Report of Phase II 2006-2007

Addressing Gaps for Policy Initiative towards Reduction of Mercury Contamination Sources in India in association with Indian Partner Organisations

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I. AGREED PROJECT PROPOSAL

Project Title: *Addressing Gaps for Policy Initiative towards Reduction of Mercury Contamination Sources in India in association with Indian Partner Organisations*

Existing Gaps

Mercury is not extracted in India; it is totally imported. In fact, India is one of the largest consumers of mercury in the world. About 170 tonnes of mercury was imported and consumed in the year 2004-05[1]. And this is probably an underestimation as there is a thriving illegal trade in the commodity.

Mercury finds a wide variety of application in India. Some of the major consumers of mercury in India are the chlor alkali industry, measuring instrument industry, chemical industry and lamps etc. Except some initiative from the chlor alkali industry, there has been hardly any attempt to phase out mercury from the industry. In most cases, even basic standards of occupational safety are not followed.

The healthcare industry is one of the glaring examples of mishandling of mercury. Healthcare uses mercury in many ways like in thermometer, sphygmomanometer, dental amalgam, chemicals etc. The scattered source combined with lack of awareness regarding mercury among the healthcare workers is of grave concern.

The coastal areas of India are significantly polluted with mercury and a high level of mercury is being detected in Indian fish, both saline and freshwater. Fish absorb methyl mercury from water as it passes over their gills and as they feed on aquatic organisms. Larger predator fish are exposed to higher levels of methyl mercury from their prey. Methyl mercury binds tightly to the proteins in fish tissue, including muscle. Nearly all fish contain trace amounts of methyl mercury, some more than others. In areas where there is industrial mercury pollution, the levels in the fish can be quite elevated. Cooking does not appreciably reduce the methyl mercury content of the fish.

The Minamata tragedy in Japan in 1950s and 1960s is the biggest case of mercury poisoning, where around 1,000 people were affected by mercury exposure. This was caused by consuming mercury-contaminated fish. To prevent such a tragedy from happening in India, people who eat fish need to be made aware of mercury contamination and its implications.

By certain estimations, the arguable potential release of mercury into India's environment could currently be anywhere between 172.5– 200 tonnes every year[2], and these figures exclude releases from other fossil fuels. This amount represents a grave danger for the country.
Though some small initiatives have been taken up in the country, but it lacks concrete direction from the all concerned because of following factors:

1. Lack of public awareness in the country
2. Low priority by the government.
3. Low acknowledgement by concerned industries

From http://dgft.delhi.nic.in/- Source The Directorate General of Commercial Intelligence and Statistics (DGCI&S), Kolkata, under the Ministry of Commerce, Government of India.

[2] Source: Down to Earth (Green Rating Project, CSE)

I.I PROPOSED DELIVERABLES IN THE PROJECT

1. Study on the mercury management systems in Chlor-alkali Plants and creating awareness
2. Mercury in Healthcare –Preparing a Status Report for Goa
3. Study on Mercury Contamination in Fish
4. National Level Consultation Meeting

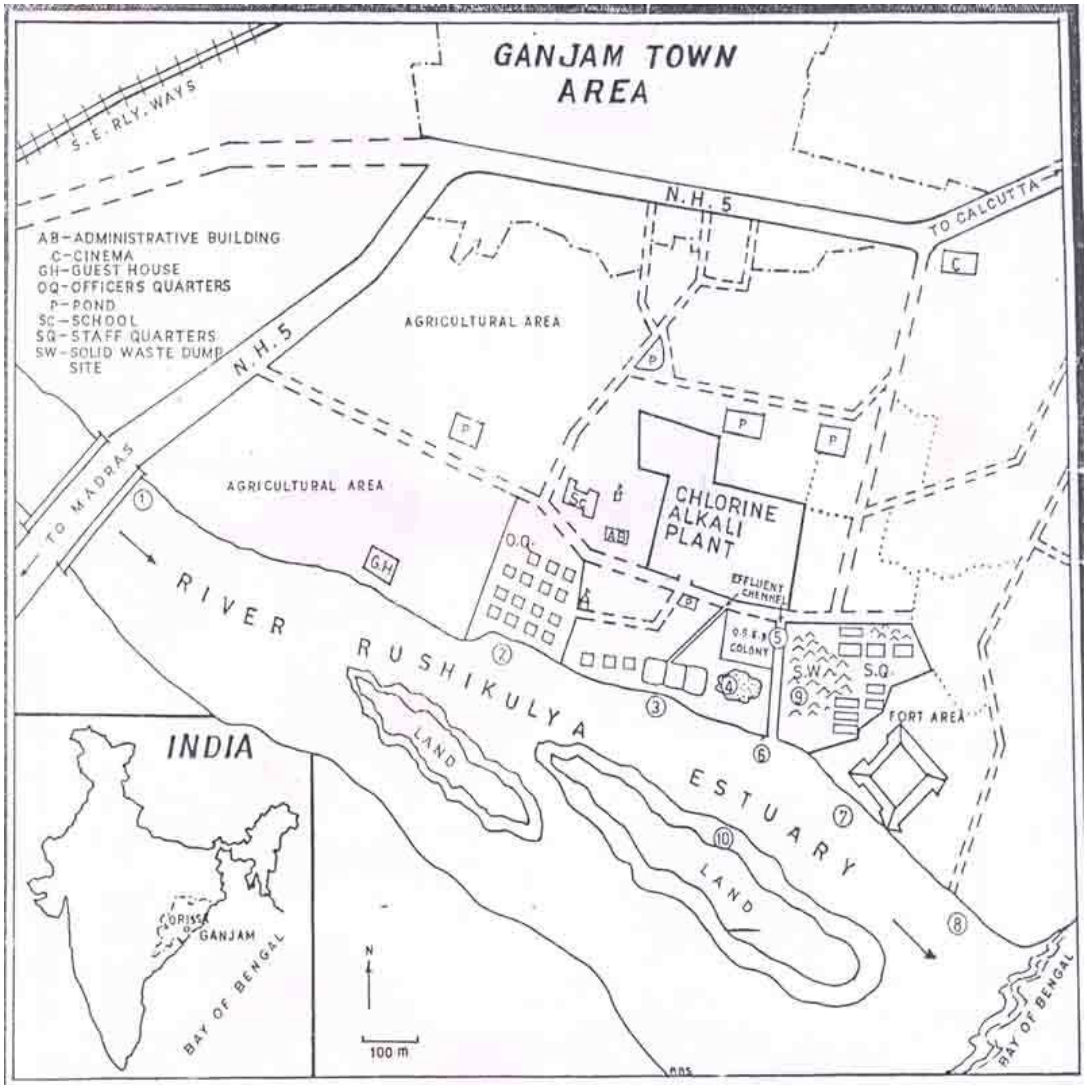
II. DETAILED DESCRIPTION OF ACTIONS

II.I Study on the mercury management systems in Chlor-alkali Plants and creating awareness

Though the study originally proposed to cover two mercury based and two membrane based plants in India, but due to difficult situation in getting access in these plants only one mercury-based plant was covered which is located in Orissa. Due to this reason it was decided to use the Lumex metre for this assessment the rest of the study was shifted to Phase III.

Assessment of Mercury Based Chlor Alkali Plant in Orissa

This plant is in operation since 1967, is one of the oldest Chloralkali plant in India. The plant is situated at Ganjam that is south of Orissa and two hundred kilometer from Bhubaneswar on the eastern sea coast of India.



Map: Location of Jayshree Chemical Orissa

The river Rushikulya, an important river of south Orissa is flowing very closely to the plant. Earlier the liquid effluents of the plants was released directly to the river but now the liquid wastes are channeled into a safety tank constructed with on the riverbed. Most importantly the famous nesting ground of Olive Ridley (see turtle), in the Rushikulya estuary in Bay of Bengal is barely one km from the plant site.

Photo: The Plant

Data on Mercury

The industry was procuring mercury from MMTC. Now it is being supplied by one of the biggest metal supplier of India called Major Metals Ltd. (Bombay). And Industry officials say it is largely sourced from Germany**.** Mercury comes in a flasks. One flask contains 34.5 kg of mercury.

Consumption of the Mercury

Looking in to the records of mercury use by the plants. It has used 93 kg of mercury for per metric ton of production from January 2004 to January 2005. In the subsequent years the mercury used in manufacturing process was reduced to 67 Kg per metric ton in 2005-06 and 48 kg per metric ton 2006-07. The figures showed that total mercury used in the year 2006 was 655.50 Kg. Since its inception the industry has consumed 13,855 kg of mercury.

The cost of buying 1 kg of mercury is Rs.1390/- in last year. One flask of mercury costs around rupees 48000. With this estimate the annual consumption of mercury by this industry is of rupees 1, 28,730/-

The daily production of caustic Soda is 72 MT and industry has produced 24000 MT in 2006-07. The Industry records also revealed that nearly 3260 unit /tone of the power consumption, which has gone down to 2800 unit per tone owing to lesser production. But as per the information provided by the pollution control board nearly 90mg/tone use of mercury for NaOH preparation. The data are based on the third party assessment. The officials denied naming the third party. **According to the one of the senior representative of pollution control Board Jayashree Chemical will be shifting to membrane based technology with in 2011 Even the industry representative**

mentioning about this plan. But during the assessment there was no sign of this shift and even workers are not aware of this plan.

Mr. K.Mohan Rao who was recently retired as the vice president of the industry mentined that the company preserve mercury in a closed system. They have taken sufficient precaution in the mercury cells for this the base of the mercury cell is cemented. The workers in the industry were provided with face mask and safety gears. Without mentioning what steps he mentioned that company has taken steps to prevent mercury evaporation from the industry. He also mentioned that the waste from mercury technology is very less in quantity. And Industry has taken enough precautions in dumping mercury-contaminated waste. The dumping takes place inside the premises of the plant. The mercury waste is currently deep buried. The company has certification from by NEERI.

Photo: The Secured Landfill Site of Industry

Workers View

Talking to the workers revealed that they are dissatisfied with the management and poor maintenance of the plants and the safety precautions. They mentioned that that the mercury cells are poorly maintained and waste is poorly dumped. One worker showed the dumpsite of solid waste generating from the Industry. He mentioned that this waste site has also used to dump mercury containing waste from the industry. The workers also mentioned that they are not using any protective gears during their working inside the plant. The workers view of dumping of mercury containing waste outside the plant also corroborate wit the research done by Prof. B.B. Panda, who in his study found mercury in solid waste released from the chemical plant and being dump outside the industry.

The Supreme Court Monitoring Committee- Report of the Sub-Committee for Orissa (June 6-9, 2006) has mentioned that there were several allegations against Jayshree Chemicals for mercury discharges from their chlor-alkali plant, some of which were now affecting the Chilka lake which is also showing the presence of PCBs. Despite this, Jayshree Chemicals is proposing to expand its plant. Therefore, the NGOs appealed to the SCMC that the unit should not be allowed to expand unless it takes care of the current mercury discharge level which violates the HW Rules and the apex court order. Mercury discharge is an extremely serious matter and OSPCB should ask for a time-bound commitment to reduce the mercury discharge level and follow the CREP guidelines. The order dated 14.10.2003 does not permit operation of units violating the HW Rules, nor does it allow new consent or authorization for existing units or their expansion unless existing violations are cured.

Photo: Waste water outside the Industry

Community Perspective

The data collected through primary survey conducted in three villages (Puruna Bandha, Bichana Pada Palli and Pallibandha) located with in 3-kilometer radii of Jayashree chemicals. The primary occupation of the occupant is fishing, agriculture and some of members of the village community is employed with Jayashree Chemicals.

Headaches, skin rashes, tiredness, hair losses are common problem in the area. The people are not aware about the contamination of mercury in those areas, but complain about the chlorine gas, which is being released frequently. According Dr. Swarupananda Mishra, a private practitioner in one of the village mentioned that neurological problems are detected among these villagers, but it is very difficult to give any concrete view that these problems are due to mercury pollution.

Environmental Issue

The solid wastes release from the plants is generally dumped in the open land and contaminates with the mercury. These villages are situated very close to the dumping sites. People complained that the soils is getting low in productivity. The result of researches conducted by Prof BB Panda have also showed close relationship between the mercury contaminated solid waste release from Jayashree Chemicals and its affects on some specific plants.

Photo: The treatment Lagoon of Industry

Photo: Industry Dump Site Outside the Plant

The community staying very close to the solid waste-dumping site of the plant is using water of near by tube well for cooking and drinking purpose. They have complained about the taste and colour of water of tube well. The water of near by pond also has a different taste.

II.2. Study Two: Mercury Usage in the Healthcare Sector in Goa - A Status Report by Goa Desc

Introduction

Goa is one of the smallest states in the country, which is well known as an international tourism destination. With a population of 1.4 million it receives an equal number of tourists both domestic and foreign and is said to have a bright future in medical tourism.

The health infrastructure in the State is divided on the one hand by a network of Government run Hospitals and Primary Health Centres which cover the 2 districts and all 11 Talukas while on the other by a large number of Nursing homes and hospitals which are largely situated in the more urbanized 5 Talukas.

As our earlier efforts in creating awareness on the need to manage medical waste and the importance of having environmentally friendly solutions to dispose waste were well received it was felt that we have to go the next step i.e. take on the discussion of tackling hazardous waste. It is in this context that we felt undertaking specific awareness campaign on the hazards of handling mercury would require a preliminary study of usage of mercury in the healthcare sector of Goa.

Scope of the Study

At the outset it was clear that the scope of the study would be limited as there was very little information on hazards of mercury usage in the Health sector in general although dental clinics in general are better informed as there is greater usage. Therefore the scope of the study was limited as it was being used to make an entry in the health sector so as to focus on the usage of mercury and its impacts. What the findings of the hospitals that were contacted have shown us is that although mercury is not used in large quantities in the hospitals, the limited usage of mercury and its spread to all the 11 eleven Talukas and the limited information available on its harmful effects of its mishandling is worrisome for the State of Goa.

Objectives of the Study

The objectives of the study therefore were the following:

1. To place on record that mercury is being used in hospitals
2. To identify what kind of information on mercury is required.
3. To identify the stakeholders that would require awareness.
4. To identify an action plan for awareness on safe handling of mercury

Methodology

As the study was meant to make an entry in the health sector on the issue of usage and handling of mercury it was decided to gather data from 5 hospitals (three from the North District and two from the South District) by conducting a baseline survey. In this effort it was decided not to involve the Govt. District hospitals or any of the Primary Health Centres (PHC) so as to avoid a negative reaction to the entire awareness campaign in the future. It was decided to keep the study at a basic level at this stage to avoid negative reaction to the proposed awareness on safe handling of mercury.

Reactions to the Study

Goa although being in the list of supposedly advanced states in the country with respect to infrastructure, literacy levels, health indicators etc has the track record of not being able to handle its waste. Over the last 15 years the waste management issue has been central to manifestos of political parties and priorities of successive Govts. So much so that the 12 Municipal Councils 1 Corporation and 185 village Panchayats have yet to identify and put in place a proper waste disposal system in place. Currently there is a petition before Honourable High Court of Bombay challenging the inaction of the Goa Govt. and the local self bodies in preparing a proper waste disposal system. In this context there has been much concern and skepticism among the medical fraternity to baseline surveys on waste management and more particularly to hazardous & toxic waste.Since the baseline survey was used as the entry point to focus on actual usage of mercury the immediate reaction was "what's the fuss about mercury ?" why not deal with larger issue of the overall waste management ? Is mercury really that much of a problem that needs a survey and a full fledged awareness campaign on its safe handling?

Study Area

Of the 5 hospitals that we selected 3 (Dr. Olavo Ribeiro's Hospital, Bhagyoday Hospital & J M J Hospital) are from the North Goa District and 2 (Dr. Lawande's Hospital & Medical Research Centre and Grace Intensive Cardiac Care Centre & General Hospital) from the South Goa District. Of the five hospitals 4 fall within the jurisdiction of Municipal Councils while 1 within a Village Panchayat area. With respect to governance the Goa Panchayati Raj Act is followed in Panchayats and incorporates the 73rd Constitutional amendment while the Municipal Councils are governed by the Goa Municipal Act 1968 and does not incorporate the 74th Constitutional amendment.

Hospital	Beds	daily outpatients
Dr. Lawande's , Margao, South Goa	30	30
Grace Cardiac, Margao, South Goa	30	None
Dr. Olavo Ribeiro, Mapusa, North Goa	20	10 - 15
JMJ, Porvorim, North Goa	23	10 - 15
Bhagyoday, Mapusa, North Goa	20	1 - 2

Demography of Hospitals

Sr. No.	Name of Hospitals	Nature	No. of Bed	Bed occupancy	No. of doctors R / V	No. of nurses	Other Staff
1	Dr. Lawande's	Private	30	70%	4 / 6	14	4
2	Grace Cardiac	Private	30	100%	4 / 20	40	15
3	Dr. Olavo Ribeiro	Private	20	95%	2 / 16	6	3
4	JMJ	Private	23	60%	1 / 13	16	12
5	Bhagyoday	Private	20	80%	4 / 10	8	5

*No. of Doctors - **R** – Resident and **V** – Visiting*

FINDINGS AND OBSERVATION

Usage of mercury in the hospitals

All 5 hospitals use mercury fever thermometers and used in Departments of medicine, surgery, pediatrics and orthopedics besides casualty there was a mixed feedback on the matter of fresh purchases every year. While the bigger hospitals reported purchases of approximately two thermometers monthly (24 annually) the smaller hospitals purchased one monthly (6 annually). While logically more the patients, more usage and therefore more purchases it was also found that in the smaller hospitals more care is taken while handling equipment to avoid theft and breakages thereby avoiding repeated fresh purchases. This defensive approach was found to be good but however it does not expose the hospital to issues of repeated purchases which means more usage of mercury based equipment on the one hand and delay in putting in place a safe disposal system on the other hand. Mercury thermometers were also found to be used in incubators in the hospitals covered in the survey.

Mercury Sphygmomanometers (blood pressure devices) are used in the casualty, medicine, OT and ICU of the hospitals. While the purchases are between one to two annually, breakages are by and large negligible.

Sl No.	Name of Hospitals	Number of Beds	Frequency	Numbers Used		Numbers Replaced/ annually	
				Thermometer	BP Apparatus	Thermometer	BP Apparatus
1	Dr. Lawande's	30	3	2	2	24	1
2	Grace Cardiac	30	3	5	2	15	3
3	Dr. Olavo Ribeiro	20	3	3	2	18	2
4	JMJ	23	3	3	2	2	1
5	Bhagyoday	20	3	2	2	5	1
	Total	**123**	**3**	**15**	**10**	**64**	**08**

Disposal of the Mercury waste

The mercury that is recovered from breakages is collected and eventually disposed of through waste disposal facility provided by the Municipal Council. It maybe noted that there is no separate disposal facility for hazardous waste in the State of Goa.

Usage of alternative products of mercury in hospitals

Since the present mercury instruments are the most commonly available and most commonly used the introduction of alternatives have not been on the agenda. The staff of the hospitals being familiar with the present mercury based instruments need to be exposed to the alternatives which are available and are electronic/digital based. The need for such exposure to alternatives was highlighted as necessary with the medical fraternity.

Conclusion

The opportunity to conduct this study on the usage of mercury in the healthcare facilities in Goa will now provide us the necessary impetus to take the awareness campaign on safe handling of mercury in case of spills, information on alternatives to mercury as well as the larger issues of handling, segregation, transportation, treatment, and disposal of medical waste. The study has also provided us the opportunity to plan for environmentally friendly systems to deal with medical waste as the all the

5 hospitals have agreed to be partners in this process so that they could act as models for the other hospitals in Goa. Lastly the study has provided us the opportunity to prepare an action plan for the campaign on mercury elimination in the Govt. run health facilities.

Suggestions/recommendations

The study in the 5 hospitals has resulted in the following suggestions/recommendations:-

1. There has to be comprehensive plan for the handling, segregation, transportation, treatment, and disposal of medical waste, which is focused on the stakeholders in the healthcare sector in Goa.
2. There has to be an action plan on mercury, which would include a Week long program twice a year with specific activity allotted for the different levels of the staff in the hospitals.
3. On the matter of handling spills and putting in place a prevention program it was felt that actual "demos" be conducted with audio-visual support on special occasions like CME's and other gatherings of the medical fraternity.
4. Alternatives to mercury instruments need to promoted in a big way through demos of samples along with short presentation on the harmful effects of mercury to gatherings of Associations like the IMA (Indian Medical Association) which also has a Taluka level organization and the Goa branch of TNAI (Trained Nurses Association of India). This effort could be supplemented with lecture type inputs in the institutions like the Goa Medical College, Goa Dental College, Goa College of Pharmacy and the Institute of Nursing Education.
5. The Village based consumer Forums need to take the mercury campaign to homes so that preventive steps when handling mercury are popularized and information on alternate instruments is provided.
6. The need to incorporate the handling of mercury into the guidelines on the handling of medical waste as defined in the Goa Non-Biodegradable Garbage (Control) Act 1996 (Goa Act. 5 of 1997) and the Goa Non-Biodegradable Garbage (Control) Rules 1997.
7. To involve the Association of Nursing Homes in organising an input on handling mercury for staff handling the cleaning and waste disposal so that besides protecting themselves they can undertake segregation of medical waste at source.
8. To promote alternatives to incinerators by providing information on other methods and processes like segregation of infectious waste, autoclaving, composting and use of EM (effective microbes).

II.3. Study Three Study on Mercury Contamination in Fish by DISHA, Kolkotta

Introduction

West Bengal has a long history of industries capable of releasing mercury in the environment. Mining, coal fired production processes including thermal power stations, direct discharges of industrial, municipal and medical waste – all are present here. As such there is a felt need of undertaking a Fish Testing Study for mercury contamination covering the pollution prone spots.

Studies have been undertaken in India to measure the extent of mercury contamination in fish. But these studies are generally with educational or research institutions and are yet to enter the domain of environmental activists and/or concerned people. As such there is a need to bring out a collection of such studies for the environmental activists and concerned people.

Also so far there has not been any campaign literature on mercury hazards in Bengali language. This is affecting the development of awareness regarding mercury among the environmental activists in West Bengal. These awareness materials will also help in taking this information to the neighboring country Bangladesh, which is also a fish eating community.

This project will seek to address following objectives –

1. To quantify and assess the level of mercury in fish in selected pollution prone areas in West Bengal.
2. To assess the level and extent of mercury contamination in fish in India as found in different studies undertaken in the matter.
3. To publish a resource handbook on mercury hazards in Bengali language to help develop awareness among the activists and concerned people.

Methodology and Sampling

Collecting Fish (mostly predators and omnivorous fish) and crustacean (shrimps and crabs) samples from pollution prone Areas of West Bengal and testing them for mercury through digested sample preparation, Cold Vapour Atomic Absorption Spectrophotometry of the digested solutions and analysing the results so as to give results in wet weight basis (e.g. mg/Kg).

Laboratory and Procedure

The laboratory procedures on the fish samples entrusted to ***Good Earth Enviro Care*** Laboratory. The digestion of the samples would be undertaken by the aforementioned laboratory. The digested solution would then be subjected to *Cold Vapour Atomic Absorption Spectrophotometry* at the West Bengal Pollution Control Board Laboratory. The AAS results would then be analysed by ***Good Earth Enviro Care*** on the basis of the amount of tissue taken and the results conveyed in terms of mg per Kg of flesh tissue. The calculations and results would then be checked by the Principal, i.e. DISHA and analysis of the results carried out.

Locations of sample collection

Sl. No.	Location	Water Body
1	Farakka (near NTPC thermal power plant), Murshidabad District	River – Ganga mainstream and the Bhagirathi Feeder Canal
2	Asansol (Coal Mines), Bardhaman District	Pond
3	Durgapur – Asansol (Industrial Belt), Bardhaman District	River – Damodar
4	Kolkata (Metropolis)	East Kolkata Wetland, fish aquaculture ponds
5	Kolkata (Metropolis)	Mudiali Nature Park Wetland, fish aquaculture ponds
6	Ganga (Hooghly) downstream of Kolkata	Budge Budge, River Hooghly.
7	Haldia (Industrial Belt)	Estuarine Confluence of Hooghly and Haldi rivers
8	Digha (Tourist Spot)	Sea – Bay of Bengal

9	Hugli District (Agricultural Belt)	Pond

The fish and crustacean samples were collected by the Society for Direct Initiative for Social and Health Action (DISHA), the Principals in this investigation.

Sample Collection

In Farakka, the NTPC thermal power plant is located on the bank of and very close to the Ganga Feeder Canal and is about 2.5 Km from the nearest point of the Ganga mainstream. Therefore, on visiting the area, it was decided to take at about half the catch from the Feeder Canal (which is a major source of fish coming to the Farakka and neighbouring markets). The rest of the catch was taken from the Ganga mainstream.

It was initially planned to take fish samples from ponds in the Raniganj coal mining area in the Bardhaman District. However, on account of difficulties in establishing contacts in the Raniganj area actual collection of samples were done in the area bordering on Raniganj but closer to Asansol. However, all the samples were collected from ponds located at the very heart of the coal mining area.

The catch from Damodar River, off the Durgapur–Asansol Industrial Belt in Bardhaman District, proceeded as initially planned.

There was difficulty in adequately establishing contact in the Bardhaman agricultural area. It was therefore considered expedient to collect fish samples from another major area – the Hugli District Agricultural area.

The catch from the Kolkata Metropolitan area, East Kolkata Wetland aquaculture ponds and Mudiali aquaculture ponds, proceeded as initially planned.

It was initially decided to take fish samples from River Rupnarayan at near Kolaghat NTPC power plant. However, the visits to Kolaghat were undertaken during monsoon when the river was in flood and fishing was hampered. Repeated visits failed to yield any catch. (Hilsa from the river was available, but it had been decided that Hilsa would not be collected for testing, for reasons discussed later.)

However, instead of taking fish samples from Hoogly/Ganga, directly adjacent to the Kolkata Metropolitan area, it was seen fit to collect samples from a little downstream – the Budge Budge area – so as to take into account possible effects of the entire Kolkata and neighbouring urban-industrial complex.

In the case of Haldia it was found that the initial plan of taking catch from the nearby marine waters was not feasible as the actual fishing is done not so much on the sea off Haldia, but rather in the estuarine zone where the river Haldi meets the Hoogly before opening into the sea. It was the latter zone therefore, which has been the source of the fish samples from Haldia. The catch from Digha proceeded exactly as planned.

One problem has persistently dogged our investigation. Although it was decided that such species would be collected as are widely consumed, the emphasis was mainly on collecting carnivorous and omnivorous fish and crustaceans (varieties that are widely consumed). These are considered 'desired' samples for purposes of this investigation, as being somewhat higher in the aquatic food chain they are more susceptible to biomagnification of mercury. Moreover, in the case of crustaceans such as crab and shrimp, the organisms are often bottom dwellers and hence more susceptible to mercury contamination. However ponds in the agricultural areas of West Bengal tend to specialise in farming

of various kinds of carps (which have the widest and most liveliest markets) and there is a tendency towards weeding out other fish varieties (particularly the carnivorous ones) from the ponds. So catching hold of a range of 'desirable' samples from a particular location has been a problem. Procuring 'desired' fish samples from the River Rupnarayan at Kolaghat has also proved a problem and repeated visits have yielded nothing. This is because fishing in that area tends to specialise in Hilsa, with very little by-catch that falls in our 'desired' category. (Hilsa has of course been considered out of bounds for this investigation as it is primarily a plankton feeder and besides, it is an anadromous species and its migratory character makes investigation of location-specific- pollution futile).

The Process of Collecting and Sending To the Laboratory

All Fish and crustacean samples were collected from specified locations that had been decided on earlier, and any change in the collection site was on the terms mentioned earlier.

Care was taken to collect the samples from fishers operating at the locations. There was no case of collecting samples at second hand, e.g. the local market (where for example the fish could have come from distant locations thereby belying the entire rationale of location selection). The samples were kept separated from each other and from all possible contaminants, and in a protected near zero degree Celsius environment, during the entire period from collection to delivery to the laboratory and were handed over to the laboratory within 24 hours of the collection. (Only in the case of Farakka collection did the delivery to the Laboratory occur about 30 hours after the collection, but the fish was kept in freezing conditions during the entire period).

Each fish and crustacean sample was identified and listed according to name of the variety and entered into a packet labeled with an identification tag. A careful record was kept of which variety had been kept in which packet. A further check was made against the record at the time of handing over to the laboratory.

The Lab Methodology

The First Stage

The Laboratory to which the samples were delivered for digestion is the *Good Earth Enviro Care*, at Narendrapur Kolkata, a Laboratory accredited by the West Bengal Pollution Control Board. The initial phase of Acid Digestion was done in that Laboratory. The Acid Digestion method that this Laboratory follows is according to the standard procedures used at the Research Laboratory of the Swedish Environment Protection Board.

The Second Stage

The digestion solutions prepared at the Laboratory were next sent to the Laboratory of the West Bengal Pollution Control Board at Salt Lake, Kolkata, for mercury determination by Atomic Absorption Spectrophotometry.

Reports Received From the Laboratory

The basic sample was of course one or other particular kind of fish or crustacean. But the entire mass of the basic sample was not tested. Tissues from the most edible/commonly eaten portion of the fish, that is the muscles and associated fatty tissues, were taken in specific amounts and then chemically digested. The results that we have got thus pertain to those portions only. It is quite

possible that we would have found different, and indeed higher, values for other parts of the basic samples – for example the brain, the liver and the excretory organs. In fact, studying the mercury levels in brain and liver would be of import for these are actually eaten. Thus a study, of mercury determination of different parts of different fish species would be of a much more comprehensive nature. However, testing for different parts from one sample would result in higher testing cost per fish and therefore, within the severely limited budget, it was considered expedient to test for mercury contamination that particular portion of each organism sample that is certainly to be consumed. The idea was to get indicative results for the largest variety of samples from a wide geographical area as possible within the budgetary limit.

The reports do not name the fish from which the tissue samples have been taken. The same are provided in the tables below.

C. THE TEST RESULTS

Table 1. Results of test

Sample Code ♫	GEEC Code#	Weight of Sample taken for analysis	Mercury (as Hg) µg/L	Value of Blank (as Hg) µg / L	Mercury(as Hg) Mg / Kg	Local Name	Scientific Name	Feeding habit
1	BS-01	5.3973	34.36	13.43	0.1939	Banspata	*Devario devario*	*Feeds on worms, small crustaceans and insects*
2	BS-02	5.2083	22.22	13.43	0.0844	Phitemaachh	*Trichiurus gangeticus*	Feeds on a wide variety of small fish and crustaceans
3	BS-03	6.6397	21	13.43	0.0570	Kankra	*Portunus sanguinolentus*	*Small organisms including molluscs*
4	BS-04	5.4338	11.99	13.43	BDL*	Brown chingri	*Metapenaeus dobsoni*	*Plankton, small shellfish and worms*
5	BS-05	6.3105	52.94	13.43	0.3130	Tampra	*Megalaspis cordyla*	*Omnivorous*
6	BS-06	5.0821	16.07	13.43	0.0260	Amudi	*Stolephorus devisi*	*Omnivorous*
7	BS-07	4.7226	9.05	13.43	BDL	Maurala	*Amblypharyngodon mola*	*Herbivorous*
8	BS-08	6.3889	17.2	13.43	0.0295	Bhola	*Nibea soldado*	Feeds on small fishes and invertebrates
EC-1	BS-09	10.3097	7.119	2.727	0.0426	Mrigel	*Cirrhinus cirrhosus*	*Juveniles are omnivorous adults are almost entirely herbivorous.*
EC-2	BS-10	16.7199	5.862	2.727	0.0188	Lilentika	*Oreochromis niloticus*	*Feeds mainly on phytoplankton or benthic algae*
EC-3	BS-11	11.4862	6.715	2.727	0.0347	Bata	*Labeo bata*	*Herbivorous, feeds mainly on plants*

EC-4	BS-12	16.2801	9.711	2.727	0.0429	Lyata	*Chanos chanos*	*Larvae eat zooplankton; juveniles and adults eat cyanobacteria, soft algae, small benthic invertebrates, and even pelagic fish eggs and larvae.*
EC-5	BS-13	12.5147	5.077	2.727	0.0188	Rui	*Labeo rohita*	*Feeds on plants.*
EC-6	BS-14	7.0369	5.352	2.727	0.0373	American Rui	*Cyprinus carpio*	Omnivorous, feeding mainly on aquatic insects, crustaceans, annelids, mollusks, weed and tree seeds, wild rice, aquatic plants and algae; mainly by grubbing in sediments. TL 2.5
EC-8	BS-16	3.5345	3.818	2.727	0.0309	Kucho Chingri	*Mysis sp.*	*Phytoplankton, Zooplankton, worms*
0-1	BS-17	12.1149	8.862	2.727	0.0506	Koi	*Anabas testudineus*	*Feeds on macrophytic vegetation, shrimps and fish fry*
0-2	BS-18	11.9291	5.848	2.727	0.0262	Hybrid Magur	*Clarias gariepinus*	*Generally carnivorous fish*
0-3	BS-19	14.8519	3.382	2.727	0.0044	Pangash Tangra	*Pangasius pangasius*	*Carnivorous*
5M	BS-20A	10.6548	6.562	2.727	0.0360	Pangash	*Pangasius pangasius*	*Carnivorous*
1M	BS-20B	10.7754	11.08	2.727	0.0775	Punti	*Puntius puntio*	*Omnivorous*
10M	BS-20C	10.9027	14.1	2.727	0.1043	Bata	*Labeo bata*	*Herbivorous, feeds mainly on plants*
6M	BS-20D	11.4463	6.158	2.727	0.0300	Bele	*Glossogobius giuris*	Feeds on small insects, crustaceans and small fish.
4M	BS-20E	10.3034	9.574	2.727	0.0665	Shingi	*Heteropneustes fossilis*	Omnivorous
MU-1	BS-21A	15.5423	210.5	65.56	0.9326	Lyata	*Chanos chanos*	*Already mentioned*
MU-2	BS-21B	3.2147	BDL	65.56	BDL	Chanda	*Chanda nama*	*Feeds on planktons as well as worms*
MU-3	BS-21C	9.3187	BDL	65.56	BDL	Shol	*Channa striata*	Feeds on fish, frogs, snakes, insects, earthworms,

								tadpoles and crustaceans
MU-4	BS-21D	5.0562	BDL	65.56	BDL	Kholse	*Colisa fasciatus*	*Omnivorous*
MU-5	BS-21E	15.833	266.7	65.56	1.2704	Phali	*Notopterus notopterus*	Feeds on insects, fish crustaceans and some young roots of aquatic plants
1	BS-22E	5.3493	BDL	BDL	BDL	Shol	*Channa striata*	*Already mentioned*
2	BS-22D	5.4747	BDL	BDL	BDL	Lyata / Chang	*Chanos chanos*	*Already mentioned*
3	BS-22C	7.386	2.84	BDL	0.0385	Grass Carp	*Ctenopharyngodon idella*	Feeds on higher aquatic plants and submerged grasses; takes also detritus, insects and other invertebrates
4	BS-22A	4.6862	BDL	BDL	BDL	Rui	*Labeo rohita*	*Already mentioned*
5	BS-22F	5.4373	2.43	BDL	0.0447	Bata	*Labeo bata*	*Already mentioned*
6	BS-22G	5.8173	2.54	BDL	0.0437	Mirik	*Species identification uncertain*	*Possibly omnivorous*
7	BS-22B	8.5289	2.52	BDL	0.0295	Punti	*Puntius puntio*	*Already mentioned*
7A	BS-22H	7.6862	4.13	BDL	0.0537	Tilapia	*Oreochromis mossambicus*	Omnivorous, feeds on almost anything from algae to insects but also crustaceans, and fishes
7B	BS-22I	3.3571	1.39	BDL	0.0414	Bhyada	*Nandus nandus*	Feeds on aquatic insects and fishes
8	BS-22J	3.8003	BDL	BDL	BDL	Phali	*Notopterus notopterus*	*Already mentioned*
9	BS-22L	4.5801	BDL	BDL	BDL	Daanrke	*Rasbora daniconius*	Feeds mainly on aquatic insects and detritus
10	BS-22N	6.4237	1.29	BDL	0.0201	Shol	*Channa striata*	*Already mentioned*
11	BS-22O	6.0121	3.15	BDL	0.0524	Chingri	*Mysis sp.*	*Already mentioned*
12	BS-22M	5.1142	BDL	BDL	BDL	Tilapia	*Oreochromis mossambicus*	*Already mentioned*
13	BS-22K	6.8159	4.68	BDL	0.0687	Baan	*Ophisternon bengalense*	*Predator fish, carnivore*
1F	BS-23B	7.5746	BDL	BDL	BDL	Galda chingri	*Macrobrachium rosenbergi*	*Plants and worms as juveniles, omnivorous*

								as adults
2F	BS-23E	6.7117	BDL	BDL	BDL	Ghere	*Ictalurus punctatus*	Feed on insects, shrimps, other crustaceans and small fish
3F	BS-23L	5.4681	2.96	BDL	0.0541	Bata	*Labeo bata*	*Already mentioned*
4F	BS-23I	5.5511	6.12	BDL	0.1102	Tangra	*Mystus tengara*	*Omnivorous*
5F	BS-23C	10.9696	1.18	BDL	0.0108	Galda chingri	*Macrobrachium rosenberg*	*Already mentioned*
7F	BS-23A	9.9924	2.08	BDL	0.0208	Lyata	*Chanos chanos*	*Already mentioned*
6F	BS-23D	5.4672	1.19	BDL	0.0218	Pankal	*Macrognathus pancalus*	*Carnivorous*
8F	BS-23G	5.5812	2.95	BDL	0.0529	Kankra	*Scylla serrata*	*Omnivorous*
9F	BS-23K	10.9356	3.11	BDL	0.0284	Aar	*Sperata aor*	Predatory, adults feed on small fishes and worms
10F	BS-23J	4.9686	2.8	BDL	0.0564	Shingi	*Heteropneustes fossillis*	*Already mentioned*
11F	BS-23F	6.9132	6.38	BDL	0.0923	Bhyada	*Nandus nandus*	*Already mentioned*
12F	BS-23H	4.5459	BDL	BDL	BDL	Tangra	*Mystus tengara*	*Already mentioned*
1H	BS-24H	7.3616	BDL	BDL	BDL	Bhola	*Nibea soldado*	*Already mentioned*
2H	BS-24E	4.508	2.37	BDL	0.0526	Tarui	*Xenentodon cancila*	*Carnivorous predator fish*
3H	BS-24A	6.5048	2.29	BDL	0.0352	Topse	*Polydactylus sexfilis*	Feeds mainly on crustaceans (shrimps and crabs), polychaete worms, other benthic invertebrates
4H	BS-24B	11.212	7.6	BDL	0.0678	Silver carp	*Hypophthalmichthys molitrix*	*Already mentioned*
7H	BS-24F	9.773	3.83	BDL	0.0392	Bagda	*Pynaeus Monodon*	*Omnivorous*
8H	BS-24G	3.9843	2.37	BDL	0.0595	Topse	*Polydactylus sexfilis*	*Already mentioned*
9H	BS-24D	13.3234	4.32	BDL	0.0324	Kankra	*Scylla serrata*	*Already mentioned*
10H	BS-24C	13.554	7.43	BDL	0.0548	Bhola	*Nibea soldado*	*Already mentioned*
BJ-1	BS-25A	9.9092	2.09	BDL	0.0211	Bhola	*Nibea soldado*	*Already mentioned*
BJ-2	BS-25B	6.3768	4.6	BDL	0.0721	Bhola	*Nibea soldado*	*Already mentioned*

BJ-3	BS-25C	7.7227	4.13	BDL	0.0535	Bacha	*Eutropiichthys vacha*	Feed on small fish and insect
BJ-4	BS-27A	6.9673	1.53	BDL	0.0220	Phasha	*Setipinna phasa*	Adults feed mainly on mysids and small prawns (reduced feeding during breeding), juveniles mainly on copepods
BJ-6	BS-27B	4.0376	2.24	BDL	0.0555	Pomfret	*Pampus argenteus*	Feeds on ctenophores, salps, medusae, and other zooplankton groups
BJ-7	BS-27C	3.9854	BDL	BDL	BDL	Kajari	*Ailia coila*	*Uncertain, possible herbivorous*
H-1	BS-26A	8.4548	3.94	BDL	0.0466	Shol	*Channa striata*	*Already mentioned*
H-2	BS-26B	10.1242	BDL	BDL	BDL	Silver carp	*Hypophthalmichthys molitrix*	Feeds on phytoplankton and zooplankton
H-3	BS-26C	12.4635	6.84	BDL	0.0549	Mrigel	*Cirrhinus cirrhosus*	*Already mentioned*
H-4	BS-26D	9.9574	4.63	BDL	0.0465	Lilentika	*Oreochromis nilotica*	*Already mentioned*
H-5	BS-26E	11.0651	6.79	BDL	0.0614	Pangash	*Pangasius pangasius*	*Omnivorous*
H-6	BS-26F	6.5517	2.84	BDL	0.0433	Kankra	*Scylla serrata*	*Already mentioned*
H-6A	BS-26G	5.2574	2.08	BDL	0.0396	Kankra	*Scylla serrata*	*Already mentioned*

* BDL stands for 'Below Detection Level
# GECC code has been given by the Laboratory *Good Earth Enviro Care*
♫ Sample code has been given by DISHA, the Principal Investigators

The Catch and the Codes

- The first 8 samples in the above table, Sample Code 1 to 8 or GEEC Code BS-01 to BS-08 are from the sea catch at the Digha coast.
- The next 10 samples, from Sample Code EC-1 to 0-3 or GEEC Code BS-9 to BS-19 are from the East Kolkata Wetlands aquaculture ponds.
- The next 10 samples, from Sample Code 1M to MU-5 or GEEC Code BS-20B to BS-21E are from the Mudiali Nature Park Aquaculture Ponds.
- The next 9 samples, from Sample Code 1 to 7B or GEEC Code BS-22E to BS-22I are from ponds in the heart of Asansol colliery belt in Bardhaman district.
- The next 6 samples, Code 8 to 13, are from the River Damodar in the vicinity of Durgapur Industrial Township.
- The next 12 samples, Codes 1F to 12F are from Farakka.
- The next 8 samples, Codes 1H to 10H, are from Haldia
- The next 6 samples, BJ-1 to BJ-7, are from Budge Budge.
- The next 7 samples, H-1 to H-6A, are from ponds in the Hugli District agricultural belt.

The Data

The tables show that 76 samples have been tested. As is evident 17 samples show Hg BDL, i.e. mercury below detection levels. 59 samples exhibit detectable levels of mercury.

The fourth column gives the AAS results indicated in µg / litre. Here BDL figures indicate mercury 'below detection level', but these do not necessarily mean 'no mercury'. They simply indicate that the AAS has been unable to find detectable levels within the range of instrumental precision. Any values below 1 µg / litre have been indicated as BDL. But now it is important to find out how BDL values translate to the values of mercury contamination in the sixth column.

The figures for the Digha catch. We see that the 'blank' for the Digha samples gives a value 13.43 µg/litre. This means when the 'blank' sample was subjected to spectrophotometric analysis in an AAS the latter yielded this value for the 'blank' sample.

Now let us take the sample BS-01. Here we find that the proportion of mercury detected in the sample is 34.36 µg/litre. Now we must deduct the 'blank' value from this. We get 20.93 µg/litre. It is this value that is truly pertinent in our investigation. And it is this value that leads to the mercury value that is given in mg/Kg, which is 0.1939 mg/Kg in the case of this sample.

The method is as follows. The quantity of the digested solution was 50 ml. It was this solution that was subjected to spectrophotometric analysis and yielded the value 34.36 µg/litre. And having deducted the 'blank' value from this one gets 20.93 µg/litre, as mentioned above, and this can be taken to represent the correct proportion of mercury in the solution.

Now if the proportion of mercury in a 50 ml sample is 20.93 µg/litre, then the actual amount of mercury in the solution would be $1/20^{th}$ of 20.93 µg (this is because 50 ml is $1/20^{th}$ of 1 litre). This works out to be 1.0465 µg.

Now we must look at another figure. The quantity of the tissue sample taken from BS-01 for dilation and subsequent testing is shown in the report. It is 5.397 gm.

Therefore 5.397 gm yields → 1.0465 µg of mercury. Therefore 1 Kg (1000 gm) will yield (1000/5.397) x 1.0465 = 193.9 µg of mercury. Converting to milligrams we get 0.1939 mg.

Therefore the level of mercury contamination is 0.1939 mg/Kg.

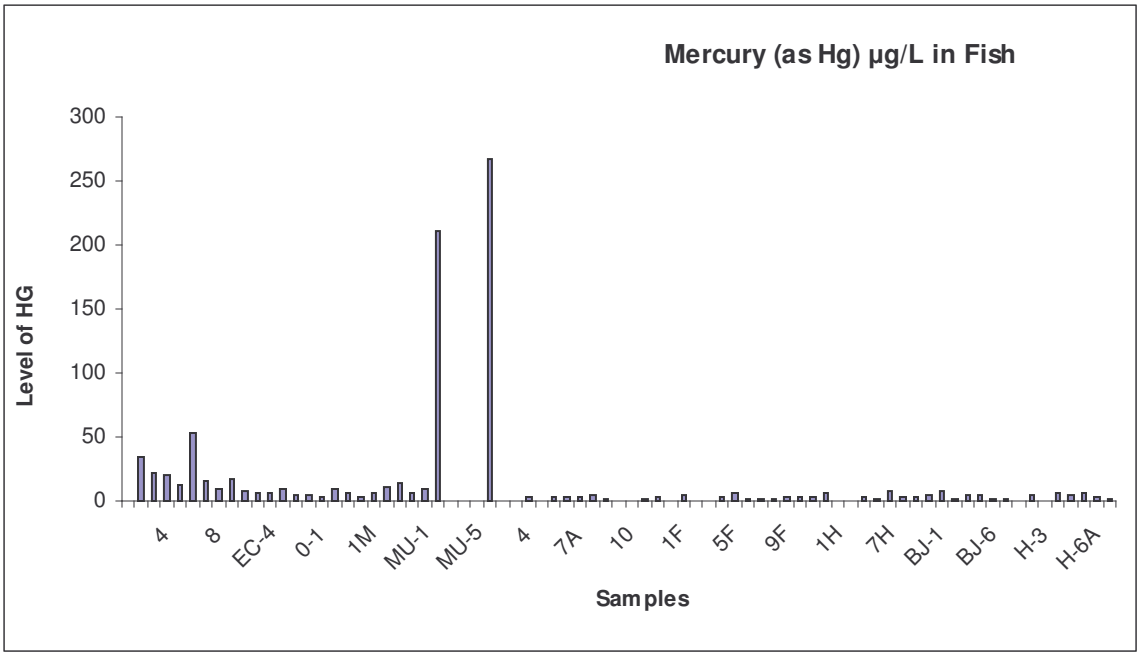
Only in the case of the Digha samples was the solution volume taken as 50 ml. In the case of all other samples 100 ml samples were prepared. Therefore in undertaking computation of other samples one must compute on the basis of 100 ml.

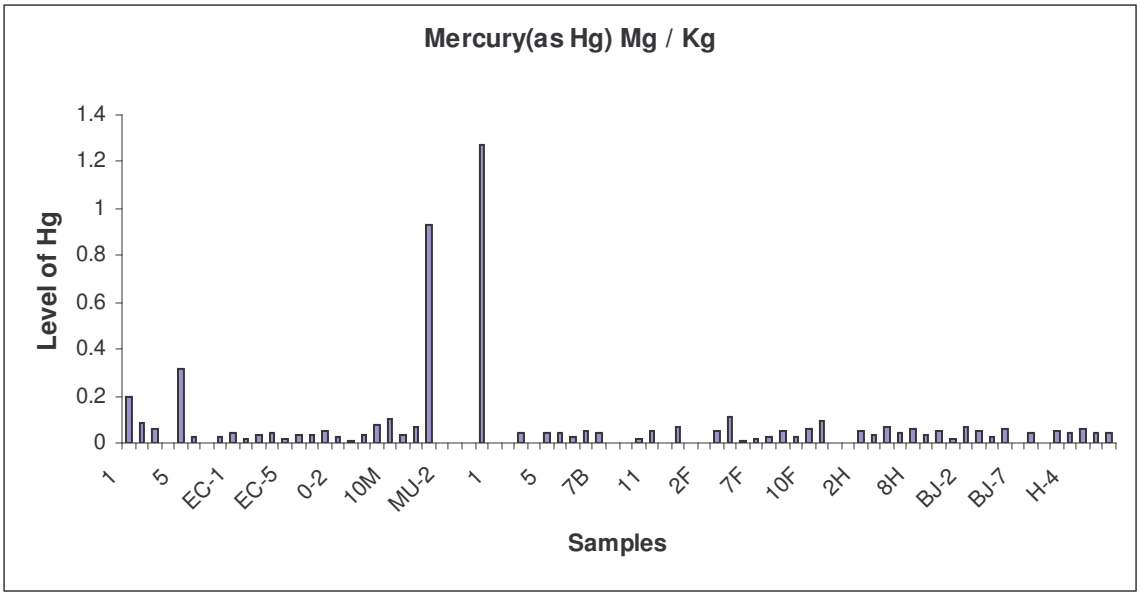
Thus we should take another instance from the other samples to find if the above calculation works out.

Let us take the last sample, Sample Code H-6A, collected from Hugli District. Here the AAS value is 2.08 µg/litre. The 'blank' value is BDL therefore the subtraction is not called for and we can straightaway take the 2.08 µg /litre as indicative of the mercury level. Since 100 ml sample was prepared the amount of mercury in the sample would be 2.08 / 10 = .208 µg. The tissue amount is 5.2574 gm. Therefore 1 Kg of tissue would be expected to yield (1000/ 5.2574)*0.208 = 39.5633 µg. Converting to milligrams we have 0.0396 milligrams (rounded to the fourth decimal place). Therefore the mercury level is 0.0396mg / Kg and that is exactly what is shown in the sixth column.

D. Analysis of Result

The key aspect of understanding the result is to appreciate that the study has impressive sample spread. Some 44 species, mostly finfish and some crustaceans, have been collected as samples from different parts of West Bengal and tested for mercury. But on the other hand, with one or two exceptions, only one species per locale has been sampled. Therefore, the study lacks depth. Moreover, once the locale and the species to be collected had been decided upon, the collection has generally been random – fish brought in by the fishers were simply taken in without much premeditation.





The number of samples per species per locale tested is simply inadequate for diagnosing a pattern of mercury levels for different species. A careful look at the results will show that occasionally samples that one would expect to have relatively lower levels have higher and vice versa. It is understandable that mercury levels will vary with locale due to specificities of local conditions. But in a particular locale one expects a certain pattern – one expects that predators/carnivores will have higher levels of mercury than herbivores or omnivores, because of biomagnification. But we see for example in the Mudiali catch, Sample no. 5M, which is a persistent carnivore, has considerably lower mercury level than Sample No. 1M – which is omnivorous, having no obsessive interest in a carnivorous repast. And what is really perplexing is that Sample no. 10M, which is essentially an herbivore and is from the same locale, has a much higher value than either. This however, should not be taken as an argument against biomagnification moving up trophic levels, but rather that more samples of each species need to be tested for an identifiable species-contamination pattern to emerge.

Another difficulty is the randomness that we have just mentioned. Whatever was brought in by the fisher was taken in. However, we know that that as methylmercury is excreted very slowly, it tends to bioaccumulate in the body of an organism over time and older fish will tend to show higher mercury levels than juveniles. So it is not at all surprising that an adult herbivore or omnivore might show higher mercury level than a small juvenile carnivore. Therefore in order to arrive at a species-contamination comparison chart one must compare, as far as possible, adults of all species. In such a procedure the collection pattern cannot be random as has been in the case in this study.

But randomness, notwithstanding its shortcomings, has its virtues. The random nature of fish collection in this study actually represents, to some extent at least, the randomness of actual fishing and fish sale. For, it is not only adult and much older fish that are caught and are consumed. Juveniles and younger fish find their into people's stomach. So if the study samples are populated by a large number of younger fish then it is what makes the study more representative of what people actually eat.

Therefore the study, notwithstanding the fact that it is far from being comprehensive, is indicative. And hence an analysis of its results should prove valuable.

Outcomes

The reference dose suggested by the Environment Protection Agency (EPA) of the United States of America was taken as criteria for analysis.

In 1997 the EPA recommended a "reference dose" of 0.1 micrograms of methylmercury per kilogram of body weight per day (0.1 μg/kg/day) in their *Mercury Study Report to Congress* (EPA, 1997). In 2000 the National Research Council (NRC), at the request of Congress, thoroughly studied the issue of methylmercury and confirmed the EPA's reference dose of 0.1 μg/kg/day as "scientifically justifiable for the protection of public health" in their report *Toxicological Effects of Methylmercury* (NRC, 2000). Public health organizations and environmental groups have pressed for the more protective EPA level, with effective enforcement. Some, after conducting their own studies, have recommended even lower levels. On the other hand, industry groups prefer higher levels, strenuously resisting any move to make the EPA level enforceable. In this study we have seen it fit to accept the level advised by the US EPA, and supported by the US NRC, to be one that should be used in evaluating the threat posed by mercury in fish.

Now that we have a criterion, we must find out how far the fish that have been tested could be considered dangerous to human health. One look at the EPA criterion shows that in order to do so, we have to first estimate how much methylmercury is likely to be there in the fish that have been tested.

But the testing was for total mercury in the fish flesh and not methylmercury. However, we know that the bulk of the mercury in fish is methylmercury. Studies have shown that while the proportion may vary, very often the proportion is well above 90%, and easily above 80%. Therefore to take a conservative estimate of 75% is good enough, and 90% is also a very likely proportion. We have used both these proportions in evaluating our results.

The next thing that has to be done is to estimate how much fish is actually eaten. West Bengal is a fish eating State and fish is considered to be an essential component of the diet by the overwhelming proportion of Bengalis. Children are encouraged to take fish so as to help them grow in body and mind. And this is more so in coastal villages and villages close to large water bodies like rivers, lakes or large ponds, where fish is easy to come by and meat something of a rarity. So consuming 100 gm fish in a single day is by no means unusual for a Bengali. In this study we have tried to assess health impact on the basis of an average 100 gm daily fish diet.

The next item to consider in employing the EPA criterion is the fish eater's body weight. The average weight of the adult Indian woman is less than 50 Kg and 35 Kg would represent the weight of the average Indian 10 year old. For a 50 Kg person the recommended average daily intake on the basis of the EPA criterion should not exceed 5 μg and for a 35 Kg child the recommended average daily intake should not exceed 3.5 μg. (This is simply arrived at by multiplying 0.1 μg / Kg with the body weight.)

The total mercury levels in mg / Kg for each fish sample was first converted into mercury levels μg / Kg of fish flesh (multiplying by 1000).

Then the figure of total mercury in 100 gm of flesh tissue for each sample was found by simply dividing the above result by 10.

i. Now given the amount of total mercury, the amount of methylmercury in 100 gm of each sample fish was estimated at 75% of the total mercury
ii. A similar estimate was made for 90% proportion of methylmercury
iii. Now it was estimated whether or not the above values exceeded the recommended dose for a 50 Kg person and a 30 Kg child.

The figures for i, ii and iii above are shown in the following table (Table 2)

Table 2: Sample wise levels of Hg

GEEC Code	MeHg at 75%			MeHg at 90%		
	MeHg at 75%	Reference dose of MeHg for a Person weighing 50 Kgs (5 μg)	Reference dose of MeHg for a Person weighing 35 Kgs (3.5 μg)	MeHg at 90%	Reference dose of MeHg for a Person weighing 50 Kgs (5 μg)	Reference dose of MeHg for a Person weighing 35 Kgs (3.5 μg)
BS-01	14.5425	Exceeded	Exceeded	17.451	Exceeded	Exceeded
BS-02	6.33	Exceeded	Exceeded	7.596	Exceeded	Exceeded
BS-03	4.275		Exceeded	5.13	Exceeded	Exceeded
BS-04	0			0		

BS-05	23.475	Exceeded	Exceeded	28.17	Exceeded	Exceeded
BS-06	1.95			2.34		
BS-07	0			0		
BS-08	2.2125			2.655		
BS-09	3.195			3.834		Exceeded
BS-10	1.41			1.692		
BS-11	2.6025			3.123		
BS-12	3.2175			3.861		Exceeded
BS-13	1.41			1.692		
BS-14	2.7975			3.357		
BS-16	2.3175			2.781		
BS-17	3.795		Exceeded	4.554		Exceeded
BS-18	1.965			2.358		
BS-19	0.33			0.396		
BS-20A	2.7			3.24		
BS-20B	5.8125	Exceeded	Exceeded	6.975	Exceeded	Exceeded
BS-20C	7.8225	Exceeded	Exceeded	9.387	Exceeded	Exceeded
BS-20D	2.25			2.7		
BS-20E	4.9875		Exceeded	5.985	Exceeded	Exceeded
BS-21A	69.945	Exceeded	Exceeded	83.934	Exceeded	Exceeded
BS-21B	0			0		
BS-21C	0			0		
BS-21D	0			0		
BS-21E	95.28	Exceeded	Exceeded	114.336	Exceeded	Exceeded
BS-22E	0			0		
BS-22D	0			0		
BS-22C	2.8875			3.465		
BS-22A	0			0		
BS-22F	3.3525			4.023		Exceeded

BS-22G	3.2775			3.933		Exceeded
BS-22B	2.2125			2.655		
BS-22H	4.0275		Exceeded	4.833		Exceeded
BS-22I	3.105			3.726		Exceeded
BS-22J	0			0		
BS-22L	0			0		
BS-22N	1.5075			1.809		
BS-22O	3.93		Exceeded	4.716		Exceeded
BS-22M	0			0		
BS-22K	5.1525	Exceeded	Exceeded	6.183	Exceeded	Exceeded
BS-23B	0			0		
BS-23E	0			0		
BS-23L	4.0575		Exceeded	4.869		Exceeded
BS-23I	8.265	Exceeded	Exceeded	9.918	Exceeded	Exceeded
BS-23C	0.81			0.972		
BS-23A	1.56			1.872		
BS-23D	1.635			1.962		
BS-23G	3.9675		Exceeded	4.761		Exceeded
BS-23K	2.13			2.556		
BS-23J	4.23		Exceeded	5.076	Exceeded	Exceeded
BS-23F	6.9225	Exceeded	Exceeded	8.307	Exceeded	Exceeded
BS-23H	0			0		
BS-24H	0			0		
BS-24E	3.945		Exceeded	4.734		Exceeded
BS-24A	2.64			3.168		
BS-24B	5.085	Exceeded	Exceeded	6.102	Exceeded	Exceeded
BS-24F	2.94			3.528		Exceeded
BS-24G	4.4625		Exceeded	5.355	Exceeded	Exceeded
BS-24D	2.43			2.916		

BS-24C	4.11		Exceeded	4.932		Exceeded
BS-25A	1.5825			1.899		
BS-25B	5.4075	Exceeded	Exceeded	6.489	Exceeded	Exceeded
BS-25C	4.0125		Exceeded	4.815		Exceeded
BS-27A	1.65			1.98		
BS-27B	4.1625		Exceeded	4.995		Exceeded
BS-27C	0			0		
BS-26A	3.495			4.194		Exceeded
BS-26B	0			0		
BS-26C	4.1175		Exceeded	4.941		Exceeded
BS-26D	3.4875			4.185		Exceeded
BS-26E	4.605		Exceeded	5.526	Exceeded	Exceeded
BS-26F	3.2475			3.897		Exceeded
BS-26G	2.97			3.564		Exceeded

At methylmercury proportion of 75% and 100 mg of daily intake 12 samples tested above the recommended dose for a person of 50 Kg and 27 samples tested above the recommended dose for a young person of 35 Kg.

At methylmercury proportion of 90% and 100 mg of daily intake 17 samples tested above the recommended dose for a person of 50 Kg and 37 samples tested above the recommended dose for a young person of 35 Kg.

As no one eats a single variety all the time it was considered useful to compute the average for each locality.

Table 3: Daily intake of fish in sample locations

	Average for 100 gm daily fish intake		
Locality	Total Hg	MeHg at 75%	MeHg at 90%
Digha	8.798	6.599	7.918
East Kolkata Wetlands	3.071	2.303	2.764
Mudiali	25.172	18.879	22.655
Farakka	3.730	2.798	3.357
Bardhaman District as a whole	2.617	1.963	2.355
Hugli	4.175	3.131	3.758
Budge Budge	3.736	2.802	3.362
Haldia	4.268	3.201	3.841

The figures are self-explanatory and it can be readily seen that the averages are high for people with lesser body weights, mainly children and young adolescents.

Conclusion

The figures for Mudiali are drastically high, far higher than figures from other localities. However, a little scrutiny will show that this is the result of the exceedingly high figures of just two samples, MU-1 and MU-5. Are these two figures just an aberration or do they indicate something significant? The two fish concerned are both that have carnivorous propensities and both have an affinity for the lower depths of the water body. But whether this alone can explain the findings is hard to tell. A more comprehensive testing of the fish from the locale is called for.

What explains the relatively high figure for samples from the agricultural belt of the Hugli district? It may be noted that Hugli competes on almost equal terms with the figures from Haldia (an estuarine area in the vicinity of an industrial conclave). Are there mercury components in the agricultural inputs used that would explain these high figures? More mercury contamination studies and comprehensive investigation into this question is required.

Awareness on Mercury By Disha

DISHA has been undertaking campaign activities on mercury hazard and safety since 2005. One of the major tasks undertaken in 2005 was a survey of 5 schools and 5 colleges regarding mercury awareness and mercury safety standards. The survey report, which tended to indicate alarming lack of awareness and low mercury safety standards, was published and circulated. DISHA also undertook campaign activities to raise mercury awareness.

In 2007, with the support of this grant DISHA undertook a follow up survey in the same schools and colleges. It was seen from the survey that generally there has been no substantial change in the safety protocols although there has been some increase in awareness. The recent survey also indicated that the institutions have received no instructions/recommendations/guidelines regarding mercury use from any Quarter – Universities, Boards, Dept. of Environment or the State Pollution Control Board.

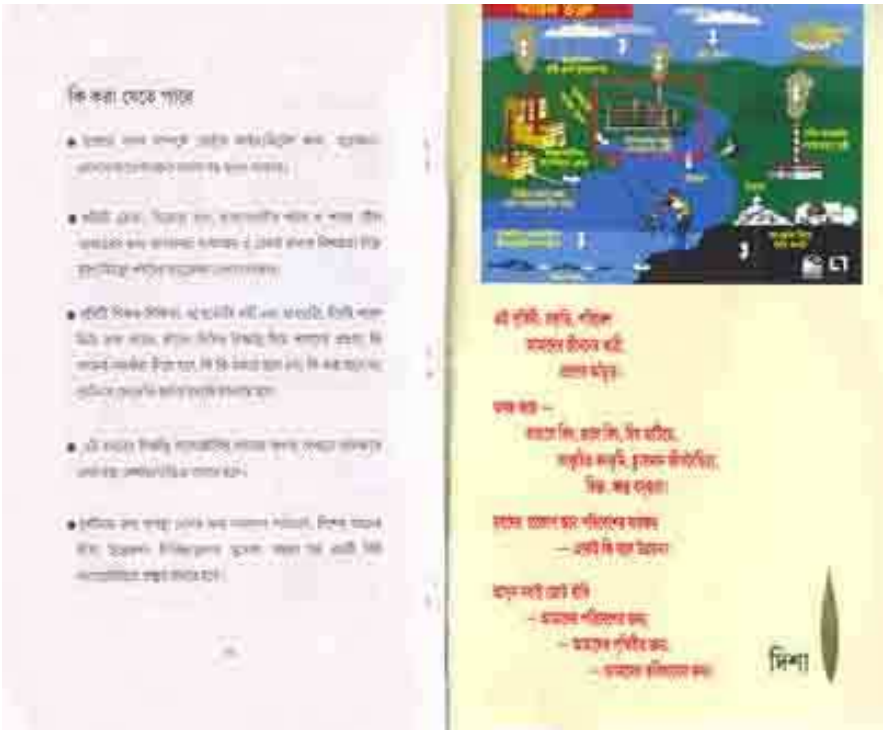
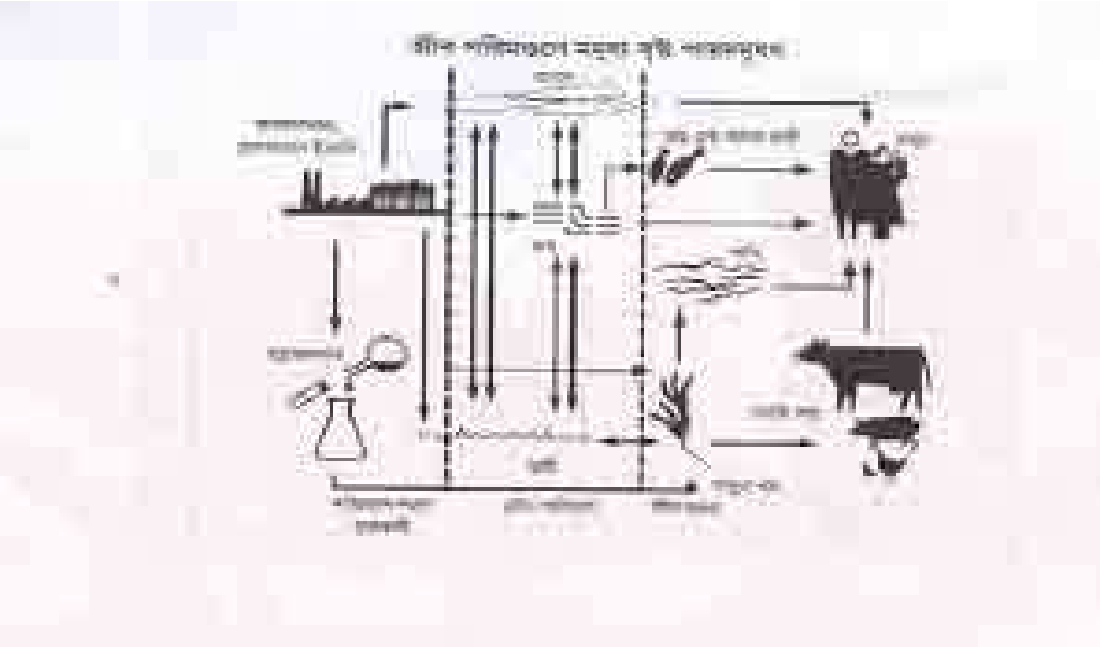


Photo: Description of Mercury Cycle in Bengali



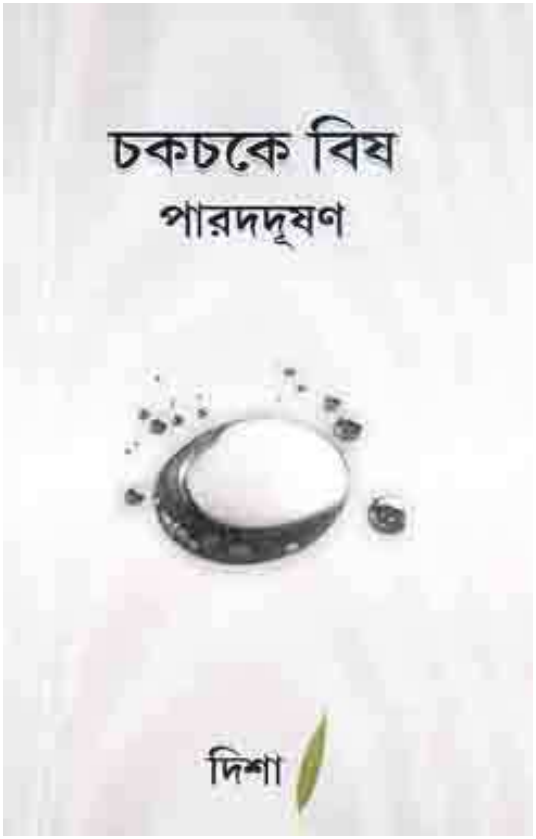


Photo: Front Page of Source book on Mercury in Bengali

DISHA is in the process of communicating with all the authorities mentioned on this matter. DISHA also brought out source book in Bengali language for the fish eating community of west Bengal. This was the first of its kind of reading material in Bengali. This material was widely circulated to citizen groups, grass root ngo's in West Bengal.

III Other Parallel Activities

The organization continued its work for mercury substitution and replacement from health care. In 2007, major changes happened following the release of Hospital Ambient Air report. This report has not only generated lot of awareness in all the sections but also led to questions being raised on mercury usage and its effect on human health and environment in the Parliament of India..

Taking note of these and earlier findings, the government of Delhi in June 2007 took the major step ahead towards reduction of mercury waste from health care. In July-August 2007, the health department of Delhi government released an order that stopped any further purchase of mercury containing measuring equipments by all the government hospital in Delhi.

In September 2007, Toxics Link organized first conference on mercury in India. The Conference focussed on all the sectors that use mercury. It had participation of senior government officials from Ministry of Environment and Forest, Department of Health, Delhi government, Universities, environment institutions and large number of NGOs from across the country. The Conference was huge success in terms of both its outreach and content. As a major outcome of it has seen formation of Mercury- Free Health Care group by health care professionals and Mercury Free India group by civil society members. The conference also led to the decision taken by BIS for the labeling of Fluorescent lamps and bulbs.

Policy initiatives on Mercury under National Rural Health Mission: Toxics Link as part of the Infection Control and Waste management Committee under Ministry of health, Government of India has actively advocated the inclusion of mercury and its management in the policy framework and guidelines. Due to its efforts Mercury Management has been incorporated in these guidelines. The policy framework has been published and is communicated to all the states under National Rural Health Mission. These guidelines are to be placed in whole chain of health system (from District Hospital to Sub Centre). The respective state will adopt and train their health care personnel in the coming year.

Toxics Link has conducted awareness in schools, among policy persons and communities on the issue of mercury. It has conducted parents and teachers training programme for shift to mercury alternatives at household levels. Based on these efforts, the Government of Delhi had invited it to submit proposal for mercury awareness in schools under Delhi government.

In last two years, the organization has conducted ten regional level workshops across the country and through these workshops it has trained and oriented more that 400 individuals from 26 states, on the issue of medical waste and mercury in health care.

Toxics Link, through its strong collaboration with some of the large professional bodies, has conducted training and awareness on mercury in health care. It has organized various training programmes for nurses from TNAI (Trained Nurses Association of India) and Hospitals of CMAI (Christian medical Association of India), which is amongst the largest association of 500 hospitals in the country. The organisation also shares a good relation with IMA (Indian Medical Association) and IDA (Indian Dental Association) and has conducted various sessions on mercury with them.

Report Release

Mercury in Hospital Ambient Air: Staff and Patients at Risk

Films and Animations

1. Mercury: No Silver Lining

2. Animation on Mercury Spill Management as training tool for Nurses

IV Successes and Failures

We have evaluated the project on the basis of three major areas

1. Media Coverage
2. Citizen Awareness
3. Taking issue at Policy Level

The issue of mercury was widely covered by the media. Over the period of last three years the issue of mercury was highlighted widely in the media. In this year the issue of mercury in health care and CFl was widely discussed and published by the media. All these coverage's are direct campaign of Toxics Link. Toxics Link at its various platform has addressed the issue of mercury. In last one and half year.

Due to its awareness at various levels we have received various queries on from across the country. In 2007, we have received many questions on mercury related issues. These web queries are strong indication of rising awareness levels across the country among variety of population. Some of the examples of these queries are given below, text in bold indicate the date of query received:

a. Mercury levels in indian rivers. **on 5 Jun 2007**

b. Research results done about mercury by toxics link

c. Anything about indian mercury disasters

d. What should one do with used CFL.? **On 12 Jun 2007**

e. Delhi Governement has no clear policy about disposal of used cfl. in such a scenario what should a person do while disposing used CFLs? Is there any safe method? **On 14 Oct 2007**

f. Decide whether to use CFL or not? **On 14 Oct 2007**

g. If there is some safe way then may be I would switch to using CFLs. **On 5 Sep 2007**

h. Over a few months, state electricity companies and Green Peace have been campaigning the use of CFL bulbs in residences. Meantime, some reports in media have also highlighted the alarming mercury level in these bulbs. Will you please tell me the level of mercury in these bulbs and also measures to tackle it? **On 30 Aug 2007**

i. Broken Thermometre: We have carefully gathered the mercury and sealed it in plastic bags. how do we dispose of it. Also we used an incadescent bulb to locate the mercury balls, is this going to harm us? **On 21 Jul 2007**

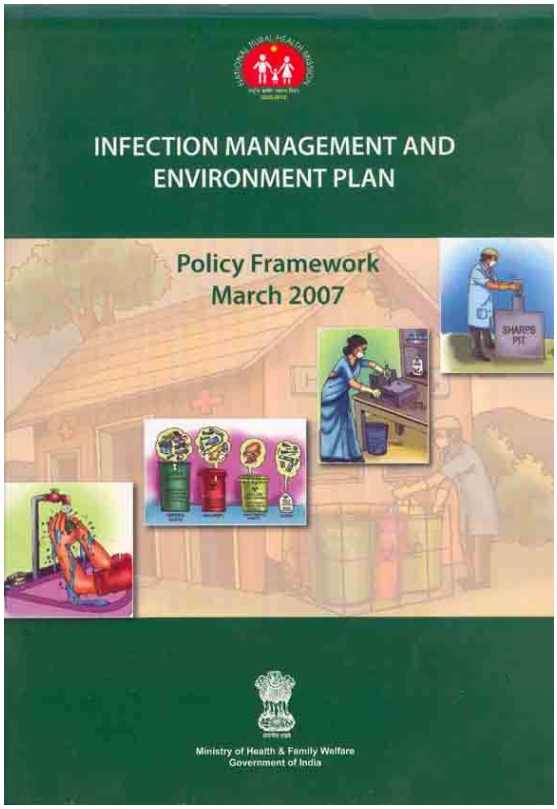
j. Research on mercury & aluminum poisoning in India**:** Is there any research on mercury and aluminum poisoning conducted by any laboratory in India? I would like to know about both ethyl and methyl mercury. **On 3 Jul 2007**

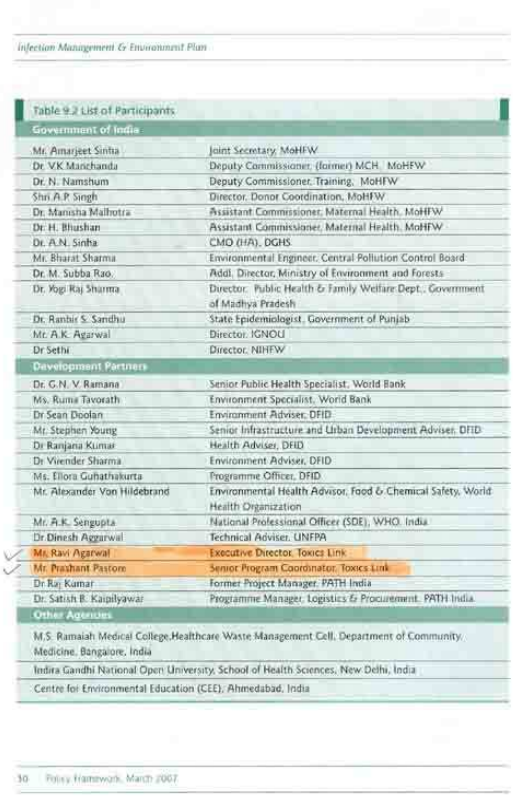
k. Parad shivlangam**:** how do we know that any particular said parad shivlingum is actually made of parad & also if we have it at home how do we make sure that its use is nontoxic (while pooja we touch it is it safe?) etc. **on 23 March 2007**

l. **Mercury spill:** A blood pressure device with mercury broke in one of our rooms. We tried to collect as much as we can and have stored the same in sealed plastic bags. What can we do with the bags? Are there any agencies that can professionally clean that room? **On 21 Feb 2007**

m. Mercury spill**:** We had a bit of a spill with a BP Machine in our bedroom this saturday. The mercury that spilt evaporated and has left behind a strong odour in the room, we need your help for a professional clean up of the room as my mother is also a cancer patient. Can you please advise and help us? **On 23 July 2007**

Our work has also led to changes at Policy level. One of the strong policy recognition of mercury by the ministry of health and family welfare by including mercury spill management in its policy document and subsequently in primary health care module.





Infection Management & Environment Plan

Table 9.2 List of Participants

Government of India	
Mr. Amarjeet Sinha	Joint Secretary, MoHFW
Dr. V.K.Manchanda	Deputy Commissioner, (former) MCH, MoHFW
Dr. N. Namshum	Deputy Commissioner, Training, MoHFW
Shri A.P. Singh	Director, Donor Coordination, MoHFW
Dr. Manisha Malhotra	Assistant Commissioner, Maternal Health, MoHFW
Dr. H. Bhushan	Assistant Commissioner, Maternal Health, MoHFW
Dr. A.N. Sinha	CMO (HA), DGHS
Mr. Bharat Sharma	Environmental Engineer, Central Pollution Control Board
Dr. M. Subba Rao.	Addl. Director, Ministry of Environment and Forests
Dr. Yogi Raj Sharma	Director, Public Health & Family Welfare Dept., Government of Madhya Pradesh
Dr. Ranbir S. Sandhu	State Epidemiologist, Government of Punjab
Mr. A.K. Agarwal	Director, IGNOU
Dr Sethi	Director, NIHFW
Development Partners	
Dr. G.N. V. Ramana	Senior Public Health Specialist, World Bank
Ms. Ruma Tavorath	Environment Specialist, World Bank
Dr Sean Doolan	Environment Adviser, DFID
Mr. Stephen Young	Senior Infrastructure and Urban Development Adviser, DFID
Dr Ranjana Kumar	Health Adviser, DFID
Dr Virender Sharma	Environment Adviser, DFID
Ms. Ellora Guhathakurta	Programme Officer, DFID
Mr. Alexander Von Hildebrand	Environmental Health Advisor, Food & Chemical Safety, World Health Organization
Mr. A.K. Sengupta	National Professional Officer (SDE), WHO, India
Dr Dinesh Aggarwal	Technical Adviser, UNFPA
Mr. Ravi Agarwal	Executive Director, Toxics Link
Mr. Prashant Pastore	Senior Program Coordinator, Toxics Link
Dr Raj Kumar	Former Project Manager, PATH India
Dr. Satish B. Kaipilyawar	Programme Manager, Logistics & Procurement, PATH India.
Other Agencies	
M.S. Ramaiah Medical College,Healthcare Waste Management Cell, Department of Community Medicine, Bangalore, India	
Indira Gandhi National Open University, School of Health Sciences, New Delhi, India	
Centre for Environmental Education (CEE), Ahmedabad, India	

Photo: (on left) Cover page of national policy on Infection management and Environment plan (on right) highlighted names members of Toxics Link as part of working group

2.7 Mercury Spills

Mercury is a hazardous chemical used in different instruments like thermometers and blood pressure instruments within the health care facilities. It has to be managed properly to ensure it does not cause harm to the health care workers and the community at large.

Do's

1. Always wear personal protective gears like gloves and masks while handling mercury spills from breaking of thermometers or leaking blood pressure equipments.
2. Always collect mercury droplets together by using two cardboard pieces.
3. Drop the collected mercury into a bottle having some water. Tightly cover the bottle's lid.
4. Send the bottle containing mercury back to the stores.

Don'ts

1. Never touch the mercury with bare hands.
2. Never throw the mercury in waste bins or drain.

Photo: Included chapter on mercury spill management in national guidelines

V. Other Relevant Material Produced

Toxics Link has done various press and report releases in the year 2006-207. Please follow the links to see the full press release.

• Mercury in measuring devices will soon be history in Europe!
New Delhi, 16/07/2007
By Toxics Link
In a major breakthrough for anti-mercury campaigners across the globe, particularly in Europe, it is now official that mercury-based barometers will be on the list of banned products that contain the deadly neurotoxin, in the backdrop of the recent European Parliament vote seeking to place a complete ban on its trade by 2010.

• EU parliament's resolution on banning Mercury trade welcomed
Toxics Link calls for Indian Government to take stock
New Delhi, 22/06/2007
By Toxics Link
Hailing the passing of a resolution to ban mercury trade by the European Union Parliament, Delhi-based Toxics Link has urged the Indian Government to take a cue from the move against the lethal heavy metal by banning its import and phasing out its usage in the country.

• Stop it and store it! EU must safely manage excess mercury
New Delhi, 12/06/2007
By Toxics Link
Anti-mercury campaigners throughout Europe urged EU leaders to ensure excess mercury is held in secure, constantly monitored sites. The European Commission will give its opinion on amendments proposed by the European Parliament's Environment Committee, before Parliament votes on the issue on June 19-20, 2007.

• India to demand international ban on mercury trade at UNEP meet in Nairobi
New Delhi, 02/02/2007
By Toxics Link
Toxics Link will call upon governments across the globe to place a ban on mercury exports in a bid to check increasing mercury pollution at the 24th United Nations Environment Programme Governing Council meeting to be held from February 5-9, 2007.

• Mercury in hospitals may be poisoning medicos and patients: Says new study by Toxics Link
New Delhi, 10/01/2007
By Toxics Link
High level of mercury, has been found in the indoor air of selected hospitals, hinting at persistent exposure of healthcare staff and those visiting such facilities, according to a new research released by Delhi-based environmental group Toxics Link.

• Mercury Present In Parad Shivlings, Says Environment Group; Questions Minister's Denial In Parliament
New Delhi, 02/08/2006
By Toxics Link
The State Minister for Environment and Forests has stated that there is no 'conclusive evidence' for establishing the claim for presence of high content of mercury in Parad Shivling placing question mark on adoption of policy against mercury in India.

V. Financial Report

Utilisation of funds from European Environmental Bureau towards the project titled:-

Addressing Gaps for Policy Initiative towards Reduction of Mercury Contamination Sources in India in association with Indian Partner Organisations

.

Period:- 1/8/06 to 31/3/07

Description	Budget (Rs.)	Expenditure (Rs.)	Balance (Rs.)
Project 1	125,000	13,350	111,650
Project 2	81,000	81,000	-
Project 3	150,000	125,000	25,000*
Project 4*	100,000	-	100,000
TOTAL	**456,000**	**219,350**	**236,650**

The unspent amount under project four, which is for the consultative meeting, is carried forward to the phase three.