such routine functions for the city or the system as a whole cannot be treated as a part of the Ganga Action Plan. Each proposal for renovation of existing sewerage lines should,

therefore, be established as essential for eliminating or drastically reducing an overflow and thus stopping a given source of pollution.

Construction of Interceptors :

Cities where sewage outfalls into the river exist, the immediate task is to divert the sewage to a suitable location for further treatment, using sumps, pumps and intercepting sewer line parallel to the river bank. Since the cost of diversion of sewage through pipe line goes up as the distance of travel increases, length of diversion (intercepting sewer) should be kept at a minimum. Sometimes, for want of space near the river bank, the location of the treatment may have to be away from the river bank. It may, therefore, be necessary for the sewage to be diverted to more than one location.

Renovation/Construction of new Treatment plants :

In cases of renovation, only those plants which are discharging effluents into the river and causing pollution should be taken up. In preparing schemes for both renovation and new construction, the recovery of resources in the form of methane gas or other forms of energy should be specifically considered. The utilisation of the treated effluents for irrigation, pisciculture and algae culture should also be examined. Where such items are not feasible for some special technical or other considerations, their omission should be properly justified in the report. Though the cost and estimates of revenue may vary, the concepts are important which make the approach to this Action Plan distinctly different from conventional approaches to the treatment of municipal wastes. The items of resource recovery should not, therefore, be an after-thought but an integral part of the scheme. Each treatment location should be viewed as a factory for resource recycling, where sewage is the raw material, and energy, manure, poultry feed, fish, and irrigant are marketable products. The technical, financial and organisational requirements for operating such a treatment plant/factory should be reflected in the feasibility report.

Feeding human/animal wastes for sewage/sludge digester :

In partially sewered cities, sewage from unsewered areas along with cattle dung are collected, carted (head load or animal cart load) and dumped into manholes of some sewer system. The sewer system may remain open ended, thus causing the waste to flow in the river. Places where such situations exist, arrangements for bringing the human and animal

*Diverting sewage to suitable location (s)
for further treatment*

Each treatment plant to become a factory for recycling wastes

wastes from these parts and feeding the wastes to the sewage-sludge digesters for sanitary disposal and production of more biogas (energy) and manurial matters should be considered. The sub-components included in this item are extra equipment for collection and cartage of human/animal waste from unsewered areas within economic haul distance and from area causing river pollution.

Provision of Sewage/Sullage Pumping Stations :

Renovation or new construction may be necessary and considered mainly for outfall drains and intercepting sewers. In some cases boost-pumps may also be necessary.

Construction of Cattlesheds :

The Action Plan has envisaged the construction of large community cattle sheds in urban areas to facilitate collection of wastes and generation of biogas. The experience with such projects in some of the cities has been mixed. For example in the Calcutta metropolitan area large cattlesheds with necessary facilities have been constructed but it has not been possible to shift any significant number of cattle to these sheds from the existing locations. However, in some of the towns covered under the Action Plan, such cattlesheds may be existing on the river bank itself with the wastes falling directly into the river. There may be specific cases where diversion or treatment of such wastes either by connection to sewers or biogas digester plants may be feasible.

Low Cost Sanitation Schemes :

Many states in the country have taken up low-cost sanitation schemes such as the provision of pour-flush latrines with leach pits and other models, on an extensive basis in urban and rural areas. In the cities under the Action Plan where substantial parts are unsewered and where extension of sewage will take much time and cost, such low-cost sanitation schemes, particularly in the parts of the city adjoining the river, may help reduce BOD. Such schemes may be considered as supplement to ongoing low cost sanitation schemes in the relevant cities.

Biological Conservation Schemes/Pilot Projects etc. :

Where pilot projects are proposed to be taken up to establish the feasibility of technology applications, the proposal should indicate the nature of the current problem, technology proposed to be applied

source of such technology and availability; the research components, the availability of technical personnel, cost, time schedule etc.

Similar should be the approach in the case of biological conservation schemes as well.

Effluent from Industries :

Under the laws of the land the responsibility for treatment of the industrial effluents is that of the industry. While the concept of 'Strict Liability' should be adhered to in some cases, circumstances may require that plans for sewerage and treatment systems should consider industrial effluents as well. Clusters of small industries located in a contiguous area near the river bank and causing direct pollution to the river such as the tanneries in Jajmau in Kanpur, is a case in point. In some cases, waste waters from some industrial units may already be connected to the city sewer and, therefore, merit treatment along with the sewage in the sewage treatment plant. It may also be necessary in some crowded areas to accept wastewaters of industries in a city sewer to be fed to the treatment plant, provided the industrial waste is free from heavy metals, toxic chemicals and is not abnormally acidic or alkaline.

In such circumstances, scheme proposals have to carefully examine the case of integrating industrial wastes for purposes of conveyance and treatment as also the possibilities for apportionment of capital and operating costs between the city authorities and the industries concerned.

The feasibility reports should also contain the following information :

- (1) Quantity of pollution load (expressed in kg of BOD per day, and also dry-weather flow in cu. m. per day) getting discharged into the river.
- (2) Number of locations, quantifying each in terms of pollutional load, where sewage/sullage are getting discharged into the river and proposed to be controlled and/or prevented.
- (3) Layout of the modification of the existing treatment plants and/or cases where new treatment plants are to be built.
- (4) It is desirable that the treated effluent prior to application as irrigant water conform to the following effluent quality;
 - BOD is less than 50 mg/l
 - suspended solids less than 50 mg/l.

The case of clusters of small tanneries in Jajmau area of Kanpur

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(5) A brief economic and financial analysis of projects generating revenues and economic analysis (cost-benefit, cost-effectiveness or least cost analysis as appropriate) for other projects.

It has been suggested that the treated effluent to be discharged into the river should contain;

BOD of less than 20 mg/l and

Suspended solids less than 20 mg/l. The first meeting of the Steering Committee considered this issue and noted that even in several developed countries BOD of 30 mg/l and suspended solids of 50 mg/l were being accepted as limits. It was decided that for the present these limits may be followed. In specific cases where the requirements of use for drinking or other purposes immediately below the points of effluent discharge so require, the limits for treated effluents may be set at 20 mg/l for BOD and suspended solids.

In each case the quality standards for the treated effluent should be properly explained and justified in the feasibility report.

The Ganga Project Director proposes to formulate further guidelines for preparation of detailed project reports. Pending the same the guidelines contained in the manuals and circulars from the CPHEEO, Ministry of Works & Housing regarding designs and standards for public health engineering works may be followed in so far as they are consistent with the above parameters.

Organisational Structure for the Action Plan

Pollution control in the river involves many organisations like local bodies, industrial units, State and Central agencies, specialist organisations, expert groups and so on. Above all, public cooperation and participation have to be mobilised to sustain awareness about the problems of pollution of the river, to speedily implement the Action Plan and to maintain the purity of the river. An appropriate mechanism is, therefore, necessary for coordinated action at various levels.

The Central Ganga Authority

To oversee the implementation of the Action Plan, the Government of India have set up by Resolution a Central Ganga Authority (CGA) under the chairmanship of the Prime Minister

*50 mg. of suspended solids
per litre of water, is the limit*

Five Functions of CGA & 7 Functions of Steering Committee

The functions of the CGA shall be the following :

- (a) To lay down, promote and approve appropriate policies and programmes (long and short term) to achieve the objectives;
- (b) To approve the Action Plan;
- (c) To mobilise financial resources;
- (d) To review the progress of implementation and give necessary directions to the Steering Committee; and
- (e) To take all such measures, as may be necessary, for achieving the objectives of the Authority.

The CGA will meet at least once a year.

A Steering Committee has also been constituted under the same resolution and after consultations with the concerned Ministries, with The Secretary, Department of Environment, as Chairman

Subject to general or specific directions of the CGA, the Steering Committee shall perform the following functions :

- (a) Promote appropriate policies, plans, programmes and projects for improving water quality in the Ganga;
- (b) Examine and approve the components of the Action Plan and the Annual Plan;
- (c) Determine the manner in which funds are to be allocated to various agencies for implementing the Action Plan;
- (d) Sponsor water quality monitoring through concerned agencies;
- (e) Sponsor studies relevant to the objectives of the Authority;
- (f) Oversee and monitor the implementation of the Action Plan and give necessary directions to the Agencies concerned;
- (g) Report to the Central Ganga Authority the progress of implementation

The Ganga Project Directorate :

The Government of India have created a small wing in the Department of Environment called the Ganga Project Directorate to service the

Central Ganga Authority and the Steering Committee and to perform the following functions :

- Appraisal and approval of the sub-projects prepared and submitted by the field level agencies;
- Coordination of the various agencies;
- Release of funds to the agencies;
- Monitoring project progress and improvement in the quality of the river at critical points;
- Reporting to the Steering Committee on progress of the projects.

The Wing is headed by a senior level person as Project Director. He will be assisted by a group of technical, scientific and other personnel. The wing has started functioning from June, 1985.

It is also envisaged that the Member, Planning Commission, in-charge of Science & Technology and Environment will oversee the monitoring mechanism and quarterly reports on the progress of the Action Plan will be submitted to him.

River Water Quality Monitoring :

Impact of Action Plan will be felt through the improvement of river water quality. The 39 monitoring stations on the main course of the river Ganga, as maintained by the Central Pollution Control Board, will continue and be strengthened in terms of capability.

Arrangement at the State Level :

Since the treatment of municipal wastes is a principal component of the Action Plan, the State Government and its agencies will have a substantial responsibility for the preparation and execution of these projects. It is necessary that at the State Government level one department is identified as the nodal department which will be responsible for coordinating the preparation of different schemes and their implementation. In Uttar Pradesh, the Urban Development Department has been identified as the nodal department for coordination. In Bihar and West Bengal it will be the Environment Department. Subject to the supervision of the nodal department, different state government agencies like Water and Sewage Boards, Public Health Engineering Directorates, State Pollution Control Boards, Development Authorities, Local Bodies etc. may be assigned the

*There has to be continuous monitoring
of river water quality*

work of individual scheme preparation and execution. There will also be an inter-departmental committee in each of the three states with the Secretary of the nodal department as the convener :

(a) to screen the schemes before sponsoring, indicating their *inter se* priority,

(b) to under-write State Government's role or contribution in the execution/maintenance of the project as may be necessary for the proper fulfilment of the objectives of the scheme,

(c) to ensure inter-departmental coordination at the state level,

(d) to review physical and financial progress from time to time and,

(e) to arrange for furnishing such information as is required by the Ganga Project Directorate.

The monitoring of the progress of the projects, their impact on river quality and the operation and maintenance of the completed projects are extremely important. The Department of Environment in consultation with the Planning Commission, various Central Government Ministries and State Agencies concerned will be evolving appropriate mechanism in this regard shortly

□

Poet Hali on Ganga

Woh deene Hejazi ka bebak beda

Nishan jiska aqsai alam mein pahuncha

Mazahim hua koi khatra na jiska

Na 'Amman' mein thithka na 'Kulzam' mein jhihka

Kiye passipar jisme saton samandar

Woh dooba dahane mein Ganga ka aakar.

(The fearless ship of Islam, whose flag fluttered over all the world; that could not be deterred by danger, either in 'Amman' or in 'Kulzam'; the ship which crossed the seven seas, came here and sank in the bed of the Ganga.)

DRI Seminar on the Ganga : The Proceedings

THE DRI SEMINAR ON THE GANGA was held here on August 11. PROF. RAMDEO MISRA, doyen of ecologists, presided.

The following participated :

SHRI TARLOK SINGH, ICS (Retd.) former Member, Planning Commission ;

SHRI NANA DESHMUKH, Chairman, DRI ;

PROF. C. K. VARSHNEY, Professor of Environmental Science, JNU ;

PROF. K.S. BILGRAMI, Professor of Botany, Bhagalpur University, Bhagalpur, Bihar ;

DR. L. P. MALL, Vikram University, Ujjain ;

DR. L. C. MISHRA, Botanist, DAV College, Kanpur ;

DR. S. B. PANDEY, former Reader in Botany, Allahabad University ;

DR. SAHDEV KUMAR, Professor, Department of Man-Environment Studies, University of Waterloo, Canada ;

DR. NARINDER SINGH, JNU ;

DR. MURLI MANOHAR JOSHI, Professor of Physics, Allahabad University ;

DR. SUDHIRENDRA SHARMA, Centre for Policy Research ;

SUSH'L KUMAR MITTAL, Hydro-Geologist, Punjab Govt. ;

TEJI GROVER, 'Friends of the Earth' Group, Chandigarh ;

S. N. GHOSH, Environmentalist (Convener) ;

DEVENDRA SWAROOP, DRI ;

K. R. MALKANI, DRI ;

Others present included : S. K. RAO and C. P. JAYALAKSHMI



(L to R) Sarva Shri S. N. Ghosh, Dr. R. D. Misra, Malkani, Pandey, Tiwari, L. C. Mishra, Narendra Singh, Prof. Varshney, Dr. Mall.

of JNU, HIMANSHU JOSHI and SURESH SISODIA of Roorkee University and AVINASH TIWARI of Allahabad University.

NANA DESHMUKH, Chairman DRI, welcomed the participants and said he was happy that so many experts had gathered to discuss the Ganga problem. He was sure some good would come out of it.

PROF. R. D. MISRA was requested to take the Chair. Prof. Misra said he was happy to note that the problems of the Ganga had at last caught the public attention. He said there were hundreds of problems facing the Ganga. He hoped that the Seminar would be able to throw some light on them.

SHRI SAILEN GHOSH, posed a number of questions. He said that Ganga water is credited with unique electrochemical properties; it remains in a germ-free condition for a year or more, even if kept bottled up. But hardly any scientific study has been made to determine the sources of these properties. Is it because Ganga has arisen from the youngest mountain system in the world and, therefore, is richer in minerals? Is it because it is fed by a large number of tributaries or sub-tributaries arising from high hills in the world's wettest tropical zone? Is it because its high gradient in the hilly region, followed by very gentle

slopes, lend it any particular character? Has it any special pattern of depth variation and flow-directions which make for ideal distribution of gases to establish a level of equilibrium conducive to high productivity?

Then, as regards Ganga cleaning, can this be done by merely setting up some plants to process municipal wastes and treat industrial wastes? Should the sewerage and the industrial wastes, after treatment, be allowed to drain into the river? If they are to be optimally processed, why will not the industrial plant, recycle the treated water in their entirety for their own use, with minimum intake of fresh water? Will the sewerage be treated to such a level as to make it safe for irrigation purposes?

Can the Ganga be cleaned without an ecological approach to the Ganga basin as a whole? Without the restoration of Himalayan ecology, can Ganga be cleaned? Without checking the trend of urbanization on Ganga banks, can the Ganga be kept clean? Is it not essential to establish a green belt along both banks of Ganga from upwards of Devaprayag to Ganga Sagar? Without this afforestation, will there not be floods submerging these very treatment plants? He requested the Seminar to take up these questions.

A dozen questions posed by Shri Sailem Ghosh

PROF. R. MISRA, Chairman of the Seminar, said that the large number of tributaries in the wettest tropical zone acquire a unique intensity from the four months of monsoonal rains. This intensity and the high gradient of the Himalayan ranges lend a great velocity to the downflows. These huge volumes gushing through the steep slopes clash furiously at their confluences and get ionized. This is likely to be the source of Ganga's electro-chemical properties.

PROF. BILGRAMI said that pollution was hurting the fish population of Ganga. And superior fish was suffering more than inferior fish.

The Ganga Dolphin was being killed for its oil, whose smell was then used to attract other fish into the nets.

The nylon fishing nets were economical, but they were harmful for fish.

DR. SAHDEV KUMAR said industrial wastes were more dangerous than the domestic/municipal wastes.



(L to R) Dr. Joshi, Shri Tarlok Singh, Nana Deshmukh, L. C. Mishra, Ghosh.

PROF. BILGRAMI agreed with Dr Sahdev Kumar. But he said that industrial pollution can be identified, localised and contained, while urban pollution was very varied and, therefore, more difficult to handle.

DR. SUDHIRENDRA SHARMA said that we should deal with policy. Since deforestation is being carried out under political patronage, its counter-measure, afforestation, also has to be supported by a political movement.

Also the people must be involved in keeping the Ganga clean. Nobody should, for example, ease himself in the Ganga.

DR. M.M. JOSHI said the Kumbh Mela and other Melas should be used, to reach the masses on this subject.

PROF. PANDEY said that that was precisely what they did in Prayag.

But PROF. NARENDRA SINGH said that Kumbh Mela itself was a big source of pollution.

DR. BILGRAMI said that in 1981 the government had said that they would involve all the universities in the Ganga basin in the task of studying and cleaning the Ganga ; but this had not materialised.

PROF. PANDEY said much of the tree-planting was only on paper.

SUDHIRENDRA SHARMA saw no reason why there should not be private forests.

PROF. MALL said that till recently, in Central India, there used to be 50% forest cover. But now it was already down to 25%.

He said that floods were not an unmitigated disaster. Flood waters diluted the pollution of a river. And the next crop on flooded lands was always bumper.

Till 1979, there was no sewage treatment plant in the Chambal basin. The river had a high content of heavy metals, thanks to industry in the Nagda area. The mass death of cattle in Panna came as an eye-opener. A sum of Rs. 2 crores only was spent on keeping the Chambal clean. Today its waters are quite pure and BOD has come down from 110 to just 10.

SHRI GHOSH said that industrial effluent should be recycled in its entirety, and not allowed to drain into the water. Prof. Mall said that 60% of this water was, in fact, being recycled.

Bilgrami : Pollution is killing fish, particularly superior varieties

DR. JOSHI mentioned that the costs of setting up mechanisms for fool-proof de-pollution would probably be as high as the cost of the production plant itself.

PROF. MALL said that there were not many instances of that kind.

DR. SAHDEV KUMAR said that in computing comparative costs of pollution and pollution treatment, we should not leave out the high costs of pollution in terms of sickness and health care. The point is whether we can industrialise without pollution—and whether an alternative technology was possible.

He gave the example of the Great Lakes area, which had 40% of the U. S. population. These Lakes had 3000 toxic elements, of which only 81 are being treated. No government is strong enough to force these factories, not to pollute the Lakes.

Ludhiana gets its water supply from wells. Industrial pollution had



(L to R) Sarva Shri Mittal, Jayalakshmi, Sahdev Kumar, Joshi, Sudhikendra Sharma, Sisodia, Prof. Varshney, Devendra Swarup and Dr. Mall.

affected water as much as 60 feet below the surface—and hand pumps did not go deeper than that. Even nickle and cyanides have been found in the water upto a depth of sixty feet. For getting a safe water supply for Ludhiana, we have to go down 150 feet.

In Bhatinda, the impact of super-thermal power station may include high incidence of TB.

NANAJI said that Ganga and Gandhi should be the inspiration for a new technology.

MALKANI drew attention to a recent article by Prem Shanker Jha in 'the Times of India' in which the author said that London was recycling its water nine times. He wanted to know whether this was really feasible.

PROF. VARSHNEY said that control of water pollution was eminently practicable. Japan was recycling its water many times over. Indeed Nature itself was recycling water all the time, converting polluted water into potable water.

Prof. Varshney said that water pollution may be of many kinds; nitrates, for example, can be easily processed out. But certain non-degradable compounds can keep accumulating in the system. Nuclear pollution

Varshney: Water can be recycled a dozen times

is much more difficult to handle as compared to other types of pollution. However, the solutions to pollution problems are difficult where there is too much concentration of industry anywhere. Technically, in many cases, complete recycling of water is possible. The river organisms take good care of many pollutants. The question, however, is whether we have the right kind of plan for development.

SHRI TARLOK SINGH said that government interest in cleaning up the Ganga was very welcome. But its Action Plan was something that came from above. The Ganga problem is different in the four different regions of the Ganga basin. And for action purposes, there had to be even greater decentralisation and specialisation.

PROF. R.D.MISRA, Chairman, said that the basic question was our value system. And that should determine the density of population—and of industry—and also the type of industries.

He said that cleaning the Ganga cannot be a 5-year plan; it has to be a permanent plan, a way of life.

PROF. PANDEY said that even as individual cleaning is a daily programme, keeping the Ganga clean should also be a daily, permanent affair.

PROF. BILGRAMI said that at the present rate, it will take 500 years to clean the Ganga.

DR. L.C. MISHRA said that the Ganga had been moving away from Kanpur. People said it was God's displeasure over Kanpur's pollution of the Ganga. A drift channel had had to be made to bring a stream of Ganga water to Kanpur. He said people who came to bathe in the Ganga at Kanpur, only got skin diseases and ring-worm. It was, therefore, of the utmost importance that sewage water was treated to extract manure and purify the water.

SHRI GHOSH said that it was hazardous to release the post-treatment effluents or sewerage into the river, in the belief that the air and the sun would do the remaining purification in the river course. Shri Ghosh said that the country needs to re-examine the potentially destructive effects of the Tehri Dam, the superthermal and the fertiliser and the atomic power plants on the Ganga's ecosystem.

Deendayalji and Dr. Lohia had raised the Ganga issue in 1956

SHRI TARLOK SINGH asked whether Government's Action Plan was realistic, and the cost estimates, correct.

PROF. BILGRAMI said that the Government's 11-Point Plan of Action took no note of rural pollution and faecal matter. Nor did it take care of animal carcasses consigned to the river.

Whereas not a gram of fly-ash should get into the water, hundreds of tonnes of the same were ruining it. And yet the Plan was silent on this subject. They should use fly-ash to make bricks--and not let it pollute water. Using valuable clay to bake bricks, was ruinous for soil fertility.

SHRI GHOSH said that microbiological treatment of polluted water was cheaper and safer than chemical method. Also, we need to have continuous technical evaluation of the Ganga waters by an independent agency.

PROF. VARSHNEY said that management is a critical factor; competent staff, committed to the task, was crucial. We have to have specially trained personnel to run the sewage treatment plants. Nuclear wastes must not be allowed to get mixed up with river waters.

He pointed out that the government Action Plan was altogether silent on the management aspects of the upper reaches of the Ganga.

DR. MURLI MANOHAR JOSHI said that in his boyhood days he used to hear the family priest bless children by reciting the shloka :

"Yawat Ganga Kurukshetre, Yawat Tishthati Medini

Yawat Ramkatha Loke, Tawat Jiwati Balaka."

This tradition still prevails in many parts of our country. The Sanskrit verse has a deeper meaning which generally escapes our notice. It says that the three entities of everlasting nature are : the planet earth, its ecosystem as symbolised by the eternal flow of Ganga, together with the inexhaustible waters in the lake at Kurukshetra, and the value system epitomised by the legend of Lord Rama. The priest blesses the child to live as long as these three remain in existence. In other words the child should live in happy harmony with the planet, the ecosystem and the value system. Thus, the secret of a long life lies in maintaining an equilibrium between the living organism and its environment, both natural and

social. According to the ancient Indian scriptures, defecation in the holy waters of the Ganga is a sin and people were prohibited from discharging any foul matter in the rivers. Keeping the Ganga and other rivers clean, was prescribed as a duty of the citizen and had become a part of their life.

As far back as 1956, Deendayalji and Dr. Lohia had raised the Ganga issue; but in those days, neither the people nor the Government had woken to the need. It was dismissed as an irrelevant issue, not related to the development of the country. It is heartening indeed to find that Government have now realised its significance and an authority has been set up to keep the Ganga clean.

Emphasising the need to adopt a holistic view of the problem, Dr. Joshi said that the Ganga issue was not simply to somehow keep this one river alone clean; in the ultimate analysis it was related to a much wider and complex issue of maintaining a healthy ecosystem all-round. The moot question is: can you prevent the pollution of Ganga without taking care of the industrial policy, urban development programmes, forest policy, demographic factors, agricultural policy and habits of personal hygiene and conditions of rural masses? Perhaps you can't. The issue, therefore, calls for a total re-examination of the very foundations on which our socio-economic paradigm is based and the critical evaluation of the technology we are using. Let us remember that the technology adopted by Bhagirathi brought the sanctifying Ganga water to the plains; the modern technology is polluting it to dangerous levels. It is high time that we recognise that all technology that degrades the environment beyond the limits of toleration, is unacceptable.

In fact the degradation of environment is one of the serious challenges which constitute the predicament of mankind. Life is a wonderful experience and one wonders whether it exists in other parts of our universe or not, but life does exist on our planet. We must bear in mind that, for sustaining life, we possess only two entities viz. the planet earth and its environment. Let us not create an economy which destroys them. That would mean the end of life. The message of the Ganga issue for me is that the economy must come to terms with the ecosystem, and not disturb and degrade it. Mankind must realise that there can not be limitless growth on a planet with limited boundaries and finite environment.

*"May you live as long, oh child,
as there is water in the Ganga"*

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Hence the need for a new technology and alternative socio-economic paradigm and of a value system.

We must create public awareness on this very vital issue. It need not be emphasised that half of India's poor lived in the Ganga basin. They are one of the poorest lots in the whole world. The revival of the Ganga is crucial for their up-liftment. We have to mobilise public opinion for a very clean Ganga. All industries which pollute the Ganga, must either stop doing so or be shifted elsewhere. The atomic power plant at Narora should be moved to some other location so that the Ganga is kept completely free from radiation hazards. Students and youths should be involved with the cleaning of the Ganga---and for propagating its urgency. Spiritual and religious leaders should be requested to reiterate that polluting Ganga is a sin.

At this stage the Draft Statement was taken up for consideration. It read :

WE WELCOME the setting up of the Central Ganga Authority to clean up the great river and restore it to its pristine purity. We hope and pray that the CGA will see to it that, within the next five years, the ecosystem in the Ganga catchment area is restored to health; that a green belt of great trees is grown on both sides of the river from Haridwar to Howrah; that all towns and cities on the Ganga are equipped with properly functioning Sewage Treatment Plants; that all factories in the Ganga basin install proper treatment plants for their noxious/toxic effluents; and that the use of such chemical fertilizers, pesticides, insecticides, weedicides, detergents etc., as are poisoning the soil and the waters, is banned. The laws in all these respects also need to be made more specific---and their implementation, more stringent.

We would also like to urge that the emphasis should be on results achieved---and not on money spent. Also we don't have to confine ourselves to the Ganga basin alone. Many other rivers in the country are equally, or even worse, polluted. Their cleaning and restoration should also be taken in hand. The important factor here is *not* money, but the necessary will and the vision.

We also recognise that this is not a task for the government alone. Public-spirited individuals and organisations will also have to play an active role in this great enterprise. We note with satisfaction that the Chipko movement in Chamoli District, UP, the Swachh Ganga movement in Allahabad, the Ganga Mukti Andolan in Bihar, and some other non-Government organisations, have already done good work in this direction.

The Ganga problem begins in the Himalayas, which have been deforested and degraded beyond belief. All illegal felling of trees must be made a cognisable of-

*Ecology should be compulsory subject
in school and college*

Felling a tree is as serious, said Nehru, as killing a man.

fence; ("killing a tree is as serious as killing a man" said Nehru); no tree should be allowed to be cut unless two have been planted in its place; planting at least one tree in one's life, should be considered almost a religious duty by all citizens.

Government should offer tree saplings free to all those who would plant them. All donations for social forestry to bonafide non-profit-making voluntary organisations, should be made tax-free. We must not rest until India's present forest cover of only about 12% is increased to the ecologically required 33%.

The installation of urban sewage treatment plants and chemical treatment plants for industrial effluents, is basically the job for municipal authorities and law enforcement agencies. It is also for these authorities and agencies to see that industries, destructive of the environment, are kept out of the sensitive upper reaches of the Ganga; that garbage is not dumped into rivers; that industries do not let any mercury, lead, arsenic or cyanide to escape from factory premises; that superthermal power stations do not discharge hot water and fly ash, to the detriment of Ganga's aquatic life; and that treatment plants extract biogas and manure from waste water, and make it fit for repeated recycling. But all these jobs have been neglected all these years; and they will continue to be neglected, until and unless we have a watchful citizenry. It is, therefore, of the utmost importance that well-informed and public-spirited individuals and institutions come together in the various centres and keep a watchful eye on the proper working of these plants and arrangements, and a proper implementation of the laws on the subject.

However, even more important than this is the education of the masses on the subject. As a wise saying goes: "If you plan for one year, plant rice; if you plan for ten years, plant trees; and if you plan for a hundred years, educate mankind." This education in an ethical ecological consciousness, must begin early in life. School texts should have lessons on Ecology and Environment. And all degree colleges should offer Ecology as a subject to all students, regardless of whether they are studying Arts, Science or Commerce.

Indeed Ecology is part of our culture. The Indian concept of *rita* is a recognition of the unity of all life, all reality. Toybee describes it as "the spiritual presence in and behind the universe". The soil, the wind, the water, vegetation and all animate life constitute one single sacred cycle of life. Corrupting and destroying any one of them would be eventually destroying all life. We must live in harmony with nature—and not make war on it—or we will perish.

We the participants resolve to keep in touch with one another and with all others interested in the cleaning of our environment, for the integrity of our ecology, for the quality of our life and, indeed, for life itself.

SHRI TARLOK SINGH said that we should take a broader, holistic view of the problem. The Action Plan was too specific on some points, too general on some others. The approach was too centralised, when the need was for a regional and even sub-regional approach.

Another suggestion was that the Ganga Plan must be a continuing process and not only a 5-year plan.

PROF. PANDEY wanted the nuclear plant removed from the seismic area of Narora.

DR. BILGRAMI said that even while paying lip service to afforestation, Government continued to cut forests. For example the Bihar Forest Department had sent round a secret note that Forest Revenue must not be allowed to go down from the current Rs. 38 crores. How do they reconcile forest revenue with saving the forest? He said that Forestry and Fishing Department staff needed to be instructed in Ecology more than anybody else.

It was decided that the draft statement may be re-written and elaborated and then circulated. Meanwhile a brief Note may be issued to the Press.

It was decided to have a Committee of Eleven to follow up the matter, meet from time to time, contact the Central Ganga Authority and carry the issue to the masses.

Concluding the deliberations, Prof. R.D. Mishra said it had been a very valuable session.

Nana Deshmukh thanked the participants and said that we must not let either the government or the people to forget the Ganga—the purity of our waters and the integrity of our environment.

The next day the following statement was issued to the Press:

New Delhi, August 12—An expert Seminar on cleaning the Ganga was held here by the Deendayal Research Institute, yesterday.

Prof. R. Mishra, doyen of Indian environmentalists, presided.

The Seminar welcomed the setting up of the Central Ganga Authority. It hoped that, in the next five years, all urban settlements on the Ganga will be equipped with properly functioning Sewage Treatment Plants; that all factories in the Ganga basin will be required to instal appropriate treatment plants; that the use of chemical fertilizers etc., poisoning the soil and the water, will be curbed.

An 11-member Committee to educate and mobilise Public Opinion

"Swachh Ganga, Swachh Bharat": A Clean Ganga, a Clean Bharat

But the Seminarists felt that we will have to go into the deeper causes of pollution, to clean up our environment, and keep it so. To this end, we will have to keep all industry, destructive of the environment, out of the sensitive upper reaches of the Ganga. We will also have to plant a green belt of trees from Devprayag to Ganga Sagar. We will have to shift atomic energy plant from seismically sensitive Narora to a safer location. Super-thermal power plants on the banks of the Ganga or its tributaries, too, are likely to have serious environmental consequences. Indeed, we will have to evolve alternate technology to minimise pollution. And we will have to examine our value system, to identify and eliminate the basic causes of the maladies that afflict modern society.

The participants pointed out that anti-pollution laws must be made more specific and that they should be rigorously implemented. They also felt that keeping the Ganga—or the general environment—clean, has to be a continuing process, a part of our daily life.

One participant said: "If you plan for one year, plant rice; if you plan for ten years, plant trees; and if you plan for a hundred years, educate mankind. It was therefore of the utmost importance that Ecology lessons are included in school texts and Ecology courses started in all colleges. Also the mass media should be fully utilised to spread the message: "A Clean Ganga: A Clean India" (Swachh Ganga: Swachh Bharat). Cleaning the Ganga will inaugurate the movement for the cleaning of all rivers in India.

Ecology, it was pointed out, is part of our life and culture. The Indian concept of *rita* is a recognition of the unity of all life, all reality. The soil, the water, the air, plants, animals and man constitute one web of life. Polluting or destroying any one of them, would be eventually destroying all life. We must live in harmony with nature—or we will perish.

At the conclusion of their deliberations the Seminarists decided to organise informal groups of interested individuals and organisations in the various centres along the Ganga, to inform and mobilise public opinion on the subject, and secure people's participation in this task. To this end the following Sub-committee was constituted: Prof. R. Misra (Chairman); Shri Tarlok Singh; (formerly of the Planning Commission); Prof. Varshney (JNU); Prof. Bilgrami (Bhagalpur University); Dr. L.C. Mishra (Kanpur); Prof. Mall (Vikram University, Ujjain); Prof. M.M. Joshi (Allahabad University); Prof. Chhaphekar (Institute of Science, Bombay); Nana Deshmukh (DRI), Sri Sailen Ghosh and Sri K.R. Malkani (Conveners).



The Toynbee-Ikeda Dialogue on Ending Environmental Pollution

Not long ago, two of the greatest modern minds discussed a wide range of human problems. They were Arnold Toynbee, doyen of historians, and Daisaku Ikeda, leader of the Sokka Gakai cultural movement in Japan. They even discussed the deeper causes of environmental pollution. Their discussions were published in a great Volume which should adorn every library, private and public (CHOOSE LIFE, Oxford University Press; 1976; Pp. 342; £ 9.20).

Here we reproduce some excerpts from their dialogue on the subject of Environment:

IKEDA: Only by living in harmony with the natural environment in a give-and-take relation is it possible for man to develop his own life creatively. Based on this approach, Buddhism teaches that the relationship between man and nature is one not of opposition but of mutual dependence. This relationship is described by the term *Esho Funi*.

Sho stand for *shoho*, the independent life entity; *e* stands for *eho*, the environment supporting that life. Since human life influences and depends on its environment, the two—*Esho*—are inseparable—*Funi*. Should man and his environment be regarded as two separate and opposed entities, it would be impossible to grasp either in true perspective.

TOYNBEE: A Westerner who has been educated in the Greek and Latin languages and in pre-Christian Greek and Roman literature, finds *Esho Funi* familiar, because this was the *Weltanschauung* of the pre-Christian Greco-Roman world.

The revolutionary concept of Judaic monotheism opened the way for the deliberate, wholesale violation of *Esho Funi*. According to chapter I, verses 26-30, of the Book of Genesis, God placed the whole of his non-human creation at the disposal of his human creatures to exploit in any way that they might choose.

The effect of this revolutionary doctrine was to disrupt the *funi* between *shoho* and *eho*. Man was divorced from his natural environment,

Let Hindus, Buddhists and Shintoists join hands . . .

which was divested of its former aura of divinity. Man was licensed to exploit an environment that was no longer sacrosanct. The salutary respect and awe with which man had originally regarded his environment was thus dispelled by Judaic monotheism in the versions of its Israelite originators and of Christians and Muslims.

IKEDA : In attempting to conquer the natural world, mankind has upset the fixed, basic rhythm of nature. Having suffered, and having been brought to the verge of destruction by man's actions, nature is now rebelling against humanity.

TOYNBEE : The Judaic ideology was first formulated in Palestine as early as the ninth century B.C., yet it was not put into practice unreservedly till the seventeenth century of the Christian era. The practical application of the Judaic ideology has been exceptional among people who have accepted this ideology in theory. The Muslims, for instance, have been more reluctant than any other of the civilized peoples to adopt modern technology and, with it, the ideal and the objective that modern technology serves. I believe that nothing short of a religious conversion (using the word religious in the broadest sense) will move the present generation in the advanced countries to make immediate sacrifices at their own expense on behalf of *Esho Funi*. I should like to see *Esho Funi* adopted all over the world as a religious belief involving a moral obligation.

In order to save mankind from the consequences of technology inspired by greed, I believe that we need worldwide cooperation among the adherents of all religions and philosophies. I hope that Hindus, Buddhists, and Shintoists will take the initiative in this. The adherents of the Judaic religions are handicapped by their paralyzing tradition of exclusiveness and intolerance, which is part of the nemesis of their monotheism. Among the Hindus and the East Asian peoples there has been a tradition of mutual tolerance and respect among adherents of different religions. Between Buddhists and Shintoists in Japan there has been positive cooperation. This is the practice and the spirit that is needed for a concerted worldwide struggle to cure pollution by cutting away its root, which is greed.

IKEDA : In the past few years, large-scale natural disasters have occurred with alarming frequency in many parts of the world. Some

scientists claim that in thousands of years man has rarely experienced so many disasters in so short a time. In order to ensure the continued existence of the human race and to save our cosmic oasis from catastrophe, mankind must first realize that his behavior influences natural harmony and then strictly regulate any human action that might have adverse effects.

TOYNBEE : The greater man's power, the greater his need for religion. If the application of science is not inspired and directed by religion, science will be applied to the indulgence of greed, and it will serve greed so effectively that it will be destructive. . .

IKEDA : If industrial wastes can be clearly identified and their courses traced, it is relatively easy to put a stop to them. But because everyone living in cities in one way or another contributes to the generation of pollution of many kinds, the solution to this part of the environmental destruction problem is more complicated. In the past, once an urban organization was completed and set in smooth operation, it was capable of dealing with sewage and other pollution generated within its area. Today developments in civilization have increased pollution beyond the scale with which the classic urban structure can cope.

A known number of industrial concerns are responsible for industrially caused environmental pollution, and the majority of the citizens are victims. Although political regulations, laws and civic movements can eliminate this kind of pollution, in the case of general urban pollution, the majority of the citizens are at once the guilty parties and the victims.

TOYNBEE : I agree that environmental pollution has two sources: industrial waste and wasteful private consumption by whole populations living under modern urban conditions. I also agree that the first kind of pollution is much less difficult to check than the second.

As you say, industrial waste is produced by a limited number of identifiable business enterprises and probably can be checked effectively by legislation. Private consumption, on the other hand, can be checked only by the voluntary action of innumerable individuals. Sumptuary laws, unlike legislation dealing with industry, have usually proved to be ineffective. Voluntary action for restraining consumption is likely to be ineffective too unless it is inspired by religion.

*Only religion can inspire man
to consume less . . .*

The havoc that advertising plays in whipping up consumption

IKEDA : The problem is difficult but by no means impossible to solve. To effect improvements on the broad scale, each citizen must strive to reform himself by examining his daily life strictly and eliminating from it all acts that are liable to blame as contributory to pollution. For instance, let us examine the trend in the world of motorization. Each year manufacturers urge citizens to buy their newer, sleeker models as if failure to ride in the latest automobile constituted disqualification as a modern man. The advertising campaigns of these manufacturers are very skillful, as are those of the makers of electrical appliances and other articles of daily use, all of whom operate on what is called the principle of built-in obsolescence. But this greed-inspired pandering to innate human selfishness has done much to create the desperate condition in which we now find ourselves. We must become aware that accumulations of the effects of the small acts of daily life could generate a global disaster that might rob our progeny of the right to exist.

TOYNBEE : In the past, when all mankind was poor, our ancestors were constantly threatened with shortages of food, clothing, housing, and other necessities of life. In these circumstances, frugality was held to be a virtue and luxury to be a vice. But, since the Industrial Revolution, frugality has threatened the manufacturers with a lack of markets for their products and has consequently threatened their employees with loss of employment. Therefore, frugality on the consumers' part has become a vice, not a virtue, in the eyes of the manufacturers and their employees. Manufacturers have sought to stimulate consumption artificially by advertising. It is not a coincidence that the advertising business is coeval with the Industrial Revolution.

However, as you have pointed out, the sectional interest of the manufacturers and their employees in stimulating consumption is inimical to the general interest of society. The stimulation of greed by advertising is producing wholesale pollution. This is a threat to the health, and even to the life, of people now alive. Our present greed also threatens to rob future generations by using up irreplaceable resources.

Moreover, greed is an evil in itself. It is a feature of the animality of human nature, but man, besides being an animal, is something more. In indulging our greed, we lose human dignity. Therefore, so far from stimulating our greed, we ought to restrain it—and this on principle, even if greed were not producing the disastrous material effects of pollution for

the present generation and of destitution for posterity—if mankind is to survive pollution. Since the Industrial Revolution, manufacturers have been trying, by advertising, to condition the public into giving priority over all other objectives to the maximum satisfaction of greed. We need to reverse the order of our priorities and to make the restraint of greed and the practice of frugality our first objectives. There are at least three grounds for this: the maintenance of human dignity, the protection of our own generation against the danger of pollution, and the conservation for future generations of the limited natural resources of our planet. We need to replace the ideal insinuated by the advertising industry with the ideal exemplified in Buddhist and Christian monasticism.

IKEDA : Precisely. Freedom is of great importance, but deciding which of man's many aspects shall enjoy freedom is still more important. Given unlimited scope of activity, greed oppresses man's loftiest spirit because it inevitably tramples down what is highest in the human mind. When greed has the upper hand, the situation is analogous to what might happen if a wicked criminal were turned loose on an innocent populace. Like the villain, who must be guarded and, if need be, put in bondage for the sake of good of the people, greed must be restrained for the sake of what is best in man. But this restraint must not be applied socially from the outside; it must arise from the independent self-awareness of the individual.

We must adopt the standpoint that the awareness of the dignity of life must be the basic principle on which all our actions rest. Once we have established this premise, we must go on to take the following concrete actions. First, limit consumption of physical materials to a minimum and devise ways to use waste products in production. This step will both help eliminate environmental pollution and guard against the exhaustion of natural resources. Second, make maximum use of the physical energy of the human body. In addition to reducing pollution and conserving resources, this step will promote and maintain greater human health. Third, be cautious about the unlimited use of medicines, additives to foods, other chemical products and be aware that harm almost invariably accompanies whatever good these substances do.

Each individual human must put these simple rules into practice in his daily life and must battle with anyone who would endanger the

The ecological movement must have a strong spiritual basis

Arnold Toynbee and Daisaku Ikeda CHOOSE LIFE

A Dialogue

*Religion is
the centre
of things. . .*



future of mankind by disregarding them. Scientists must make use of their knowledge to enlighten the people, and journalists must apply the power of their words to expose evil occurring in these connections. The housewife can carry on the fight in the home, and the laborer at the place of work. For a movement of this kind to be effective and meaningful, it must have a strong spiritual basis, and I agree with you that the power of religion is required to build this basis.

The kind of religion that is needed must make each individual human being deeply aware of two important things: the truth that the life force of a single person is more important than all the material wealth of the world and the equally important principle that both life and the dignity that is inherent in it can be supported only in harmony with nature.

TOYNBEE: Yes, the present threat to mankind's survival can be removed only by a revolutionary change of heart in individual human beings. This change of heart must be inspired by religion in order to generate the will power needed for putting arduous new ideals into practice.

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From Gangotri to Gangasagar with Raghubir Singh & Eric Newby

GANGA (The Perennial Press, Hong Kong) is a beautiful pictorial book that will bring joy to any reader. The pictures are by well-known photographer Raghubir Singh. And it has a 44-page introduction by Eric Newby, well-known author of 'Slowly Down the Ganges'.

We produce below a few extracts from the 'Introduction' to give readers some idea of the value of this great work.

—Ed.

A SHORT WHILE before Jawaharlal Nehru died I had the good fortune to be granted an interview with him at New Delhi when he heard that my wife and I were about to set off on a journey down the Ganga by rowing boat.

It was a very long interview, lasting an hour and a quarter, and talking to him then I realised how much he loved the river, for during the entire time he spoke of nothing else.

When I emerged from his drawing room I found a rather angry minister kicking his heels in an ante-room; he had been kept waiting there for more than an hour—my meeting had been scheduled to last ten minutes.

I remember very well what he said about the river. But nothing that I can write can compare with the beautiful and simple expression of his feelings for it that are to be found in his Will and Testament, a short extract from which I give below:

'My desire to have a handful of my ashes thrown into the Ganga at Allahabad has no religious significance, so far as I am concerned. I have no religious sentiment in the matter. I have been attached to the Ganga and the Jumna rivers in Allahabad ever since my childhood and, as I have grown older, this attachment has also grown. I have

"The Ganga is the river of India, beloved of her people"—Nehru

watched their varying moods as the seasons changed, and have often thought of the history and myth and tradition and song and story that have become attached to them through the long ages and become part of their flowing waters. The Ganga, especially, is the river of India, beloved of her people, round which are intertwined her racial memories, her hopes and fears, her songs of triumph, her victories and her defeats. She has been a symbol of India's age-long culture and civilization, ever changing, ever-flowing, and yet ever the same Ganga. She reminds me of the snow-covered peaks and the deep valleys of the Himalayas, which I have loved so much, and of the rich and vast plains below, where my life and work have been cast."

It is certainly not its length that makes the Ganga one of the great rivers of the world. Its entire course is only 1,560 miles from its source to the sea. The Nile is more than two and a half times as long, as are the Amazon and the Mississippi/Missouri; the Yangtze is twice as long; even the Danube is longer.

What makes it a great river, and in this sense the greatest of all, is that for more than 430 million Hindus in India, and for countless others dispersed about the world, it is the most holy and most venerated river on earth. To each one of them it is Ganga Mai—Mother Ganga. For a Hindu to bathe in her is to be purified of all sin.

And to drink the water, having bathed in it, and to carry it away in vessels for future consumption—both confer great merit. Many devout Hindus drink no other water at all, and those who live at a distance contrive to receive regular supplies of it, for Ganga water has extraordinary qualities. Bottled at one of the sacred bathing places, or anywhere else for that matter, it will keep for at least a year. Taken on board outward bound ships on the Hooghly near Calcutta in the days of sail, it is said to have outlasted all other waters, although it is not possible to fill a ship's drinking water tanks with Hooghly water today. It also seems to have a genuine capacity for absorbing germs and rendering them innocuous.

My wife and I have both drunk the water unboiled in the 5-mile stretch of the river where it first enters the Indian Plain, and boiled and made into tea thereafter for most of the rest of its course as far as the Bhagirathi, and without any unfortunate effects. Yet whenever we left

the river we invariably became ill. I would not attempt to explain this. I only state it as a matter of fact.

It may have something to do with the silt, a mixture of mud and sand which is brought down in phenomenal quantities when the river is in flood and which may act as a sort of water filter. A Victorian engineer Sir Charles Lyell—only a Victorian engineer would have had the stamina to make such a computation without a computer—wrote that 335,000,000 tons of silt were discharged at Ghazipur on the Middle Ganga. "Nearly the weight of 60 replicas of the Great Pyramid," he said, a comparison impossible for the mind to encompass even if one has seen one Great Pyramid.

It is certainly true that cholera, the great killer, travels up the river rather than down it. The disease is born in the stagnant waters of the Delta, the Sundarbans in Bengal, and it ascends it, carried by pilgrims who visit the sacred places in hundreds of thousands, sometimes in millions, every year.

The Ganga emerges under the name of Bhagirathi from an ice cave at the foot of the Gangotri Glacier, 12,700 feet up in the Garhwal Himalayas, 12 miles above Gangotri. The cave is known as Gomukh, the cow's Mouth; certainly nothing in nature could be nearer the divine than this lonely place to which only the most determined pilgrims penetrate, and then usually only men. Nearly all who reach Gomukh, whether Hindus or not, refer to the mystical and spiritual feelings which the place engenders.

Ganga has been variously and metaphorically described: The Sanskrit Gangastotrasatanamavali and Ganga-sahasranam stotra enumerate 108 and 1,000 of her names, respectively, all printed metrically in columns so that they can be chanted devotionally. Among the 108 and taken at random, are Kshira-subhra (White as milk), Kshira-vrksha-samakula (Abounding in "milk trees"—i.e., the banyan, the glomerate fig-tree, the holy fig, and Bassia Latifolia), Bhiti-hrt (Carrying away fear), Avyaya (Imperishable), Niranjana (Not tainted with collyrium—i.e., pure), Subhanga (Having beautiful limbs), Sankha-dundubhi-nisvana (Generating a noise like a conch-shell and drum), Bhagyajanani (Happiness), Anantha (Eternal), Omkara-upini (Having the appearance of the sacred syllable

The Ganga has hundred and eight endearing names

300 miles from its source, Gomukh, the Ganga finally reaches the plains

Om), Samsara-visha-nasini (Destroying the poison of illusion), Sumuktida (Giving complete spiritual emancipation), Jambu-dvipa-viharini (Roaming through Rose-apple-tree Island—i.e., India) and Ajnana-timira-bhanu (A sun amid the darkness of ignorance).

Three hundred miles from its source at Gomukh, the Ganga finally breaks through the Siwalik Range, the last outriders of the Himalayas, and enters the plains of India at the place where the town of Hardwar stands on the right bank. Here, the young Ganga loses much of her newly-created strength. Vast quantities of water, about three-quarters of the total volume in winter, are channelled off by a barrage into the Ganga Canal. A remarkable piece of beneficent Victorian engineering which waters the entire Doab—literally the land of the two waters—the tract between the Ganga and the Jamuna, that transforms what was formerly a famine-ridden region, into one, by Indian standards, of relative prosperity; but debilitating the Ganga itself, so that, in wintertime, it is unnavigable downstream for many miles and is rarely more than 70 yards broad.

The Plain, in which the Ganga excavates a constantly changing course, is about 200 miles wide at its widest points, and so gently sloping that in the 1,000 miles of country between Delhi and the shores of the Bay of Bengal to the east-south-east, there is a drop in altitude of only 750 feet, less than a foot a mile.

Of the navigable part of the Ganga, once it leaves the mountains, it is the 40-mile stretch below Hardwar that is least known, where it passes through the *Bhabar*, the porous place in which the torrents from the Siwaliks deposit rocks and boulders and the already enfeebled river is deprived of yet more strength as its water sinks down through the dry limestone and percolates away.

In these first miles in the dry season, when the river is already low and its water level is sinking an inch or more a day, there are many places where the entire contents of a rowing boat have to be off-loaded and carried downstream by the crew, as does the boat itself, in a series of prolonged and extended portages, anything up to a mile in length.

Gradually, as the river writhes first south and then more to the west, the jungle draws back from it a little, the slimy, slippery boulders

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in the river give way to smaller stones, then to shingle, finally to sand. What in the earlier stages were waterfalls over which portages had to be made, become long, exciting rapids down which the boat races among clouds of spray. There are at least 35 such rapids and waterfalls in the first 40 miles below Hardwar.

One hundred miles below Hardwar, the Ganga is what it will be for the greater part of the rest of its journey: a river about two miles wide, narrowing to half a mile or less in winter, sometimes swollen by the monsoon rains to the proportions of an inland sea, five, ten, twelve miles in some places, even twenty miles broad, in which only trees and the roof of an occasional house break the surface.

At Rajmahal, on the great bend of the Ganga, 600 miles east of Allahabad, where it turns south towards the Bay of Bengal, it flows at about six knots in a volume exceeding one million cubic feet a second—more than the maximum discharge of the Mississippi, and more than 150 times that of the Thames at Staines in full flood.

In the long reaches upstream from Kanpur, in the heart of Uttar Pradesh, 800 or 900 miles west-north-west of the Bay of Bengal, perhaps three weeks' journey by rowing boat from Hardwar in the season of low water, the Ganga looks much as it will until it reaches the Delta: the water full of silt containing minute chips of mica that glisten in the sun as the river churns it, occasionally erupting in rips and whirlpools and sending great bubbles to the surface, but more often simply moving inexorably downhill as if it were more heavy, semi-solid mass of a yellowish colour and rather like molten lead.

As it goes, it snakes its way along an endless succession of islands, dropping about a foot in every mile, more gently than it does in its course through the *Bhabar* where in every mile it falls over 20 feet.

The river is full of fish—*rahu*, *mauli*, *katla*, *tengra*, *lachi*, *shoul* and *ban* are the indigenous names of some of them. There is also a rarely seen monster, sometimes heard as it surfaces. It is known as the *gaunch* otherwise *Carcharias Gangeticus*, a sort of freshwater shark which is also found in the Euphrates. There are the dolphins, which are quite blind, fresh-water tortoises and mud-turtles, some large crocodiles such as the

*At Rajmahal, Ganga has 150-times
the water of the Thames!*

There are many Prayags; but the one at Sangam is the greatest

gharial—but most of them have been shot in the upper parts of the river—and there are snakes, some of them deadly.

If, in the course of this journey down the Ganga from Hardwar, I seem to have written more about it as a river and about the people who live on its banks, and less about Hinduism in its relation to the river as Ganga, this does not imply that the spiritual feelings engendered by it are less powerful. It is certainly not true for any Hindu who finds himself on its banks; neither is it true for at least one non-Hindu on whom these lonely upper reaches made a profound and lasting impression and one which he still retains many years later and will continue to for the rest of his life.

But reaching Allahabad and continuing downstream without any further reference to the unique position that the Ganga occupies in relation to the Hindu world would be unthinkable. For the confluence at Allahabad is the true *Prayag*. As we have already seen, there are others in the Himalayas and foothills which are very holy; but here, not two but three sacred rivers mingle their waters: Ganga, Jumna and Saraswati, the latter a river which formed for the early Aryans one of the boundaries of *Brahmavartha*, their home, and is now invisible to the ordinary mortal.

The Rishis, the Vedic sages, believed that the confluence of any two or more rivers was a sacred place and the confluence at Prayag was regarded as being particularly suitable for doing penance, meditating and performing *yajnas*—sacrifices. Yaga has the same meaning as Yajna, a sacrifice; Pra, the sense of extensiveness and excellence; *prayag* is the land between the Ganga and the Jumna, up to a certain distance from the confluence.

Yet, however revered by Hindus Banaras may be, to me, a non-Hindu, it somehow lacks the simplicity that I feel at the mingling of the waters at the *sangam* at Prayag. One cannot help thinking with longing of places further upstream with their simple, riverside shrines without a custodian in sight.

There is one such place in particular that I have known for more than thirty years. It is near Fatehgarh, a very old, one-time British military station, now Indian, above Kanpur, a place full of ancient trees and equally ancient thatched bungalows with thick walls, although old buildings such as these are rapidly disappearing.

There, down by the Ganga, at the foot of a deeply wooded combe (in India it would be called a nullah) a little shrine to Siva stands at the foot of a pipal tree. Buried in the heart of the tree which has grown up around it is a piece of cut stone with a frieze of figures on it that was probably carved in pre-Muslim times.

Whenever I visit this place it is always deserted. I have never seen another person there and I have visited it dozens of times. Yet there is always a fresh offering of marigolds on the plinth, so fresh that I feel whoever put it there must have literally vanished into thin air. It is a magic place and one of which there are thousands, perhaps millions in India.

There are other places still further down the river at which this feeling of sanctity and natural beauty are commingled. The island of Jahngira, near Sultanganj in Bihar is one. It is on the verge of Bengal, where the climate is damper, the fields greener, the vegetation generally more lush, the Ganga a great river, the sand flats immense.

It is at a place known as Uttara Bahini, where the river flows north, which makes it very sacred. All such places are sacred. The island rises 70 feet above the water in the dry season, an extra-ordinary, unearthly pile of smoothed, bulbous rocks with twisted trees growing from fissures in them in which no earth is apparent, crowned by a temple called *Gaibinath*, devoted to the worship of Siva. Other steps lead up from the water to subsidiary temples. The rocks are carved with figures of gods, one of them Parasurama, the sixth incarnation of Vishnu, and more ancient carvings of Buddha. On the far side where few people go, there is a great, fallen rock bearing a carving of Ganga standing on her *makara* (*saurian*).

Still another is at Colganj, perhaps a day's sail by country boat below Jahngira and about 280 miles from the Bay of Bengal, where the stream is three-fourths of a mile broad even in winter, full of country boats with big red sails. Here some *babas*, holy men, live on a large island in the river among clusters of rocks and groves of trees. It has always been hauntingly beautiful here, but in the early part of the last century it was frequented by river thugs. Unlike their counterparts on land who strangled their victims from behind with the *ruhmah*, the handkerchief, the river thugs leapt on them from the front, *en masse*. Until their power was broken at the end of the 1830s, the patroness of the thugs was Vindhya-

*The mysterious Gaibinath Mandir
on the island of Jahngira*

Ganga reaches as far as 400 miles out in the sea!

Vasini-Devi, otherwise goddess Bhowani, the Black Mother, otherwise Mahayama Durga, whose effigy and temple are on the right bank of Vindhyaal near Mirzapur in Uttar Pradesh, where the Vindhyan Hills come close to the river. A number of temples are devoted to the worship of the goddess, who was Siva's wife in her most terrible, hideous and destructive form.

From a couple of miles below the Howrah Bridge until it reaches the sea, the river, in its guise as the Hooghly, is not regarded as particularly sacred; only a few temples stand on its banks. At this point, Tolly's Nullah, where a Major Tolly canalised the old bed of the river in the 1770s, and along the old course to the east of the present one, in the district called the 24 Parganas, there are old bathing tanks which Hindus regard as very sacred.

The end—or one of the ends, since Ganga has a hundred mouths—is at the southern tip of Sagar Island, where the Hooghly meets the sea. Here, on this lonely island, Hindus believe that a narrow creek on the southern side, the Ganga Saugorkhal, is one of the hundred mouths of Ganga who came down to earth to redeem the 60,000 sons of Sagar.

On the low, flat, sandy shore where the Bay of Bengal beats, there is a temple, at the mouth of the Khal. Here, at the same time as the Melas are celebrated at Hardwar and Allahabad, a similar fair takes place. It lasts for three days. In the course of it jewels are thrown into the sea and the image of kapila, who reduced the sons of Sagar to ashes by means of flames which emanated from his person, is worshipped in the form of a block of stone.

Perhaps, materially, the end of Ganga is under the sea 60 miles south, where the long tails of sand run down towards the deeps of the Bay of Bengal, depositing the detritus of India on the bottom; or even further. Four hundred miles out in the Indian ocean the sea is discoloured by the silt brought down by her. So there is no end to her, just as no one on earth knows the exact place where she begins.

□

The Movement for Constructive Work in India

1. Some Points for the Study of Constructive Work Experience

By : V. PADMANABHAN

Managing Trustee

Gandhigram - 624302 (Madurai Distt, Tamilnadu)

1. Organising the weaker sections of the community to receive the benefits due to them:

This is one of the most difficult tasks. Gandhigram Trust has experimented with two alternatives—(a) Treating the village as a unit of planning which will include not only the weaker sections but all others. Our experience is that this results in the pressure groups in the villages controlling the organisation and leaves very little scope for the self-expression of the weaker sections, (b) Organising weaker sections alone separately. We have formed Village Welfare Associations with the weaker sections as members. The Executive Committee is elected by the General Body of which all families are members. In the Executive Committee a representative of Gandhigram Trust is also a member. This is to give some support to the association. Though these associations have not been functioning satisfactorily, yet we find that it is much better than leaving the entire leadership to the influential groups in the villages. The Government, specially development departments, should recognise such associations for financial assistance and implementation of programmes.

2. Ensuring improved delivery of public services (agricultural inputs, health care, educational opportunities, employment programmes etc.) so that they reach all those who are in need of them:

Gandhigram Trust has largely concentrated on health care and employ-

Our 17 village industries have given work to 3000

ment programmes. Under health care we have a central institution with all facilities and with a team of doctors linked to this. We have organised number of dispensaries in the villages. It is difficult to get qualified medical personnel to stay in the villages. However we have organised some sort of facilities for these persons to stay, and provided them with transport facilities, mostly motor-bikes. They cover a wider area with medical facilities. But our emphasis is on prevention rather than cure. For this purpose we attach trained health personnel to the doctors at the paramedical level. Our emphasis is also on limiting the family size. In fact the central hospital called the Kasturba Hospital does 10,000 tubectomies a year and concentrates on the care of children and mothers. We have developed a health education system which gives enough knowledge about maintaining good health, nutrition, sanitation etc. We have also tried selecting middle-aged women from the villages, posting them as contact persons in the villages. This, however, has not been very successful. To obviate the difficulty in getting qualified staff we have started running our own Arogya Sevika Training, which, apart from inculcating knowledge about health and medicine, will also give them a glimpse of the Gandhian philosophy of village service.

On the employment side we have more than 17 industries giving employment to nearly 3,000 persons in the villages. We feel that self-employment will not succeed without forward and backward linkages. For this purpose we need an organisation. This organisation will have representatives of the artisans in the Management Committee and will work on the principle of having a minimum margin in the pricing policy. Another important aspect of employment programmes is to provide the necessary technical services and marketing support. Apart from constructive work institutions adopting a life-style, it would be in consonance with the objectives for which they have been created, that they should also set an example in using largely village-made products, simple construction using local materials and organising artisans for getting all the benefits under different programmes of government. The banks which play a great role may utilise the services of voluntary organisations in reaching out to a large number of artisans. If Government assistance is available for employing technical personnel and establishing marketing outlets, it will greatly help the programme.

Under education we have been concentrating more on adult and non-formal education. Here again the policy of the government should

be to recognise well-established institutions with trained personnel for executing programmes of their pattern.

3. Application of science and technology for the betterment of rural life, including reducing the burdens of women:

This is a vast area. Voluntary agencies may be vehicles of transfer of technology rather than research and experimentings. Selected technologies suitable to particular areas have to be tried out in an intensive manner. For this purpose demonstration of these technologies will be very necessary. The present programmes only deal with transfer of technology and do not provide assistance for demonstration. It is very necessary that demonstrations are also included for financial support.

4. Protecting the environment and preventing deforestation, soil erosion and environmental degradation:

Voluntary organisations can be only catalytic agents; specially deforestation, which is taking place on a large scale, needs a massive movement. This may sometimes bring in the displeasure of the Establishment and the Government. Hence these movements will have to be organised on non-party basis and after fully explaining the purpose to the authorities.

5. Involving rural youth, including literate rural youth, in voluntary constructive work:

There is great need to involve the rural youth, specially, the semi-educated youths. Most of their problems relate to employment. Employment can be found in construction and allied activities.

6. Organising literacy, education and socio-economic programmes for women and mobilising the initiatives of women's groups and women workers in the villages:

The main points are covered under item 2. Organising women will need a large band of women workers drawn from the villages. For this purpose a programme has to be evolved for getting financial assistance.

*Wanted a Policy Statement by GOI
recognising voluntary organisations*

7. Organising training for voluntary workers, those coming from outside as well as those in the villages:

This is a very important item on which will depend the proper growth of voluntary action. Training need not be institutional. There should be an exchange of voluntary workers for short and long periods between institutions.

8. Mobilising the resources of the local community by way of contribution in labour, land, money etc:

This will be possible only if this idea is accepted by urban population. When the urban population gets all the benefits without contributing anything either by way of land or money, it will not be correct to expect this from the poorer sections in the rural areas. The poor have to work daily for their sustenance. Hence it will be difficult for them to contribute even labour. If they do so, it will be at the expense of their livelihood.

9. Problems encountered in co-operating with bodies like Panchayats and cooperatives and with the official Development Block machinery, and also with other voluntary organisations working in your area:

This differs from State to State. Where the State governments and the district administration recognise voluntary bodies, there the relationship is smooth, though not effective. But where the bureaucracy is trusted more than voluntary groups, the voluntary agencies have to knock at the doors of the departments to get even small things done. A policy statement by both the central government and the state governments, recognising voluntary organisations in development activities, is necessary. In addition, they should be able to get direct assistance from Government of India for their programmes. Of course these programmes can be evaluated by State government authorities. □

"The essence of what I have said is that man should rest content with what are his real needs, and become self-sufficient. If he does not have this control, he cannot save himself."

—Mahatma Gandhi

2. An Unusual Gandhi Ashram: Natwar Thakkar in Nagaland

NAGALAND GANDHI ASHRAM is a significant effort in constructive work in the north-east. Its heart and soul is Natwar Thakkar (born, 1932) who drew his inspiration from Kaka Saheb Kalelkar, then Chairman, Backward Classes Commission. In 1955 he started the Gandhi Ashram under the auspices of Thakkar Bapa's Bharatiya Adimjati Sevak Sangh. That was the time when the Naga Hills were coming to a boil. Therefore even the Prime Minister and President blessed this brave effort in voluntary public service.

Natwar started with a small first aid box in sleepy little 'town' called Chuchu Yimlang, with a population of less than twenty families. Today of course this town has piped water, post office, health centre, high school, a bank and even a small telephone exchange.

Until Natwar arrived on the scene, all voluntary public service in the Naga Hills had been conducted by Christian missionaries. Since Natwar was not a Christian, he was variously viewed as a government spy and anti-Christian worker. There was even an attempt on his life which fortunately failed. But soon Natwar's positive work made its impact on the Naga heart. Natwar saw that the Nagas were depending too much on government jobs and PWD contracts. This could not go on for ever. He, therefore, started vocational training facilities for school drop-outs and physically handicapped youths. He got some Naga youths trained in ITI, Harijan Colony, Delhi. He even got some Naga girls trained as Hindi teachers in Wardha. Today the eight Khadi Bhandars in Nagaland have annual sales of more than Rs. 4 lakhs; and Bee-keeping is widespread. The seven Balwadis, run by Natwar, have 270 kids.

All this expansion had been made possible by Natwar's marriage to a Naga girl, who is a product of Kasturba Gandhi Ashram, Guwahati.

The Gandhi Ashram still has many problems: the Khadi Ashrams are running at a loss; there is shortage of voluntary workers; the general uncertain atmosphere in the north-east, has an unsettling effect. But Gandhi Ashram is proud that it has completed thirty years of its service which, in itself, is an achievement in Nagaland. Shri Manmohan Singh,

now Deputy Chairman, Planning Commission, who visited the Gandhi Ashram in 1982, remarked at the time: "This Ashram is doing excellent work."

And Dr. G. Ramachandran, Chairman Khadi & Village Industries Commission, was moved to write: "There are many Gandhi Ashrams in India, and some, abroad. I have seen quite a number of them. But this one created by the Natwar Couple is unique among them... I see the courage of a man and a woman... Herein are the footprints of Gandhi. Here is an example for all of us who take the name of Gandhi. Let us all help the Natwars as much as we can."

It is a measure of Natwar's humility that the Gandhi Ashram literature does not carry any picture of his.

Vivekananda's Salute to the Common People of India

THESE COMMON PEOPLE have suffered oppression for thousands of years—suffered it without murmur, and as a result have got wonderful fortitude. They have suffered eternal misery, which has given them unflinching vitality. Living on a handful of oatmeal, they can converse the world; give them only half a piece of bread, and the whole world will not be big enough to contain their energy; they are endowed with the inexhaustible vitality of a Raktabija. And, besides, they have got the wonderful strength that comes of a pure and moral life, which is not to be found anywhere else in the world. Such peacefulness, such contentment, such love, such power of silent and incessant work, and such manifestation of lion's strength in times of action—where else will you find these!

3. The Tribals object to Projects that displace and ruin them

The Xavier Institute of Social Service is one of the more active organisations in Ranchi, Bihar. It has been specially pleading the case of tribal people displaced by the construction of major works like dams and steel plants.

Recently Dr. M. V. D. Bogaert, Director, organised a big seminar on the subject. After prolonged discussions, it passed the following resolution:

IN TRIBAL AREAS, the general complaint has been that exogenous population has been attempting to annex land belonging to indigenous tribal population. Till about a few decades ago, the charge was against private individuals. The problem acquired a new dimension with the ushering in of developmental process in tribal areas, particularly in post-Independence times. Many of the tribal areas, having rich natural resources like soil, water, minerals, ores, forests, etc., their harnessing for development of the area was inevitable. In consequence, lands acquired for public works such as industrial, mining, power, irrigation and even some forest projects, has led to displacement of a large number of tribal families. Since these families have not been capable of claiming a share in the new activities for want of education, enterprise and skill, they were rendered more or less resourceless and, in some cases, destitute.

2. Conspicuous results are visible in Central India where the tribal-concentration belt straddling across the states of West Bengal, Bihar, Orissa, Madhya Pradesh has become, since a few decades, a zone of intense industrial and mining activity. Steel Plants have been located in this belt at Durgapur, Bokaro, Jamshedpur, Rourkela and Bhilai; several industrial complexes have come up around as well as away from the steel plants; and intense mining activity supports industrial activity. The multiplier effects of steel plants and allied industrial installations have spread. However, many observers have recorded that the participation of tribals in these activities has been minimal. On the contrary, the loss of land has dealt a severe blow to the economy of an individual tribal who has been unable to secure alternative livelihood. The district of Singhbhum in Bihar is illustrative. This district has 46.12 per cent of tribal population out of a total of 24,37,799, as per the cen1971 sus. The

district is extraordinarily rich in minerals like iron, limestone, asbestos, manganese etc., as well as forest wealth. The immigrant non-tribals have monopolised mining and forest fields, with the tribal providing wage-labour, frequently at a rate less than the statutory minimum. The scenario is no different in other tribal areas.

3. The effect of establishment of irrigation or multi-purpose projects in tribal areas also has not been dissimilar. It has been noticed that while the head-works of some of these projects are situated in the tribal areas, the irrigation and power benefits are usually availed of in the low country where the tribal population is in a minority.

4. In the past, adequate care has hardly been taken at the time of displacement of tribal families from their ancestral lands for construction of head-works, to provide them alternative piece of land in the command area, except in the State of Maharashtra, where this is obligatory as per law enacted in the State. In some cases, even compensation amounts have not been disbursed till long after the loss of tribals' only resource. Even then, the amounts have been meagre. This seems to be the reason why the tribals of Chotanagpur have taken to protest against construction of Koelkaro and Subarnabha projects. The land acquisition proceedings here are at a stand-still, in the face of tribal opposition based on their past experience.

5. It would thus appear that hitherto lack of equity has characterised the proceedings. Some observers have dubbed it as a colonial non-tribal imposition aimed at draining away the resources of the tribal areas, depriving the tribal of his only resource, land. There may be no substance in such a view. But the suffering tribal is liable to believe in such stories in the absence of a just approach to the problem. At the same time, the pace of development is liable to be checked by the opposition of the local communities to the establishment of such projects. It is consequently, necessary that the Central and State Government evolve policies and strategies aimed at dispensing a fresh equitable, economic and social order while displacing tribal families for development projects which, in the ultimate analysis, have the objective of raising socio-economic levels.

6. For successful rehabilitation of displaced tribals, adoption of following measures may be considered :

i) In no case tribals should be evicted without making payment of full compensation for the land;

ii) In view of the operation of various protective enactments, open transactions in land do not reflect its market value, or its potential. Hence, a new formula needs to be devised to provide satisfactory quantum of

compensation to the tribals for land required. This could be based, *inter alia*, on capitalised income value. The compensation amount might be deposited in banks, preferably in long term deposit, so that the tribal family can derive a minimum income from the money. In case, a tribal family indicates inclination to buy land elsewhere with the compensation amount, they should be assisted in doing so by the administration, which should ensure that the alternative becomes a sustained source of income;

iii) Emergency measures should *not* be undertaken for acquisition. Further, "public purpose" should be properly defined and restrictions should be placed on excessive acquisition of land;

iv) For tribals there is no rehabilitation more effective than providing them with land as the source of livelihood. Even if the quantum of land lost by a tribal family cannot be entirely made good by alternative land, it must be ensured that some land is provided, so that the family is not completely uprooted from its traditional occupation;

v) State Governments might enact laws, similar to the Maharashtra law, which provides for grant of land in command area of an irrigation project to a family displaced on account of execution of this project;

vi) Project report for settlement of local communities should be prepared well in advance, keeping in view their present socio-economic status, the cultural profile, the anthropology of prospective development and their present skill and situation besides absorption capacity;

vii) The displaced tribals should be rehabilitated not as individuals but as a community, as far as possible. Advance planning by sensitive officers specially charged with this task, should be done. Additional financial expenditure should be provided in the project prepared for this purpose ;

viii) If land cannot be provided, employment should be provided to at least one member of a tribal family, to insulate the family from forces tending to uproot it. In order to ensure this, the members of families should first be put on the rolls of the project and, if necessary, sent for the requisite training. The necessary educational grounding should also be given as required in the circumstances. If all the displaced families cannot be accommodated within the project, efforts should be made to find jobs in other sister projects as well as in the State Governments ;

ix) A substantial training programme of entrepreneurial skills, with follow-up in helping and getting financial support, marketing outlets, supply of raw materials etc. should be built up;

x) Provision of drinking water with protected water supply scheme for such newly-established rehabilitation centres might be ensured;

xi) Provision of free house sites to the affected families where the houses of displaced families have also been acquired, should form part of any rehabilitation scheme. House-site plots, duly developed, must be made available to each family with sufficient space for community purposes;

xii) Provision of at least a primary school building, a village *chawdi* or *chaupal*, medical centre etc. are necessary. □

Sardar Patel's Concept of Model Village in Free India

What will be the village of Swarajya like ?

In the model village, the farmer will accumulate and prepare manures in pits. The courtyard of the villagers would be sprinkled with water and their womenfolk would raise rose nurseries there. Nowadays their children defecate there. Flies sit on the excreta and the same flies flit about in their rooms and houses.

How beautiful will be the children of these villages ? Their eyes, nose and face would neither be unclean nor their clothes dirty. Their cheeks would shine like roses.

In this model village, villagers will love and respect their womenfolk and they will be considered partners in the house-hold.

But when will this Swarajya be established ? When there is no trace of fighting in the villages, when all sections of the village people understand their responsibility and fulfil them.

—Sardar Patel

4. Avinashilingam Rural Centre for Coimbatore Tribals

Shri Avinashilingam Rural Centre was established in 1978 at Vivekanandapuram by the Shri Avinashilingam Education Trust in collaboration with Shri Ramakrishna Mission Vidyalaya, Perianaickenpalayam. A year later, Shri Avinashilingam Krishi Vigyan Kendra was started to supplement the activities of the Rural Centre. The object of the twin institutions is, Integrated Rural Development.

These institutions serve the western part of Karamadai Block in Muttuppalayam taluk of Coimbatore district, Tamil Nadu. This area is inhabited mostly by tribals. It has seven revenue villages, consisting of 86 hamlets. It has an area of 15,307 hectares—and a population of 36,558.

The ARC and AKVK, together with RMVRHC, run a Dairy Farm, a Goat Unit, a Poultry Farm, an Agricultural Farm, a Tailoring Unit, a Biogas Plant, a Balwadi, an Industrial Training Institute and a Nursery School.

The main job of these institutions is to run brief training courses concerning various crops, trades and crafts. For example they ran two 11-day courses on coconut cultivation for 68 men and women. People were taught to grow and consume oilseeds, lentils and vegetables.

This area is irrigated by numerous pumpsets; and yet too many of these used to go out of order. Therefore training was organised in a whole range of electrical and mechanical jobs.

Training camps were held for repair and maintenance of power sprayers, motor pump-sets, house-wiring and electrical repair work for home and farm. A week-long camp was held to instruct the villagers in motor coil-winding.

Many people were given tools for these jobs.

Camps were also held for training in cattle management. Some foreign breeds—Friesian and Jersey—have been introduced. (Perhaps superior Indian breeds would have been more suitable in the Indian condi-

tions). The veterinary hospital treated 842 calves in one year. Villagers were also taught to make wire-bags and Agarbattis.

People were also taught to cook rice in a haybox, use smokeless chulas, and have a mud-cooler—the poor man's refrigerator for the preservation of milk, vegetables, eggs.

During the follow-up, it was observed that this training had gone home. In the process, family incomes had gone up by Rs. 50 to Rs. 150 a month, a no inconsiderable addition to the poor man's budget.

The ARC also participates in Lab-to-Land programme.

Landless labourers have been given 1-2 sheep each to rear.

Science Clubs have been started in ten villages.

A high-level evaluation team of the ICAR visited the Krishi Vigyan Kendra in April 1985 and appreciated the work being done there.

Recently an Industrial Training Institute has been started to train fitters, welders and draftsmen.

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5. Official Neglect of Voluntary Organisations

Shri Govindrao Shinde, Secretary, Kushtaroga Nivaran Samiti (Leprosy Eradication Committee), Sane Guruji Vidyalyaya, Bikhoba Pathare Marg, Dadar, Bombay-28 writes:

YOUR ATTEMPT to bring together all the organisations devoted to constructive work is laudable. In Maharashtra identical work is already being done by an organisation named Gramayatam.

It is always said that welfare, developmental and constructive activities should be undertaken by voluntary institutions devoted to social work. It is, however, the general experience, that no importance is given to such social work done by voluntary institutions. On the contrary, the system of work adopted is such that all types of work in various fields gradually come under direct or indirect control of Government. Most of the institutions started by Mahatma Gandhi for constructive work have lost their significance, initiative and importance because they were brought under the sway of Government after Independence.

Even in these circumstances, some institutions are trying their best to do social work of a useful nature, but they are always short of funds and require financial assistance to make their activities more comprehensive. It is necessary to keep them well informed about all the relevant acts, rules and regulations, such as Charitable Trusts Act, Foreign Contributions

Regulation Act, provisions pertaining to exemption from income tax on donations etc. They should also be given detailed information about Indian and Foreign Charitable Trusts.

All such institutions and organisations should also be furnished with information about the various provisions in the Seventh Five Year Plan, pertaining to voluntary social organisations as also development provisions and projects in the State and Central Budgets.

As for our Leprosy Eradication Programme, it was started in village Nere, Panvel taluka, district Raigad, Maharashtra, way back in 1952. The State Government made a generous donation of 70 acres and the Samiti bought another 52 acres of adjoining land. The whole campus is known as Shantivan.

In its early stages, this Leprosarium was guided by Annasaheb Sahasrabuddhe. After him it has had the guidance of Baba Amte and S.M. Joshi. They have 7 centres and 50 clinics for follow-up work in Panvel taluka. There is a cottage-hospital for 30 indoor patients and a pathological laboratory at Shantivan. The job is tough because people think leprosy is infectious and incurable—which it is not. Also the patients find the treatment too prolonged. But it is a noble job for the social worker. For, as Gandhiji put it: "Leprosy work is not merely relief, it is transforming frustration in life, into joy of dedication, personal ambition, into selfless service."

In the last two years, 30 patients have been cured of leprosy and 1600 are under treatment.

The Samiti's 2-year plan for expansion is expected to cost Rs. 10 lakhs. Meanwhile the KNS is also developing its land. During the last two years many students from Bombay, Thane and Raigad visited the site for three days and built four sheds, dug one well and brought twenty acres of land under intensive cultivation.

□

Narada asked Yudhishtira

"Are the agriculturists in your kingdom contented? Are large tanks and ponds established all over the kingdom at regular distances, so that agriculture is not entirely dependent upon the rains only? Are the foodgrains and seeds belonging to the farmers not allowed to be destroyed? Do you generously advance them loans on a minimum interest of one hundredth per measure?"

"O child, are the three professions of agriculture, cattle rearing and trade managed by honest persons? Upon these, O Monarch, depends happiness of the people."

(Mahabharat, Sabha Parva, Ch, 8, Verse 77-80)

6. How Bishnoi Girl Amrita moved the Maharaja of Jodhpur

"These trees are my brothers and sisters," she said.

The following historical story was told to Richard St. Barbe Baker, author of 'MY LIFE : MY TREES', by Shri Sundarlal Bahuguna, Father of the Chipko Movement.

Here she relates it for the wider public :

AMRITA DEVI was leader of the first Chipko—"Hug the Tree"—people. She lived in a village tucked away in the desert area of Rajasthan, in the domain of the Maharajah of Jodhpur. The whole area was covered with trees of Khejadi—a tree which grows in the desert.

As a child, Amrita had been taught to love and protect their trees because protection of trees and wild life was one of the 29 tenets of Vishnoi faith. Were not the trees her elder brothers and sisters? They guarded the village from the attack of sand storms. From the trees came the air we breathe, the water we drink; and without the guardian trees, they would not be able to grow their food. The forest itself gave fodder to the cattle, and food, to men.

Amrita knew all these things, for they had been taught to her by her mother and her heart overflowed with love for her brother and sister trees. Each morning she would salute her trees and then choose a special one, and placing her beautiful hands firmly on the trunk, would talk to the tree. 'Tree, you are tall and beautiful, set there by the Creator. How could we live without you? You guard us, you feed us, you give us the breath of life. Tree, give me your strength to protect you! Thank you, tree!'

Other girls and boys of the village would visit their special trees, and talk to them, thanking them for being trees and for just being there. Sometimes they would break into song, praising the trees for all they gave. Among the trees were deer and other creatures who would stop their browsing to listen to their songs. They had no fear of the villagers who

never hunted them or killed them for food. When Amrita was young, she was married to a young Vishnoi of Khejadli village, who too was a tree-lover.

One day (in the year 1740), the calm was broken. Into the forest came an army of men with axes. They had been sent by the Maharajah of Jodhpur, to fell trees for lime burning, for His Highness was about to build a new palace. The men paused to sharpen their axes. The Minister (Diwan) ordered his men to fell all the trees in sight. Each man chose a tree. Amrita, who was churning the milk, saw the men sharpening their axes. She asked them not to chop, the trees as it was against their faith. The axe-men said, "if you want to protect the faith, pay a fine!" She replied, "If I pay a fine it is an insult to faith. But if I can save the tree even at the cost of my head, that is cheaper."

"Stand back", shouted the axeman. "Chop me first", pleaded Amrita. "They are my brother sister trees, our village protectors. They are the breath of life, the water we drink, and our food. Chop me first." The axeman tore her away and threw her on the ground. Amrita was quickly up again, and hugging her tree. The axeman cut through her ankles. Amrita fell to the ground and hugged her tree at ground level. Her body was chopped through before the axeman could strike the trunk. She was followed by her three daughters. Vishnois from the neighbouring villages came. Another and another jumped to protect the tree of Amrita, but they were all over-powered by the axe-men, and met their fate. The axemen had to cut their way through the bodies of the Chipko people, and they returned with but a third of the timber for which they had been sent.

The Maharajah's Diwan was angry. The lime burners had long waited for the wood, and when at long last it came, it was negligible. "Where have you been all this time?" demand the Maharajah. "I sent you to the forest to fetch wood and you return days later, empty-handed." The foreman knelt before the Maharajah and explained: "Sire, when we went to the forest to fell your Highness's trees we were hindered by the men and women of the village—the Vishnois—and whenever we selected a tree it was being hugged by a woman or man who said, 'Chop us first.' These trees are to us the breath of life, the water we drink, and the food we eat. Without them we die. Take us first. The men of your Highness had to chop through the bodies of 363 villagers—Vishnois."

"Are you telling me that you were forced to kill 363 of my people? Why did you not go somewhere else?"

"Sire, wherever we went, we found these Vishnois hugging their trees."

The Maharajah gave orders so his supervisor to stop the work on the new palace, and the next day he set out with many attendants to visit the villages of the Vishnois. Runners went ahead to reassure the villagers and let them know of the Maharajah's concern for the village. The village leaders prepared gifts of herbs and fruit and went out to welcome the Overlord who graciously accepted the gifts. On entering the village His Highness, found the air fragrant with sandalwood; incense was burning while the villagers were saying prayers for their Chipko people, those who had given themselves to save the lives of their brother and sister trees. They had not been able to save their favourite trees; they had been overpowered by the Maharajah's men. "Greater love hath no man than this, that a man lay down his life for his friends" says the Bible (John XV. 13). But what kind of love is this? We learn about the love of God to man, the love of man to God, and we know the great sacrifices often made for each other. The love for trees grows from the realization of our dependence upon them. Trees can survive without man. But man cannot survive without trees.

The Maharajah was a cultured and thoughtful man, and he was impressed that there had been no complaints. To the contrary, the village was in a festive mood. As never before in his long experience, His Highness was deeply moved and wanted to make amends. After a while he declared that from that day, no tithes would be collected; that the villages where there were Vishnois, would never again be called upon to provide timber, and that there would be no hunting of creatures.

The Maharajah was true to his word, and today the first Chipko villages are still guarded by their khejdi and beech—a green mantle of trees guarding the desert. There have been no sand-dunes, and villagers are living a healthy life on the land by the grace of the trees saved by Amrita Devi and her brave followers. It remains a sanctuary with its wild-life, an oasis in a desolate desert.

The 250th anniversary of that fateful day was commemorated by the Chipko people in India, and their sympathisers, in the spirit of rededication to a great cause, for they, like Amrita Devi, will be prepared to make the supreme sacrifice to save the natural trees and their mother earth. In 1973, 243 years later, a similar movement was started by the women of the Himalayan region to stop commercial felling of trees in the hills.

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