

The Kolkata Metropolitan Area: Probing For Four Toxic Metals in Drinking Water

PROJECT REPORT
(Project Supported by EEJP)

Society for Direct Initiative for Social and Health Action (DISHA)

30.04.2011

Project Team

Dr. Santanu Chacraverti

Mr. Bidhan Chandra Dey

Mr. Swapan Mallick

Mr. Rakesh Ghosh

Mr. Salim Mallick

Mr. Subimal Chatterjee

Office Support

Mr. Manas Ranjan Maity

Former Researcher

All India Institute of Hygiene and Public Health

Sampling Consultant

Others who contributed with their valuable suggestions:

Professor Rabindranath Majumdar

Department of Chemical Technology, University of Calcutta

Professor Swapan Sarkar

Former Research Officer

All India Institute of Hygiene and Public Health

Report Prepared by:

Dr. Santanu Chacraverti

CONTENTS

<u>Topics</u>	<u>Pg</u>
Executive Summary	4
Section A: Study Objectives	9
Section B: Project Planning	10
Section C: The Project in Action	14
I. Preparation	14
II. Actual Sampling & Transfer to Laboratory	15
Section D: Approaching the Laboratory Findings	21
Section E: The Results	29
Section F: Understanding the Results	45
Section G: Study Implications	101
Section H: Recapitulation	102
Recommendation	106
Appendix I: First Phase Collection	107
Appendix II: Second Phase Collection	133
Notes and References	159

THE MORE IMPORTANT TABLES

Table 1: Hooghly Site Collection Points	11
Table 2: KMA Tubewells Collection Points	11
Table 3: Hooghly Site Collection Points	12
Table 4: Area Indicators in the Sample Codes	16
Table 7: Metal Contaminants in Water	24
Table 8: Drinking water standard for four metals	26
Table 9: Detection Limit Set for the ICP-OES	27
Table 10: The Results	29
Table 11: Exceedance of Standards	45
Table 12: Result Analysis, Data sorted by Metal	70
Table 13: Number of Samples showing detection	89
Table 15: The Degree of Exceedance of Lead	90
Table 16: River Water Samples' Result for Lead	90
Table 18: The Degree of Exceedance of Lead in River Water Samples	92
Table 20: Number of D. Water Samples showing Exceedance for Lead	94
Table 21: The Degree of Exceedance for Lead in D. Water Samples	94

EXECUTIVE SUMMARY

I. STUDY OBJECTIVES

The aims of the present project were as follows:

- i. Testing for mercury, lead, cadmium and chromium in samples taken from tubewells and taps at different sites in the Kolkata Metropolitan Area (KMA), from the northernmost to the southernmost tip, on both banks of the river, once during the dry season and again during the wet season.
- ii. Also testing for mercury, lead, cadmium and chromium in the Hooghly water collected from different points along the entire North-South stretch of the KMA, during both the dry and wet seasons, in order to get an idea of the contamination background.
- iii. Assessing the degree of contamination in drinking water by comparing the above results to Indian and international drinking water quality standards – specifically BIS (IS: 10500: 1991), WHO and EPA.

And to present a comprehensive narrative on the basis of the above, which would be useful for civil society initiative, research and policy making.

II. THE PROJECT IN ACTION

(i) SAMPLING

The sampling was done twice.

The first phase of sampling was undertaken during the dry season of 2010, between 30th of March and 26th of April, dates inclusive.

The second phase of sampling was undertaken in the immediate post-monsoon situation, between 19th of October and 2nd of November, dates inclusive.

The pattern and details of sampling in the Second Phase, in all its fundamental features, followed almost exactly the contours of the first phase.

During each phase:

A total of 56 water samples were collected.

Of these 56 samples, 8 samples were taken from 4 locales on the river Hooghly.

48 samples of drinking water were taken.

Of these 48 samples 39 samples were of ground water – private or public tubewells or municipal supply.

Another 9 samples were drinking water samples of surface (Hooghly) water, supplied by Municipal services.

(ii) SAMPLE PRESERVATION AND TRANSFERRING THE SAMPLES TO THE LABORATORY

The methods and protocols delineated in APHA 21st Edition were followed in preservation and transfer of the samples to the laboratory. Either the samples were transferred to the laboratory on the very date on which they were collected, or, if that was not possible, were held in refrigeration. In no circumstance were any of the samples submitted to the laboratory more than 72 hours after the sampling had been done.

(iii) IN THE LABORATORY

All samples were sent to SGS India Private Limited, Behala, Kolkata, an NABL accredited laboratory with CPCB and WBPCB certification, for the analysis of metal concentration in the water samples. The total mercury concentration was determined using Inductively Coupled Plasma-Optical Emission Spectrophotometry (ICP-OES), as per procedures suggested in APHA 21st Edition.

(iv) THE RESULTS

The following table shows the detection scenario of the four metals over the two phases:

TABLE E1: THE NUMBER OF SAMPLES SHOWING DETECTION OF EACH OF THE CONTAMINANTS

Metals	All samples			River water Samples			Drinking Water Samples		
	No. of Samples	No. of Detections		No. of Samples	No. of Detections		No. of Samples	No. of Detections	
		First Phase	Second Phase		First Phase	Second Phase		First Phase	Second Phase
Cd	56	0	0	8	0	0	48	0	0
Cr	56	3	7	8	3	6	48	0	1
Pb	56	51	56	8	8	8	48	43	48
Hg	56	0	3	8	0	1	48	0	2

The above data indicates that detections for Cadmium, Chromium and Mercury are few and far between. In fact, these metals have almost wholly been detected in River Water Samples, with no detection in drinking water samples during the first phase and only two drinking water samples showing mercury and one showing chromium during the second phase. However none of these samples showing detection show exceedance of national or international standards.

However lead has been detected in an overwhelmingly large proportion of the samples. The number of laboratory results for lead in the different water samples exhibiting exceedance from the three criteria under consideration is displayed in the table below.

TABLE E2 NUMBER OF WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb) [NO. OF SAMPLES = 56]

STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	35	40
EPA	31	38
BIS	4	1

TABLE E3 NUMBER OF RIVER WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb)

NUMBER OF SAMPLES = 8

STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	5	7
EPA	5	6
BIS	0	0

Now we must concentrate on the results for lead in the drinking water samples. This has been summed up as follows:

FOR THE FIRST PHASE

DETECTION: Lead has been detected in 43 out of 48 samples.

WHO GUIDELINE for Lead: The number of samples showing exceedance of WHO guidelines was 30. Out of these 30 samples, lead values in 24 samples showed an exceedance of 100% or more. Out of those 24 samples, 15 samples show an exceedance of 200% or more. Of those 15 samples, 11 samples show an exceedance of 300% or more.

EPA MCL (Action Level for Lead): The number of samples showing exceedance of EPA MCL was 26. Out of these 26 samples, lead values in 15 samples showed an exceedance of hundred percent or more. Out of those 15 samples, 9 samples show an exceedance of 200 % or more and 4 samples show an exceedance of 300% or more.

BIS OR INDIAN STANDARD for lead: Only 4 samples showed exceedance of BIS. But in none of these samples the exceedance of lead either exceeded or was even equal to 100%.

The mean value of the samples was 0.0222 mg/l.

FOR THE SECOND PHASE

DETECTION: Lead has been detected in all the 48 samples tested.

WHO GUIDELINES: The number of samples showing exceedance of WHO guidelines was 33. Out of these 33 samples, lead values in 32 samples showed an exceedance of hundred percent or more. Out of those 32 samples, 14 samples show an exceedance of 200 % or more and 4 samples show an exceedance of 300% or more.

EPA MCL: The number of samples showing exceedance of EPA MCL was 32. Out of these 32 samples, lead values in 14 samples showed an exceedance of hundred percent or more. Out of those 14 samples, 2 samples show an exceedance of 200 % or more and 1 sample shows an exceedance of 300% or more.

BIS: Only 1 sample showed exceedance of BIS, and the exceedance was equal to 100% (See also Table 7, Serial No. 155, Column XIII).

The mean value of the samples was 0.0219 mg/l.

The dilution effect expected in the second phase was witnessed in the river water samples as follows:

TABLE C4 MEAN AND MEDIAN VALUES OF RIVER WATER SAMPLES

	FIRST PHASE (mg/l)	SECOND PHASE (mg/l)
ARITHMETIC MEAN	0.032	0.023
MEDIAN	0.038	0.020

The dilution effect on the contamination load is also seen in the surface water samples (basically Hooghly water) where the second phase shows a strikingly lower mean (and also median value).

TABLE C5 MEAN AND MEDIAN VALUES OF DRINKING WATER SAMPLES FROM SURFACE (RIVER) WATER SOURCE

	FIRST PHASE (mg/l)	SECOND PHASE (mg/l)
ARITHMETIC MEAN	0.0304	0.0166
MEDIAN	0.0300	0.0100

However the dilution effect is not witnessed in the ground water samples, where in fact the mean value for the second phase is very slightly higher than the mean value for the first phase – 0.0203 mg/l and 0.0231 mg/l respectively.

The explanatory hypothesis advanced to explain this fact is that:

The overwhelming majority of the samples have been collected from private or public tubewells that go deep underground, often to a depth of 600 ft. or more.

The lead contamination of groundwater at sufficient depths is rather low, as compared to surface water. Therefore the dilution of contamination caused by the result of increased volume of water in aquifers in the immediate post monsoon scenario is easily offset by any local factors – including the effect of a very hot summer, plus that of high temperatures prevailing during a rain deficient monsoon, on the lead in the plumbing.

Study Implications

We have seen that lead values have readily exceeded the WHO standard and a large number of samples have shown high degree of exceedance. This is however not merely the exceedance of an arbitrary value. For the WHO standard is based on the Provisional Tolerable Weekly Intake (PTWI) for lead and its exceedance is a serious issue, particularly for infants and children. And exceedance by 100% or more is a very serious health concern. It can be readily seen or easily shown that if a particular sample indicates an exceedance of $E\%$ above the WHO guideline value for lead, then drinking that water at rates normal for tropical India would lead to exceedance by *at least* $E\%$ of the PTWI.

The Question of Indian Standard

While a large number of drinking water samples showed massive exceedance of WHO and EPA standards for lead, the samples showing exceedance of BIS was 4 in the first phase only 1 in the second phase.

This of course results from the range of lead values and the fact that the BI Standard for lead in drinking water is pegged 400% above the WHO standard. This degree of difference is somewhat of an anomaly and is not noticed in the case of any other metal contaminant.

A four hundred percentage exceedance of the WHO standard is certainly an alarming state of affairs. For the WHO standard is based on lead PTWI and is therefore by no means an arbitrary figure. To uphold a drinking water standard far higher than the WHO guideline value can only be defended on the grounds that WHO's PTWI value or the associated reasoning is unacceptable. But one does not find that viewpoint argued in the official Indian pronouncements on drinking water.

However, apparently the revision of IS regarding lead is underway and the draft BIS, in circulation since 2009, *specifies the lead standard in drinking water as 0.01mg/litre and announces that beyond this concentration the water becomes toxic*. If one were to apply this draft BIS for lead then BIS exceedance for lead in our study would exactly mirror the WHO exceedance statistics. The implications are obvious.

Recommendation

The obvious recommendation at this point would be to bring the results of this study to concerned authorities and press for further investigation of lead in drinking water. The lead in the water must be tested at various points of the water supply vector. The CPCB and the State PCBs should be immediately lobbied to undertake such investigation in collaboration with independent scientists and civil society groups. And the results of the investigations should be made public. The next phase of action can only be worked out after we have the results of a comprehensive investigation in our hands.

SECTION A

STUDY OBJECTIVES

The aims of the present project were as follows:

- i. Testing for mercury, lead, cadmium and chromium in samples taken from tubewells and taps at different sites in the Kolkata Metropolitan Area (KMA), from the northernmost to the southernmost tip, on both banks of the river, once during the dry season and again during the wet season.
- ii. Also testing for mercury, lead, cadmium and chromium in the Hooghly water collected from different points along the entire North-South stretch of the KMA, during both the dry and wet seasons, in order to get an idea of the contamination background.
- iii. Assessing the degree of contamination in drinking water by comparing the above results to Indian and international drinking water quality standards – specifically BIS (IS: 10500: 1991), WHO and EPA.

And to present a comprehensive narrative on the basis of the above, which would be useful for civil society initiative, research and policy making.

SECTION B

PROJECT PLANNING

SELECTING THE LAB AND PLANNING TESTING AND COLLECTION

The Laboratory needs to be selected before collection begins. The lab selected has to be one which has all the proper accreditations, sufficient experience of metal contamination testing procedures and professional integrity.

It is also important that the whole testing procedure be discussed with the Laboratory Technician / Chemist, including issues of testing protocol (e.g. AOAC), instrumentation (e.g. AAS or ICP-OES) etc.

Water testing for detecting contamination involves sampling precautions /specifications which vary according to the class of contaminants to be detected. This needs to be worked out with the Laboratory before the actual collection begins.

COLLECTION OF WATER SAMPLES

1. Collection Basics

Drinking water in the KMA come from two sources. The riparian townships and urban areas on the Hooghly get most of their drinking water from this river, while many of the non-riparian urban sprawls and villages still depend largely on groundwater – which may get supplied either through pipes to homes or via local tubewells. However, even residents within the Kolkata Municipal Corporation, in certain areas, often try to procure their drinking water from tubewells. Therefore the effort should and would be directed at collecting water samples from both these sources.

2. Collection Strategy – Space and Time

The general area of collection of course would be the KMA, including the Hooghly stretch from the northernmost point of the KMA to its southernmost point. Collection would also target some important industrial clusters (which, in any case, constitute important areas of the KMA).

Collection would be done twice, one during the dry season (winter /spring onset) and another the wet season (monsoon) as contamination / toxic concentration levels are likely to vary with varying water abundance.

3. Collection Strategy – The River, Tap water and Groundwater

Tests of Hooghly water have occasionally shown traces mercury, lead, cadmium and chromium contamination. Nevertheless it would be important to take samples from the Hooghly water again for the purposes of this study, as the Hooghly constitutes one of the main sources of drinking water in the KMA.

Tap water in the KMA has two sources, the Hooghly and groundwater. Occasionally the two are mixed in the municipal supply. In other areas the tap water comes either exclusively from the Hooghly or exclusively from groundwater sources. Tap water samples in the KMA will thus be tested bearing in mind its source.

In areas where drinking water comes exclusively from groundwater sources, only samples of water from tubewells will be tested.

4. Collection Specifics

(a) To collect water samples from the Hooghly from 4 different points along the entire North-South stretch of the KMA, once during the dry season and again during the wet season, taking 2 samples from each point, in order to get an idea of the contamination background. (Total number of samples, 16).

TABLE 1

HOOGHLY SITE: COLLECTION POINTS				
COLLECTION POINTS	Shore Land use character	MODE OF COLLECTION	NUMBER OF SAMPLES	NUMBER OF SEASONS
Off Bansberia	Relatively less industrialised and urbanised	From boat. Water samples to be collected from mid river	2	2
Off Baranagar	Industrial and Urban		2	
Off Khidirpur	Industrial and Urban		2	
Off Budge Budge	The downstream end point of KMA urban-industrial zone		2	
TOTAL NUMBER OF SAMPLES			16	

(b) To collect water samples from tube wells in 13 different sites within the KMA – 9 urban sites and 4 rural sites – from Kalyani in the North to Budge Budge in the South (on the east bank of Hooghly) and from Bansberia in the North to Uluberia in South (on the west bank), once during the dry season and again during the wet season.

TABLE 2

KMA TUBEWELLS: COLLECTION DETAILS					
COLLECTION POINTS	LOCATION CHARACTER	MODE OF COLLECTION	NUMBER OF SAMPLES PER TUBEWELL	NUMBER OF TUBEWELLS	NUMBER OF SEASONS
Kalyani Municipality, East Bank of Hooghly	Relatively Less industrialised and less urbanised	To collect from the tubewell at any time of the day, marking the	1	2	2

		time of collection			
Kalyani rural area, East Bank of Hooghly	Rural and non-industrial	”	1	2	
Chinsurah Municipality West Bank of Hooghly	Relatively more urbanised and semi-industrial	”	1	2	
Bhadreswar Municipality, West Bank of Hooghly	Industrialised and urbanised	”	1	2	
Naihati Municipality, East Bank of Hooghly	Industrialised and urbanised	”	1	2	
Barrackpore Municipality, East Bank of Hooghly	Heavily industrialised and relatively more urbanised	”	1	2	
Dum Dum Municipality	Highly urbanised and semi-industrialised	”	1	2	
Bantala	Emerging urban and industrial area	”	1	2	
Tangra	Highly urbanised and industrialised	”	1	2	
Shibpur, West Bank of Hooghly	Highly urbanised and industrialised	”	1	2	
Sonarpur rural area	East Bank of Hooghly	”	1	2	
Budge Budge rural area, East Bank of Hooghly	Rural area, semi-industrialised	”	1	2	
Uluberia Municipality, West Bank of Hooghly	Industrialised, semi-urbanised	”	1	2	
Total number of Samples			52		

(C) To collect water samples from taps at 12 different urban sites within the KMA from Kalyani in the North to Budge Budge in the South (on the east bank of Hooghly) and from Bansberia in the North to Uluberia in South (on the west bank), once during the dry season and again during the wet season.

TABLE 3

KMA TAPWATER: COLLECTION DETAILS					
COLLECTION POINTS	GEOGRAPHICAL LOCATION	MODE OF COLLECTION	NUMBER OF SAMPLES PER TAP	NUMBER OF TAPS	NUMBER OF SEASONS
Kalyani Municipality, East	Relatively Less industrialised and less	To collect from the tap at any time	1	2	2

Bank of Hooghly	urbanised	of the day, marking the time of collection			
Chinsurah Municipality, West Bank of Hooghly	Relatively more urbanised and semi- industrial	”	1	2	
Chandernagore Municipality, West Bank of Hooghly	Relatively more urbanised and semi- industrial	”	1	2	
Naihati Municipality, East Bank of Hooghly	Industrialised and urbanised	”	1	2	
Dum Dum Municipality	Highly urbanised and semi-industrialised	”	1	2	
Uttarpara Municipality, West Bank of Hooghly	Highly urbanised and industrialised	”	1	2	
North Kolkata, East Bank of Hooghly	Highly urbanised, semi-industrialised	”	1	2	
Shibpur, West Bank of Hooghly	Highly urbanised and industrialised	”	1	2	
Tangra	Highly urbanised and industrialised	”	1	2	
Sonarpur Municipality	Rapidly growing urbanisation	”	1	2	
Budge Budge Municipality, East Bank of Hooghly	Highly urbanised and industrialised	”	1	2	
Uluberia Municipality, West Bank of Hooghly	Industrialised, semi- urbanised	”	1	2	
Total number of Samples			48		

SECTION C

THE PROJECT IN ACTION

I. PREPARATION

The first step of preparation was of course a survey of literature on determination of metals in drinking water.

The sampling sites had already been worked out. Next, it was necessary to decide on two things. First, which laboratory to select and secondly, once a reliable laboratory had been selected, to decide, on the basis of literature survey and in consultation with the laboratory, a number of crucial items:

- What standards to use as reference?
- What sampling methods to use?
- What method of sample analysis to employ in the laboratory?
- What personnel to employ?

a. LITERATURE ON SAMPLING AND METAL DETERMINATION METHODOLOGY

A wide range of literature was consulted on sampling methods and methodology for metal determination. It was finally decided that in this regard the almost universally accepted guideline was provided by 'Standard Methods for Examination of Water and Wastewater', of the American Public Health Association (APHA), 21st Edition, 2005.¹ Therefore this work was consulted both by the sampling team as well as the laboratory.

b. THE LABORATORY

On recommendation of experts and on the basis of past experience the laboratory selected was SGS India Pvt. Ltd, Kolkata. This is an NABL accredited Laboratory which also has accreditation from the CPCB and the West Bengal PCB.

i. Standard

It was decided that the World Health Organisation (WHO) guidelines on drinking water quality would be given the greatest importance in understanding and assessing the issue of metal contamination of drinking water. However, the United States' Environmental Protection Agency (US EPA) guidelines and the BIS would also be used as comparative yardsticks.

ii. Sampling Procedure

The internationally standard reference for deciding sampling methods for water and wastewater is the 'Standard Methods for Examination of Water and Wastewater', of

the American Public Health Association (APHA), 21st Edition, 2005. This was selected as the base reference. However, Bureau of Indian Standards (BIS) guidelines for sampling for metals in water were also consulted.

iii. Laboratory Analysis

It was also decided that the samples would be analysed in the laboratory by ICP method as described in the APHA, 21st edition.

iv. Personnel

It was decided that personnel with adequate experience with sampling procedures as described in APHA and BIS and such personnel were selected. DISHA maintained careful monitoring over the entire process of collection and sampling. It was also decided that adequate care would be taken for on-job training of assistants, so that after a number of sampling runs the set of persons who were able to conduct proper sampling expanded.

II. ACTUAL SAMPLING AND TRANSFER TO LABORATORY

As will be evident from the sampling plan given above, sampling had been planned to be undertaken during two seasons – wet and dry. This was accomplished as planned.

i. BASIC SAMPLING PROCEDURE

The sampling methodology was the same in the two phases. The basic principles followed are to be found in APHA for drinking water samples the more or less universal standard guidelines for river water sampling, which are fairly uniform in their procedures. These need not be discussed here in detail. But certain features are being mentioned as these are likely to be of concern and interest.

There were basically two categories of sampling.

First was the river water sampling.

As per plan and at each phase river water was collected from 4 zones on the river Hooghly, from the northern tip of the KMA to its southern tip. At each area the sampling was done at two points, the northernmost point and drainage outfall of the shoreline settlement and southernmost point and drainage outfall of the shoreline settlement.

Sampling was done from a boat. Although sampling was done near the drainage outfalls, care was taken not to collect the sample from too near the outfalls. Although there were variations in positioning on account of river current, the sampling was done some 50-60 metres away from the outfall point and at least 30 metres from the bank.

The samples were collected by a 2 litres container, made heavy by welding iron rings at the bottom (outside the container). The sampling was done by hanging the sampler from the end of a long stick and dipping it well below the surface to a depth of about 2 metres below the surface (The rope from which the sampler was hung was

measured out and marked at 1 m intervals). The sample water was immediately transferred to **two 500 ml Tarson polypropylene bottles, one for mercury and another for cadmium, chromium and lead**. Immediate steps were taken to preserve the sample by acidifying the sample by using HNO₃ solution. Sample container preparation and preservation was in the lines prescribed in APHA 21st Edition.²

Next was drinking water sampling. Here samples were collected from taps and tubewells, private and public. In all cases of collecting samples the tap was turned on and water kept flowing for a few minutes before the actual sample was taken. Similar method was followed in the case of tubewells, where water from tubewell was pumped out for a few minutes before the sample was taken. The reason was simple enough. Water that remains over some time in the plumbing tends to get contaminated from metals, particularly lead, leaching into the water from the galvanization layer, soldering etc. Hence the effort to reduce this effect in the sample by taking samples from fresh flow. The sample water was taken in **two 500 ml Tarson polypropylene bottles, one for mercury and another for cadmium, chromium and lead**. The sample for mercury was always taken in a different container because the mercury sample needed to be digested separately for spectrophotometric analysis. However the mercury bottle had the same sample code as the other bottle, with only *Hg added at the end* for identification.

The samples were then subjected to preservation procedures as per APHA 21st Edition.³

ii. A FUNDAMENTAL FEATURE OF THE SAMPLING PROCESS

A fundamental feature of the sampling process was that all the drinking water samples collected during the second phase were from exactly the same sources as in the first phase. There was only one exception, in the case of Sonarpur when Purba Sitalapara water source, used during the first phase, was found to be defunct. Therefore sample was collected from near Hasanpur Viddyapur Primary School. Even in the case of Hooghly water, in both the phases the samples were collected from the same area. The basic idea for this was obvious – to be able to compare data from the first phase with that from the second phase.

iii. SAMPLE CODES AND SAMPLE SOURCES

A synoptic view of river water sampling in the first and second phases is given in Table 4 and Table 5 respectively. And the collection of drinking water from taps and tubewells in different localities have been detailed in Appendices I and II.

However the codes contain in themselves clues to the source of water. A code looks something like this: Bns.RU, or like this: Cns.Wt.2. The first part of the sample Code is the area indicator. These indicate the locality from which the sample was taken. These are shown in Table 4 below:

TABLE 4 Area Indicators in the Sample Codes

Sl. No.	Area Indicator	Locality	Sl. No.	Area Indicator	Locality
1	Kl	Kalyani	10	Kid	Khidirpur

2	Bns	Bansdroni	11	Shb	Shibpur
3	Cns	Chinsurah	12	Nht	Naihati
4	Brn	Baranagar	13	Mct	Barrackpore
5	Dmd	Dumdum	14	Tng	Tangra
6	Nko	North Kolkata	15	Sew	Bantala
7	Fc	Chandannagar	16	Snp	Sonarpur
8	Bds	Bhadreshwar	17	Bbj	Budge Budge
9	Utp	Uttarpara	18	Ulb	Uluberia

RU and RD in the samples would indicate river water, with RU meaning sample collected upstream and RD meaning sample collected downstream. Thus Bns.RU would mean River water taken from the river off the northern tip at Bansdroni. The string 'Pt' stands for Tapwater while 'Wt' stands for Tubewell. Therefore Cns.Wt.2 would mean second tubewell sample from Chinsurah, while 2.Cns.Wt.2 meant the second tubewell sample from Chinsurah collected during the second phase.

A more thorough idea of the codes and sample sources may be gained from Appendices I and II.

However, the codes and their implications were known only to the research team. *No one else, and definitely not the laboratory personnel, had any inkling whatsoever about the sources of the samples.*

iv. THE NUMBER OF SAMPLES

The number of Hooghly River samples actually collected and tested followed the initial sampling plan – counting to a total of 8 samples in each phase. The number of tubewell samples was exactly as planned – 26 in each phase. However, the number of tapwater samples was less by two – amounting to 22 in each phase, due to unavailability of municipality supplied tapwater in Sonarpur Municipal area. Therefore in each phase Sonarpur Municipality provided an additional number of 2 tubewell samples, instead of tap samples. This would have resulted in 2 tubewell samples more than had been planned. However, for reasons discussed in the Appendices, it was decided not to take tubewell water from Budge Budge rural area and take only tapwater from Budge Budge urban area. This resulted in offsetting the effect of increase in 2 tubewell samples from Sonarpur, leading to the initially planned total number of tubewell samples remaining the same.

v. TRANSFERRING THE SAMPLES TO THE LABORATORY

The methods and protocols delineated in APHA 21st Edition were followed in preservation and transfer of the samples to the laboratory. Either the samples were transferred to the laboratory on the very date on which they were collected, or, if that was not possible, were held in refrigeration. In no circumstance were any of the samples submitted to the laboratory more than 72 hours after the sampling had been done.

vi. SAMPLING DURING THE FIRST PHASE

SAMPLING PERIOD: The sampling was done between 30th of March 2010 and 26th of April 2010, dates inclusive.

A SYNOPTIC DESCRIPTION OF THE SAMPLING PROCESS

The sample bottles used were Tarson polypropylene bottles of 500 ml capacity. For each sample approximately 1000 ml of water was taken, and this was *distributed between two 500 ml capacity bottles* of the aforesaid variety: one of this was labelled Hg in addition to the sample code and earmarked for mercury determination and the other was earmarked for determination of Lead, Cadmium and Chromium.

Table 5 provides a compact view of sampling from the Hooghly River.

SAMPLING POINTS	Shore Land use character	Date and Time	NUMBER OF SAMPLES	MODE OF COLLECTION	NUMBER OF SAMPLES	NUMBER OF SAMPLE BOTTLES OF 500 ML
Off Bansberia	Relatively less industrialised and urbanised	30.03.2010 Northernmost tip, between 9:30 to 9:40 hrs and southernmost tip between 11:00 to 11:15 hrs.	2	From boat. In each of the sites water samples were collected from 2 points, one at the northernmost tip and the other at the southernmost tip of the respective settlements.	2	4
Off Baranagar	Industrial and Urban	05.04.2010 Northernmost tip, between 9:30 to 9:45 hrs and southernmost tip between 10:50 to 11:05 hrs.	2		2	4
Off Khidirpur	Industrial and Urban	06.04.2010 Northernmost tip, between 13:00 to 13:15 hrs and southernmost tip between 14:10 to 14:30 hrs.	2		2	4
Off Budge Budge	The downstream end point of KMA urban-industrial zone	22.04.2010 Northernmost tip, between 10:35 to 10:50 hrs and southernmost tip between 11:35 to 11:50 hrs.	2		2	4
TOTAL					8	16

A description of the process of collecting drinking water samples in the First Phase is to be found in Appendix I.

vii. SAMPLING DURING THE SECOND PHASE

SAMPLING PERIOD FOR THE SECOND PHASE: The sampling was done between 19th of March 2010 and 2nd of November 2010, dates inclusive.

A SYNOPTIC DESCRIPTION OF THE SAMPLING PROCESS

This was essentially the same as in the first phase. The sample bottles used were Tarson polypropylene bottles of 500 ml capacity. For each sample approximately 1000 ml of water was taken, *and this was distributed between two 500 ml capacity bottles of the aforesaid variety*: one of this was labelled Hg in addition to the sample code and earmarked for mercury determination and the other was earmarked for determination of Lead, Cadmium and Chromium.

Table 5 provides a compact view of sampling from the Hooghly River.

TABLE 6

Collection from Hooghly River, Second Phase						
SAMPLING POINTS	Shore Land use character	Date and Time	NUMBER OF SAMPLES	MODE OF COLLECTION	NUMBER OF SAMPLES	NUMBER OF SAMPLE BOTTLES OF 500 ML
Off Bansberia	Relatively less industrialised and urbanised	19.10.2010 Northernmost tip, between 12:55 to 13:10 hrs and southernmost tip between 13:50 to 14:05 hrs.	2	From boat. In each of the sites water samples were collected from 2 points, one at the northernmost tip and the other at the southernmost tip of the respective settlements.	2	4
Off Baranagar	Industrial and Urban	26.10.2010 Northernmost tip, between 10:20 to 10:35 hrs and southernmost tip between 11:05 to 11:20 hrs.	2		2	4
Off Khidirpur	Industrial and Urban	24.10.2010 Northernmost tip, between 8:30 to 8:50 hrs and southernmost tip between 9:20 to 9:45 hrs.	2		2	4
Off Budge Budge	The downstream end point of KMA urban-industrial zone	2.11.2010 Northernmost tip, between 6:10 to 6:25 hrs and southernmost tip between 6:50 to 7:05 hrs.	2		2	4
TOTAL					8	16

A description of the process of collecting drinking water samples in the Second Phase is to be found in Appendix II.

SECTION D

APPROACHING THE LABORATORY FINDINGS

Even before we cite the results from the laboratory we need to discuss the basic analytical approach that was decided upon.

Water, and even drinking water, contains an astonishing spectrum of dissolved or suspended chemicals. The metals we are concerned with in this report, that is cadmium, chromium, lead and mercury would also be present. The question is of course not whether such metals are present in the drinking water in KMA, but whether they are present in proportions that would be considered unsafe. It is here that the question of drinking water specifications or standards becomes relevant. For the purposes of the present study the standards that have been taken into consideration are those of WHO, the US EPA and the Indian Standard for Drinking Water, described in technical literature as IS: 10500: 1991. But a mere discussion of the standards would not suit the purposes of this study. What would be required would be a discussion of the possible sources of each metal in drinking water, the health hazards involved and only thereafter a discussion of the standards. What follows is just such a discussion, for each metal considered in this study:

Cadmium

According to WHO, cadmium contamination of drinking-water may occur as a result of the presence of cadmium as an impurity in the zinc of galvanized pipes or cadmium-containing solders in fittings, water heaters, water coolers and taps. According to US EPA contamination of drinking-water may result from corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints.

According to WHO, chronic oral exposure from cadmium is likely to result in kidney damage. Cadmium affects the resorption function of the proximal tubules, the first symptom being an increase in the urinary excretion of low-molecular-weight proteins, known as tubular proteinuria. US EPA also speaks of likelihood of kidney damage from excessive cadmium intake through drinking water.

The guideline value for cadmium in drinking water has been set by WHO at 0.003 mg/l. The US EPA has set the Maximum Contaminant Level Goal (MCLG) and Maximum Contaminant Level (MCL) at 0.005 mg/l. The Indian standard has been set at a higher level, 0.01 mg/l.⁴

Chromium

Chromium and its salts are used in the leather tanning industry, the manufacture of catalysts, pigments and paints, fungicides, the ceramic and glass industry, and in photography, and for chrome alloy and chromium metal production, chrome plating, and corrosion control.

The distribution of compounds containing chromium (III) and chromium (VI) depends on the redox potential, the pH, the presence of oxidizing or reducing compounds, the kinetics of the redox reactions, the formation of chromium(III) complexes or insoluble

chromium(III) salts, and the total chromium concentration. In the environment, chromium (VI) occurs mostly as CrO_4^{2-} or HCrO_4^- and chromium (III) as $\text{Cr}(\text{OH})_n(3-n)^+$. In water, chromium (III) is a positive ion that forms hydroxides and complexes, and is adsorbed at relatively high pH values. In surface waters, the ratio of chromium (III) to chromium (VI) varies widely, and relatively high concentrations of the latter can be found locally. In general, chromium (VI) salts are more soluble than those of chromium (III), making chromium (VI) relatively mobile. According to the US EPA, the sources for chromium in drinking water are discharge from steel and pulp mills; erosion of natural deposits.

As per WHO, increased incidences of genotoxic effects such as chromosomal aberrations and sister chromatid exchanges have been found in workers exposed to chromium (VI) compounds. The US EPA has not yet decided upon an overall toxicological profile for chromium in its various manifestations. For the EPA allergic dermatitis appears to be as of now the chief health hazard stemming from chromium contamination of drinking water.

It is more or less agreed that chromium (VI) is the real threat. However WHO has the following things to say regarding determining the guideline value of chromium in drinking water:

In principle, because the health effects are determined largely by the oxidation state, different guideline values for chromium (III) and chromium (VI) should be derived. However, current analytical methods and the variable speciation of chromium in water favour a guideline value for total chromium, which the WHO has set at 0.05 mg/litre. As a practical measure, 0.05 mg/litre, which is considered to be unlikely to give rise to significant risks to health, is presently being retained as a provisional guideline value until additional information becomes available and chromium can be re-evaluated.

The US EPA has set the MCL for total chromium at 0.1 mg/l. So far as India is concerned there is no standard for total chromium. For chromium (VI) the desirable limit as well as the permissible limit is 0.05 mg/l.⁵

Lead

According to WHO, the chief source of lead in tap water is to some extent as a result of its dissolution from natural sources but primarily from plumbing systems in which the pipes, solder, fittings, or service connections to homes contain lead. PVC pipes also contain lead compounds that can be leached from them and result in high lead concentrations in drinking-water. The amount of lead dissolved from the plumbing system depends on several factors, including the presence of chloride and dissolved oxygen, pH, temperature, water softness, and standing time of the water, soft, acidic water being the most plumbosolvent. According to US EPA, the main source of lead in drinking water is corrosion of household plumbing systems; erosion of natural deposits.

According to WHO, Lead is a cumulative general poison, infants, children up to 6 years of age, the fetus, and pregnant women being the most susceptible to adverse health effects. Its effects on the central nervous system can be particularly serious. Adults are also susceptible to lead toxicity, which can lead to central and peripheral nervous system disorders.

Overt signs of acute intoxication include dullness, restlessness, irritability, poor attention span, headaches, muscle tremor, abdominal cramps, kidney damage, hallucinations, and loss of memory, encephalopathy occurring at blood lead levels of 100–120 $\mu\text{g}/\text{dl}$ in adults and 80–100 $\mu\text{g}/\text{dl}$ in children. Signs of chronic lead toxicity, including tiredness, sleeplessness, irritability, headaches, joint pain, and gastrointestinal symptoms, may appear in adults at blood lead levels of 50–80 $\mu\text{g}/\text{dl}$. After 1–2 years of exposure, muscle weakness, gastrointestinal symptoms, lower scores on psychometric tests, disturbances in mood, and symptoms of peripheral neuropathy were observed in occupationally exposed populations at blood lead levels of 40–60 $\mu\text{g}/\text{dl}$. Renal disease has long been associated with lead poisoning; however, chronic nephropathy in adults and children has not been detected below blood lead levels of 40 $\mu\text{g}/\text{dl}$. Damage to the kidneys includes acute proximal tubular dysfunction and is characterized by the appearance of prominent inclusion bodies of a lead–protein complex in the proximal tubular epithelial cells at blood lead concentrations of 40–80 $\mu\text{g}/\text{dl}$. There are indications of increased hypertension at blood lead levels greater than 37 $\mu\text{g}/\text{dl}$.

There are other serious health effects of lead toxicity. These include interference with calcium metabolism, both directly and by interfering with vitamin D metabolism. These effects have been observed in children at blood lead levels ranging from 12 to 120 mg/dl , with no evidence of a threshold.

According to the US EPA the health effects of lead on Infants and children include delays in physical or mental development; children could show slight deficits in attention span and learning abilities, and effects of lead on adults include kidney problems and high blood pressure.

The WHO guideline value for lead in drinking water is 0.01 mg/l . The US EPA holds the maximum contaminant level goal for lead in drinking water to be zero mg/l while the MCL action level has been proposed as 0.015 mg/l . The Indian Standard, till date, has a value that is way above – for both desirable and permissible limits the value is 0.05 mg/l .⁶

Mercury

Naturally occurring mercury has been widely distributed by natural processes such as volcanic activity. The use of mercury in industrial processes significantly increased following the industrial revolution of the 19th century. Mercury is or has been used for the cathode in the electrolytic production of chlorine and caustic soda, in electrical appliances (lamps, arc rectifiers, mercury cells), in industrial and control instruments (switches, thermometers, barometers), in laboratory apparatus and as a raw material for various mercury compounds. The latter are used as fungicides, antiseptics, preservatives, pharmaceuticals, electrodes and reagents. However, mercury's industrial uses are decreasing because of environmental concerns and environmental legislation in many countries. Mercury is also widely used in dental amalgams. A less discussed use is in ethnic and folk remedies, some of which can give rise to significant exposure of individuals.

The solubility of mercury compounds in water varies: elemental mercury vapour is insoluble, mercury(II) chloride is readily soluble, mercury(I) chloride is much less soluble and mercury sulfide has a very low solubility.

Methylation of inorganic mercury occurs in water and occurs in both fresh water and seawater. Microbial action causes methylation of mercury under both aerobic and anaerobic conditions. Once methylmercury is released from microbes, it enters the food-chain as a consequence of rapid diffusion and tight binding to proteins in aquatic biota. The enzymology of CH_3Hg^+ hydrolysis and mercury (II) ion reduction is now understood in some detail. Environmental levels of methylmercury depend on the balance between bacterial methylation and demethylation.

However, according to WHO, almost all mercury in uncontaminated drinking-water is thought to be in the form of Hg^{2+} , or inorganic mercury. Thus, it is unlikely that there is any direct risk of the intake of organic mercury compounds as a result of the ingestion of drinking water. However, there is a real possibility that methylmercury will be converted into inorganic mercury.

In its latest document on mercury in drinking water WHO has confirmed the guideline value for inorganic mercury in drinking water to be 0.006 mg/l. But it has not clearly indicated the guideline value for total mercury. The implication is that, as almost all the mercury in drinking water is considered to be inorganic mercury, in case of determination of total mercury in drinking water, the value of 0.006 mg/l is to be taken as the WHO guideline value for mercury in drinking water. Likewise, the US EPA has also refrained from indicating the MCL for total mercury, and has indicated the MCL for inorganic mercury in drinking water to be 0.002 mg/l. The Indian standard refrains from the inorganic/total distinction and simply indicates the desirable as well as permissible level of mercury in drinking water to be 0.001 mg/l.⁷

The following two charts briefly summarises the above information.

TABLE 7 Metal Contaminants in Water – Possible Sources and Potential Hazards

Contaminant	Potential Health Effects from Ingestion of Water according to WHO	Sources of Contaminant in Drinking Water according to WHO	Potential Health Effects from Ingestion of Water according to US EPA	Sources of Contaminant in Drinking Water according US EPA
Cadmium	The kidney is the main target organ for cadmium toxicity.	Contamination of drinking-water may occur as a result of the presence of cadmium as an impurity in the zinc of galvanized pipes or cadmium-containing solders in fittings, water heaters, water coolers and taps.	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints.
Chromium (in its hexavalent form)	Possibility of increased risk of cancer	Chromium and its salts are used in the leather tanning industry, the manufacture of catalysts, pigments and paints, fungicides, the ceramic and glass industry, and in photography, and for	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits

		chrome alloy and chromium metal production, chrome plating, and corrosion control. Thus chromium can get into the drinking water supply as a result of contamination from industrial effluents.		
Lead	<p>Fetuses, infants, children up to 6 years of age and pregnant women are most susceptible to its adverse health effects. Lead is a general toxicant that accumulates in the skeleton.</p> <p>Lead interferes with calcium metabolism, both directly and by interfering with vitamin D metabolism. These effects have been observed in children at blood lead levels ranging from 12 to 120mg/dl, with no evidence of a threshold. Lead is toxic to both the central and peripheral nervous systems, inducing subencephalopathic neurological and behavioural effects. There is evidence of effects on the nervous system in children with blood lead levels well below 30mg/dl. The balance of evidence indicates that there are statistically significant associations between blood lead levels of 30mg/dl and more and intelligence quotient deficits of about four points in children. Results</p>	<p>Lead is used principally in the production of lead-acid batteries, solder and alloys. However, lead is rarely present in tap water as a result of its dissolution from natural sources; rather, its presence is primarily from plumbing systems containing lead in pipes, solder, fittings or the service connections to homes.</p> <p>The amount of lead dissolved from the plumbing system depends on several factors, including pH, temperature, water hardness and standing time of the water, with soft, acidic water being the most plumbosolvent.</p>	<p>Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities</p>	<p>Corrosion of household plumbing systems; erosion of natural deposits</p>

	from prospective (longitudinal) epidemiological studies suggest that prenatal exposure to lead may have early effects on mental development.			
Mercury (Inorganic)	The toxic effects of inorganic mercury compounds are seen mainly in the kidney in both humans and laboratory animals following short- and long-term exposure.	Mercury has a wide range of industrial uses. Almost all mercury in uncontaminated drinking-water is thought to be in the form of inorganic mercury or Hg ²⁺ . Thus, it is unlikely that there is any direct risk of the intake of organic mercury compounds as a result of the ingestion of drinkingwater.	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands

TABLE 8 Drinking water standard for four metals – US EPA, WHO 2008 and IS: 10500: 1991

Contaminant	US EPA MCLG and MCL		WHO Guidelines mg/l	Desirable Limit BIS (IS: 10500: 1991) mg/l	Permissible Limit BIS (IS: 10500: 1991) mg/l
	MCLG (mg/L)	MCL (mg/L)			
Cadmium	0.005	0.005	0.003	0.01	0.01
Chromium	0.1 (total)	0.1 (total)	0.05 (P) (total chromium)	0.05 (hexavalent Chromium)	0.05 (hexavalent Chromium)
Lead	Zero	TT; Action Level=0.015	0.01	0.05	0.05⁸
Mercury				0.001	0.001

(total)					
Mercury (Inorganic)	0.002	0.002	0.006		
<p>Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.</p> <p>Maximum Contaminant Level Goal (MCLG) – The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.</p> <p>TT – Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.</p> <p>P – Provisional level</p>					

Two items must be borne in mind while analysing the results from the laboratory.

First, in line with the approach developed by both WHO and US EPA the total chromium in the water was analysed. However, India does not have a desirability/ permissibility criterion for total chromium in drinking water. Therefore the chromium results in this study cannot be interpreted in terms of Indian standards.

In order to understand the second item it would be necessary to discuss the laboratory instrumentation part. The instrument used was ICP-OES and it was suitably calibrated to set the detection limit at sufficiently low range so as to be able to detect contamination levels above the rather low values indicated in the various standards (EPA, WHO and BIS). Table 9 gives the detection limits of the instrument set against the various standards with which this study is concerned.

TABLE 9 DETECTION LIMIT SET FOR THE ICP-OES

Contaminant	US EPA MCLG and MCL		WHO Guidelines mg/l	Desirable Limit BIS (IS: 10500: 1991) mg/l	Permissible Limit BIS (IS: 10500: 1991) mg/l	Detection Limit set for ICP-OES mg/l
	MCLG (mg/L)	MCL (mg/L)				
Cadmium	0.005	0.005	0.003	0.01	0.01	0.005
Chromium	0.1 (total)	0.1 (total)	0.05 (P) (total chromium)	0.05 (hexavalent Chromium)	0.05 (hexavalent Chromium)	0.01

Lead	Zero	TT; Action Level=0.0 15	0.01	0.05	0.05	0.001
Mercury (total)				0.001	0.001	
Mercury (Inorganic)	0.002	0.002	0.006			0.001

Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.⁹

Maximum Contaminant Level Goal (MCLG) – The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.¹⁰

TT – Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.¹¹

P – Provisional level¹²

As will be seen from the above table, in the case of cadmium, the detection limit set for the instrument, while being kept at the EPA MCL and well below the Indian limit, is above the WHO guideline value for cadmium in drinking water. This is the result of miscommunication and this problem was noticed only after the first phase results came in, when it was too late to rectify matters. Therefore it has become impossible to state whether the results show exceedance of the WHO guideline value for cadmium.

We shall now get to see, examine and then discuss the laboratory results for the two phases of water sampling. The bare findings are given in the next Section.

SECTION E THE RESULTS

TABLE 10 LABORATORY FINDINGS FOR THE TWO PHASES

ND = Not Detected						
FIRST PHASE RESULTS				SECOND PHASE RESULTS		
Sl. No.	Site & Code	Metal	Lab Result	Code	Metal	Lab Result
	<u>Kalyani</u>					
1.	Kl.R.Wt.A	Cadmium	ND	2.Kl.R.Wt.A	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.01 mg/l		Lead	0.05 mg/l
		Mercury	ND		Mercury	ND
2.	Kl.R.Wt.B	Cadmium	ND	2.Kl.R.Wt.B	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.012 mg/l		Lead	0.025 mg/l
		Mercury	ND		Mercury	0.001 mg/l
3.	Kl.U.Wt.A	Cadmium	ND	2.Kl.U.Wt.A	Cadmium	ND
		Chromium	ND		Chromium	ND

		Lead	0.009 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
4	Kl.U.Wt.B	Cadmium	ND		2.Kl.U.Wt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.008 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
5	Kl.U.Pt.A	Cadmium	ND		2.Kl.U.Pt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.009 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
6	Kl.U.Pt.B	Cadmium	ND		2.Kl.U.Pt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.011 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
	<u>Bansberia</u>						
7	Bns.R.D	Cadmium	ND		2.Bns.R.D	Cadmium	ND

11	Cns.Wt.A	Cadmium	ND	2.Cns.Wt.A	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.014 mg/l		Lead	0.04 mg/l
		Mercury	ND		Mercury	ND
12	Cns.Wt.B	Cadmium	ND	2.Cns.Wt.B	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.014 Mg/l		Lead	0.03 mg/l
		Mercury	ND		Mercury	ND
	<u>Baranagar</u>					
13	Brn.R.U	Cadmium	ND	2.Brn.R.U	Cadmium	ND
		Chromium	ND	2.Brn.R.U	Chromium	0.01 mg/l
		Lead	0.05 mg/l	2.Brn.R.U	Lead	0.02 mg/l
		Mercury	ND	2.Brn.R.U	Mercury	ND
14	Brn.R.D	Cadmium	ND	2.Brn.R.D	Cadmium	ND
		Chromium	ND		Chromium	0.01 mg/l
		Lead	0.045 mg/l		Lead	0.01 mg/l
		Mercury	ND		Mercury	ND

	<u>Dum Dum</u>						
15	Dmd.Pt.A	Cadmium	ND		2.Dmd.Pt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.04 mg/l			Lead	0.01 mg/l
		Mercury	ND			Mercury	ND
16	Dmd.Pt.B	Cadmium	ND		2.Dmd.Pt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.02 mg/l			Lead	0.01 mg/l
		Mercury	ND			Mercury	ND
17	Dmd.Wt.A	Cadmium	ND		2.Dmd.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.05 mg/l			Lead	0.04 mg/l
		Mercury	ND			Mercury	ND
18	Dmd.Wt.B	Cadmium	ND		2.Dmd.Wt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.033 mg/l			Lead	0.01 mg/l

		Mercury	ND			Mercury	ND
	<u>North Kolkata</u>						
19	Nko.Pt.A	Cadmium	ND	2.Nko.Pt.A	Cadmium	ND	
		Chromium	ND		Chromium	ND	
		Lead	0.02 mg/l		Lead	0.02 mg/l	
		Mercury	ND		Mercury	ND	
20	Nko.Pt.B	Cadmium	ND	2.Nko.Pt.B	Cadmium	ND	
		Chromium	ND		Chromium	ND	
		Lead	0.03 mg/l		Lead	0.03 mg/l	
		Mercury	ND		Mercury	ND	
	<u>Chandannagar</u>						
21	Fc.Pt.A	Cadmium	ND	2.Fc.Pt.A	Cadmium	ND	
		Chromium	ND		Chromium	ND	
		Lead	0.03 mg/l		Lead	0.02 mg/l	
		Mercury	ND		Mercury	ND	
22	Fc.Pt.B	Cadmium	ND	2.Fc.Pt.B	Cadmium	ND	

26	Upt.Pt.B	Cadmium	ND		2.Upt.Pt.B	Cadmium	ND
		Chromium	ND			Chromium	0.01 mg/l
		Lead	0.032 mg/l			Lead	0.035 mg/l
		Mercury	ND			Mercury	ND
	<u>Khidirpur</u>						
27	Kid.R.U	Cadmium	ND		2.Kid.R.U	Cadmium	ND
		Chromium	ND			Chromium	0.03 mg/l
		Lead	0.05 mg/l			Lead	0.03 mg/l
		Mercury	ND			Mercury	ND
28	Kid.R.D	Cadmium	ND		2.Kid.R.D	Cadmium	ND
		Chromium	ND			Chromium	0.02 mg/l
		Lead	0.03 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
	<u>Shibpur</u>						
29	Shb.Pt.A	Cadmium	ND		2.Shb.Pt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.016 mg/l			Lead	0.01 mg/l

		Mercury	ND			Mercury	ND
30	Shb.Pt.B	Cadmium	ND	2.Shb.Pt.B	Cadmium	ND	
		Chromium	ND		Chromium	ND	
		Lead	0.02 mg/l		Lead	0.01 mg/l	
		Mercury	ND		Mercury	ND	
31	Shb.Wt.A	Cadmium	ND	2.Shb.Wt.A	Cadmium	ND	
		Chromium	ND		Chromium	ND	
		Lead	0.017 mg/l		Lead	0.005 mg/l	
		Mercury	ND		Mercury	ND	
32	Shb.Wt.B	Cadmium	ND	2.Shb.Wt.B	Cadmium	ND	
		Chromium	ND		Chromium	ND	
		Lead	0.023 mg/l		Lead	0.01 mg/l	
		Mercury	ND		Mercury	ND	
	<u>Naihati</u>						
33	Nht. Pt.A	Cadmium	ND	2.Nht. Pt.A	Cadmium	ND	
		Chromium	ND		Chromium	ND	

		Lead	ND			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
34	Nht.Pt.B	Cadmium	ND		2.Nht.Pt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	ND			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
35	Nht.Wt.A	Cadmium	ND		2.Nht.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.009 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
36	Nht.Wt.B	Cadmium	ND		2.Nht.Wt.B	Cadmium	<0.005 mg/l
		Chromium	ND			Chromium	<0.01 mg/l
		Lead	ND			Lead	0.03 mg/l
		Mercury	ND			Mercury	0.001 mg/l
	<u>Barrackpore</u>						

37	Mct.Wt. A	Cadmium	ND	2.Mct.Wt. A	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.01 mg/l		Lead	0.01 mg/l
		Mercury	ND		Mercury	ND
38	Mct.Wt.B	Cadmium	ND	2.Mct.Wt.B	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.04 mg/l		Lead	0.015 mg/l
		Mercury	ND		Mercury	ND
	<u>Tangra</u>					
39	Tng.Pt.A	Cadmium	ND	2.Tng.Pt.A	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	0.007 mg/l		Lead	0.005 mg/l
		Mercury	ND		Mercury	ND
40	Tng.Pt.B	Cadmium	ND	2.Tng.Pt.B	Cadmium	ND
		Chromium	ND		Chromium	ND
		Lead	ND		Lead	0.006 mg/l
		Mercury	ND		Mercury	ND

41	Tng.Wt.A	Cadmium	ND		2.Tng.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.005 mg/l			Lead	0.01 mg/l
		Mercury	ND			Mercury	ND
42	Tng.Wt.B	Cadmium	ND		2.Tng.Wt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.005 mg/l			Lead	0.01 mg/l
		Mercury	ND			Mercury	ND
	<u>Bantala</u>						
43	Sew.Wt.A	Cadmium	ND		2.Sew.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	ND			Lead	0.1 mg/l
		Mercury	ND			Mercury	ND
44	Sew.Wt.B	Cadmium	ND		2.Sew.Wt.B	Cadmium	ND
		Chromium	ND			Chromium	ND

		Lead	0.02 mg/l			Lead	0.01 mg/l
		Mercury	ND			Mercury	ND
	<u>Sonarpur</u>						
45	Snp.Wt.A	Cadmium	ND		2.Snp.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.008 mg/l			Lead	0.03 mg/l
		Mercury	ND			Mercury	ND
46	Snp.Wt.B	Cadmium	ND		2.Snp.Wt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.05 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
47	Snp.R.Wt.A	Cadmium	ND		2.Snp.R.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.06 mg/l			Lead	0.03 mg/l
		Mercury	ND			Mercury	ND
48	Snp.R.Wt.B	Cadmium	ND		2.Snp.R.Wt.B	Cadmium	ND

52	Bbj.Pt.B	Cadmium	ND		2.Bbj.Pt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.05 mg/l			Lead	0.01 mg/l
		Mercury	ND			Mercury	ND
	<u>Uluberia</u>						
53	Ul.b.Wt.A	Cadmium	ND		2.Ul.b.Wt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.02 mg/l			Lead	0.02 mg/l
		Mercury	ND			Mercury	ND
54	Ul.b.Wt.B	Cadmium	ND		2.Ul.b.Wt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.01 mg/l			Lead	0.03 mg/l
		Mercury	ND			Mercury	ND
55	Ul.b.Pt.A	Cadmium	ND		2.Ul.b.Pt.A	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.02 mg/l			Lead	0.02 mg/l

		Mercury	ND			Mercury	ND
56	Ul.b.Pt.B	Cadmium	ND		2.Ul.b.Pt.B	Cadmium	ND
		Chromium	ND			Chromium	ND
		Lead	0.02 mg/l			Lead	0.03 mg/l
		Mercury	ND			Mercury	ND

Now we must try to understand the significance of the results. That is the concern of the next Section.

SECTION F

UNDERSTANDING THE RESULTS

It is now important to compare the above results with the WHO, EPA and the Indian Standard for drinking water. The following table does precisely that. In the following table columns I through VII belong to the First Phase and Columns VIII through XIII belong to the Second Phase. Column I is of course the Serial Number. Each Serial Number is for a sample code (Column II for First Phase and column VIII for Second Phase). Each Code displays four row entries and each row shows the lab results and corresponding analysis for each metal – Cd (Cadmium), Cr (Chromium), Pb (Lead) and Hg (Mercury). Column III and IX display the metal under consideration. Columns IV and X give the lab results in mg/litre. Column V and XI shows whether and how far the lab result exceeds the WHO Guideline Value. The exceedance is calculated in the following manner. If the standard is 1 unit while the lab result is 2.5 then the exceedance is calculated as $2.5-1 = 1.5$, which then is expressed as a percentage of the standard – which amounts to 150%. If the laboratory result were 1.5 then by the same algorithm, the exceedance would be expressed as 50%. Columns VI and XII show whether EPA MCL has been exceeded and by what percentage and columns VII and XIII do the same for BIS or the Indian Standard.

TABLE 11 EXCEEDANCE OF STANDARDS

FRST PHASE							SECOND PHASE					
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
<u>Sl. No.</u>	<u>SITES & CODES</u>	Metal	Lab Result mg/l	WHO Guideline Value whether exceeded and by what percentage	EPA Maximum Contaminant Level (mg/l) whether exceeded and by what percentage	BIS Permissible Limit (mg/l) whether exceeded and by what percentage	<u>CODES</u>	Metal	Lab Result mg/l	WHO Guideline Value whether exceeded and and by what percentage	EPA Maximum Contaminant Level (mg/l) whether exceeded and and by what percentage	BIS Permissible Limit (mg/l) whether exceeded and and by what percentage

	<u>Kalyani</u>											
1	Kl.R.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.R.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.05	400.00	233.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
2	Kl.R.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.R.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.012	20.00	Not Exceeded	Not Exceeded		Pb	0.025	150.00	66.67	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	0.001	Not Exceeded	Not Exceeded	Not Exceeded
3	Kl.U.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA

		Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
4	Kl.U.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.008	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
5	Kl.U.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
6	Kl.U.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.011	10.00	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Bansberia</u>											
7	Bns.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bns.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	0.01	Not Exceeded	Not Exceeded	NA		Cr	0.01	Not Exceeded	Not Exceeded	NA
		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.015	50.00	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
8	Bns.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bns.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	0.01	Not Exceeded	Not Exceeded	NA		Cr	0.01	Not Exceeded	Not Exceeded	NA

		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Chinsurah</u>											
9	Cns.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Cns.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
10	Cns.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Cns.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded

13	Brn.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Brn.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	0.01	Not Exceeded	Not Exceeded	NA
		Pb	0.05	400.00	233.33	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
14	Brn.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Brn.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	0.01	Not Exceeded	Not Exceeded	NA
		Pb	0.045	350.00	200.00	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Dum Dum</u>											
15	Dmd.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.04	300.00	166.67	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
16	Dmd.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
17	Dmd.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.05	400.00	233.33	Not Exceeded		Pb	0.04	300.00	166.67	Not Exceeded

		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
18	Dmd.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.033	230.00	120.00	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>North Kolkata</u>											
19	Nko.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nko.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA

		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
20	Nko.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nko.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.03	200.00	100.00	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Chandannagar</u>											
21	Fc.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Fc.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.03	200.00	100.00	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded

		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
22	Fc.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Fc.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.05	400.00	233.33	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	0	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Bhadreswar</u>											
23	Bds.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bds.Wt.A	Cd	ND	Not Exceeded	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

24	Bds.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bds.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	NA		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.06	500.00	300.00	20.00		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	0.001	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Uttarpara</u>											
25	Utp.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Utp.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.046	360.00	206.67	Not Exceeded		Pb	0.008	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
26	Upt.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Upt.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Pb	0.03	200.00	100.00	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Shibpur</u>											
29	Shb.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.016	60.00	6.67	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
30	Shb.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded

		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
31	Shb.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.017	70.00	13.33	Not Exceeded		Pb	0.005	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
32	Shb.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.023	130.00	53.33	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Naihati</u>											
33	Nht. Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht. Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
34	Nht.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
35	Nht.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

36	Nht.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	0.001	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Barrackpore</u>											
37	Mct.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Mct.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
38	Mct.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Mct.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.04	300.00	166.67	Not Exceeded		Pb	0.015	50.00	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Tangra</u>											
39	Tng.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Tng.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.007	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.005	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
40	Tng.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Tng.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA

	<u>Bantala</u>											
43	Sew.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Sew.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.1	900.00	566.67	100.00
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
44	Sew.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Sew.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
	Sew.Wt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt.B	Cr	ND	Not Exceeded	Not Exceeded	NA
	Sew.Wt.B	Pb	0.02	100.00	33.33	Not Exceeded	2.Sew.Wt.B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
	Sew.Wt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Sonarpur</u>											
45	Snp.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.008	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
46	Snp.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.05	400.00	233.33	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
47	Snp.R.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.R.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.06	500.00	300.00	20.00		Pb	0.03	200.00	100.00	Not Exceeded

		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
48	Snp.R.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.R.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.06	500.00	300.00	20.00		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Budge-Budge</u>											
49	Bbj.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA

		Pb	0.05	400.00	233.33	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
50	Bbj.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.04	300.00	166.67	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
51	Bbj.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.06	500.00	300.00	20.00		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
52	Bbj.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.05	400.00	233.33	Not Exceeded		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
	<u>Uluberia</u>											
53	Ulb.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
54	Ulb.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA

		Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
55	Ulb.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.02	100.00	33.33	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
56	Ulb.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
		Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded		Cr	ND	Not Exceeded	Not Exceeded	NA
		Pb	0.02	100.00	33.33	Not Exceeded		Pb	0.03	200.00	100.00	Not Exceeded
		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded		Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

The following table provides the same information with data sorted by metal.

TABLE 12 **Result Analysis, Data Sorted by Metal**

<u>I</u>	<u>II</u>	III	IV	V	VI	VII	<u>VIII</u>	IX	X	XI	XII	XIII
<u>Sl. No.</u>	<u>CODES</u>	Metal	Value in Sample (mg/l)	WHO Guideline Value (mg/l) whether exceeded and by what %	EPA Maximum Contaminant Level (mg/l) whether exceeded and by what %	BIS Permissible Limit (mg/l) whether exceeded and by what %	<u>CODES</u>	Metal	Value in Sample (mg/l)	WHO Guideline Value (mg/l) whether exceeded and by what %	EPA Maximum Contaminant Level (mg/l) whether exceeded and by what %	BIS Permissible Limit (mg/l) whether exceeded and by what %
1	Kl.R.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.R.Wt. .A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
2	Kl.R.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.R.Wt. .B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
3	Kl.U.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Wt. .A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
4	Kl.U.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Wt. .B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
5	Kl.U.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
6	Kl.U.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kl.U.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
7	Bns.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bns.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

8	Bns.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bns.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
9	Cns.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Cns.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
10	Cns.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Cns.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
11	Cns.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Cns.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
12	Cns.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Cns.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
13	Brn.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Brn.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
14	Brn.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Brn.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
15	Dmd.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
16	Dmd.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
17	Dmd.Wt .A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Wt .A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
18	Dmd.Wt .B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Dmd.Wt .B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
19	Nko.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nko.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

20	Nko.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nko.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
21	Fc.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Fc.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
22	Fc.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Fc.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
23	Bds.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bds.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
24	Bds.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bds.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
25	Utp.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Utp.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
26	Upt.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Upt.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
27	Kid.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kid.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
28	Kid.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Kid.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
29	Shb.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
30	Shb.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
31	Shb.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

32	Shb.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Shb.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
33	Nht. Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht. Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
34	Nht.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
35	Nht.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
36	Nht.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Nht.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
37	Mct.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Mct.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
38	Mct.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Mct.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
39	Tng.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Tng.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
40	Tng.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Tng.Pt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
41	Tng.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Tng.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
42	Tng.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Tng.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
43	Sew.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Sew.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

44	Sew.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Sew.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
45	Snp.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
46	Snp.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
47	Snp.R.W t.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.R. Wt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
48	Snp.R.W t.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Snp.R. Wt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
49	Bbj.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.R.U	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
50	Bbj.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.R.D	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
51	Bbj.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
52	Bbj.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Bbj.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
53	Ulb.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Wt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
54	Ulb.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Wt. B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
55	Ulb.Pt.A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ulb.Pt. A	Cd	ND	Uncertain	Not Exceeded	Not Exceeded

56	Ul.b.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded	2.Ul.b.Pt.B	Cd	ND	Uncertain	Not Exceeded	Not Exceeded
57	Kl.R.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Kl.R.Wt. .A	Cr	ND	Not Exceeded	Not Exceeded	NA
58	Kl.R.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Kl.R.Wt. .B	Cr	ND	Not Exceeded	Not Exceeded	NA
59	Kl.U.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Kl.U.Wt. .A	Cr	ND	Not Exceeded	Not Exceeded	NA
60	Kl.U.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Kl.U.Wt. .B	Cr	ND	Not Exceeded	Not Exceeded	NA
61	Kl.U.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Kl.U.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
62	Kl.U.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Kl.U.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
63	Bns.R.D	Cr	0.01	Not Exceeded	Not Exceeded	NA	2.Bns.R.D	Cr	0.01	Not Exceeded	Not Exceeded	NA
64	Bns.R.U	Cr	0.01	Not Exceeded	Not Exceeded	NA	2.Bns.R.U	Cr	0.01	Not Exceeded	Not Exceeded	NA
65	Cns.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Cns.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
66	Cns.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Cns.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
67	Cns.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Cns.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA

68	Cns.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Cns.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
69	Brn.R.U	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Brn.R.U	Cr	0.01	Not Exceeded	Not Exceeded	NA
70	Brn.R.D	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Brn.R.D	Cr	0.01	Not Exceeded	Not Exceeded	NA
71	Dmd.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Dmd.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
72	Dmd.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Dmd.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
73	Dmd.Wt .A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Dmd.Wt .A	Cr	ND	Not Exceeded	Not Exceeded	NA
74	Dmd.Wt .B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Dmd.Wt .B	Cr	ND	Not Exceeded	Not Exceeded	NA
75	Nko.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Nko.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
76	Nko.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Nko.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
77	Fc.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Fc.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	NA
78	Fc.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Fc.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	NA
79	Bds.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Bds.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA

80	Bds.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA	2.Bds.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
81	Utp.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Utp.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
82	Upt.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Upt.Pt.B	Cr	0.01	Not Exceeded	Not Exceeded	NA
83	Kid.R.U	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kid.R.U	Cr	0.03	Not Exceeded	Not Exceeded	NA
84	Kid.R.D	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kid.R.D	Cr	0.02	Not Exceeded	Not Exceeded	NA
85	Shb.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
86	Shb.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
87	Shb.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
88	Shb.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
89	Nht. Pt.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht. Pt.A	Cr	ND	Not Exceeded	Not Exceeded	NA
90	Nht.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	NA
91	Nht.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA

92	Nht.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
93	Mct.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Mct.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
94	Mct.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Mct.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
95	Tng.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
96	Tng.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Pt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
97	Tng.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
98	Tng.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
99	Sew.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
100	Sew.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
101	Snp.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Snp.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
102	Snp.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Snp.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
103	Snp.R.W t.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Snp.R. Wt.A	Cr	ND	Not Exceeded	Not Exceeded	NA

104	SnP.R.W t.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.SnP.R. Wt.B	Cr	ND	Not Exceeded	Not Exceeded	NA
105	Bbj.R.U	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.R.U	Cr	ND	Not Exceeded	Not Exceeded	NA
106	Bbj.R.D	Cr	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.R.D	Cr	ND	Not Exceeded	Not Exceeded	NA
107	Bbj.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	NA
108	Bbj.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	NA
109	Ulb.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Wt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
110	Ulb.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Wt. B	Cr	ND	Not Exceeded	Not Exceeded	NA
111	Ulb.Pt.A	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Pt. A	Cr	ND	Not Exceeded	Not Exceeded	NA
112	Ulb.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Pt.B	Cr	ND	Not Exceeded	Not Exceeded	NA
113	Kl.R.Wt. A	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.R.Wt .A	Pb	0.05	400.00	233.33	Not Exceeded
114	Kl.R.Wt. B	Pb	0.012	20.00	Not Exceeded	Not Exceeded	2.Kl.R.Wt .B	Pb	0.025	150.00	66.67	Not Exceeded
115	Kl.U.Wt. A	Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Wt .A	Pb	0.02	100.00	33.33	Not Exceeded

116	Kl.U.Wt. B	Pb	0.008	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Wt. .B	Pb	0.02	100.00	33.33	Not Exceeded
117	Kl.U.Pt. A	Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Pt. A	Pb	0.02	100.00	33.33	Not Exceeded
118	Kl.U.Pt. B	Pb	0.011	10.00	Not Exceeded	Not Exceeded	2.Kl.U.Pt. B	Pb	0.02	100.00	33.33	Not Exceeded
119	Bns.R.U	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bns.R.U	Pb	0.02	100.00	33.33	Not Exceeded
120	Bns.R.D	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bns.R.D	Pb	0.015	50.00	Not Exceeded	Not Exceeded
121	Cns.Pt.A	Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded	2.Cns.Pt. A	Pb	0.03	200.00	100.00	Not Exceeded
122	Cns.Pt.B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Cns.Pt. B	Pb	0.02	100.00	33.33	Not Exceeded
123	Cns.Wt. A	Pb	0.014	10.00	Not Exceeded	Not Exceeded	2.Cns.Wt. A	Pb	0.04	300.00	166.67	Not Exceeded
124	Cns.Wt. B	Pb	0.014	40.00	Not Exceeded	Not Exceeded	2.Cns.Wt. B	Pb	0.03	200.00	100.00	Not Exceeded
125	Brn.R.U	Pb	0.05	400.00	233.33	Not Exceeded	2.Brn.R.U	Pb	0.02	100.00	33.33	Not Exceeded
126	Brn.R.D	Pb	0.045	350.00	200.00	Not Exceeded	2.Brn.R.D	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
127	Dmd.Pt. A	Pb	0.04	300.00	166.67	Not Exceeded	2.Dmd.Pt. A	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded

128	Dmd.Pt. B	Pb	0.02	100.00	33.33	Not Exceeded	2.Dmd.Pt. B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
129	Dmd.Wt. .A	Pb	0.05	400.00	233.33	Not Exceeded	2.Dmd.Wt. .A	Pb	0.04	300.00	166.67	Not Exceeded
130	Dmd.Wt. .B	Pb	0.033	230.00	120.00	Not Exceeded	2.Dmd.Wt. .B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
131	Nko.Pt. A	Pb	0.02	100.00	33.33	Not Exceeded	2.Nko.Pt. A	Pb	0.02	100.00	33.33	Not Exceeded
132	Nko.Pt. B	Pb	0.03	200.00	100.00	Not Exceeded	2.Nko.Pt. B	Pb	0.03	200.00	100.00	Not Exceeded
133	Fc.Pt.A	Pb	0.03	200.00	100.00	Not Exceeded	2.Fc.Pt.A	Pb	0.02	100.00	33.33	Not Exceeded
134	Fc.Pt.B	Pb	0.05	400.00	233.33	Not Exceeded	2.Fc.Pt.B	Pb	0.03	200.00	100.00	Not Exceeded
135	Bds.Wt. A	Pb	0.02	100.00	33.33	Not Exceeded	2.Bds.Wt. A	Pb	0.02	100.00	33.33	Not Exceeded
136	Bds.Wt. B	Pb	0.06	500.00	300.00	20.00	2.Bds.Wt. B	Pb	0.02	100.00	33.33	Not Exceeded
137	Utp.Pt.A	Pb	0.046	360.00	206.67	Not Exceeded	2.Utp.Pt. A	Pb	0.008	Not Exceeded	Not Exceeded	Not Exceeded
138	Upt.Pt.B	Pb	0.032	220.00	113.33	Not Exceeded	2.Upt.Pt.B	Pb	0.035	250.00	133.33	Not Exceeded
139	Kid.R.U	Pb	0.05	400.00	233.33	Not Exceeded	2.Kid.R.U	Pb	0.03	200.00	100.00	Not Exceeded

140	Kid.R.D	Pb	0.03	200.00	100.00	Not Exceeded	2.Kid.R.D	Pb	0.02	100.00	33.33	Not Exceeded
141	Shb.Pt.A	Pb	0.016	60.00	6.67	Not Exceeded	2.Shb.Pt. A	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
142	Shb.Pt.B	Pb	0.02	100.00	33.33	Not Exceeded	2.Shb.Pt. B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
143	Shb.Wt. A	Pb	0.017	70.00	13.33	Not Exceeded	2.Shb.Wt. A	Pb	0.005	Not Exceeded	Not Exceeded	Not Exceeded
144	Shb.Wt. B	Pb	0.023	130.00	53.33	Not Exceeded	2.Shb.Wt. B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
145	Nht. Pt.A	Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht. Pt.A	Pb	0.02	100.00	33.33	Not Exceeded
146	Nht.Pt.B	Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Pt.B	Pb	0.02	100.00	33.33	Not Exceeded
147	Nht.Wt. A	Pb	0.009	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Wt. A	Pb	0.02	100.00	33.33	Not Exceeded
148	Nht.Wt. B	Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Wt. B	Pb	0.03	200.00	100.00	Not Exceeded
149	Mct.Wt. A	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Mct.Wt. A	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
150	Mct.Wt. B	Pb	0.04	300.00	166.67	Not Exceeded	2.Mct.Wt. B	Pb	0.015	50.00	Not Exceeded	Not Exceeded
151	Tng.Pt.A	Pb	0.007	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Pt. A	Pb	0.005	Not Exceeded	Not Exceeded	Not Exceeded

152	Tng.Pt.B	Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Pt. B	Pb	0.006	Not Exceeded	Not Exceeded	Not Exceeded
153	Tng.Wt. A	Pb	0.005	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Wt. A	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
154	Tng.Wt. B	Pb	0.005	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Wt. B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
155	Sew.Wt. A	Pb	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt. A	Pb	0.1	900.00	566.67	100.00
156	Sew.Wt. B	Pb	0.02	100.00	33.33	Not Exceeded	2.Sew.Wt. B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
157	SnP.Wt. A	Pb	0.008	Not Exceeded	Not Exceeded	Not Exceeded	2.SnP.Wt. A	Pb	0.03	200.00	100.00	Not Exceeded
158	SnP.Wt. B	Pb	0.05	400.00	233.33	Not Exceeded	2.SnP.Wt. B	Pb	0.02	100.00	33.33	Not Exceeded
159	SnP.R.W t.A	Pb	0.06	500.00	300.00	20.00	2.SnP.R. Wt.A	Pb	0.03	200.00	100.00	Not Exceeded
160	SnP.R.W t.B	Pb	0.06	500.00	300.00	20.00	2.SnP.R. Wt.B	Pb	0.02	100.00	33.33	Not Exceeded
161	Bbj.R.U	Pb	0.05	400.00	233.33	Not Exceeded	2.Bbj.R.U	Pb	0.03	200.00	100.00	Not Exceeded
162	Bbj.R.D	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.R.D	Pb	0.04	300.00	166.67	Not Exceeded
163	Bbj.Pt.A	Pb	0.06	500.00	300.00	20.00	2.Bbj.Pt.A	Pb	0.02	100.00	33.33	Not Exceeded

164	Bbj.Pt.B	Pb	0.05	400.00	233.33	Not Exceeded	2.Bbj.Pt.B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded
165	Ulb.Wt. A	Pb	0.02	100.00	33.33	Not Exceeded	2.Ulb.Wt. A	Pb	0.02	100.00	33.33	Not Exceeded
166	Ulb.Wt. B	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Wt. B	Pb	0.03	200.00	100.00	Not Exceeded
167	Ulb.Pt.A	Pb	0.02	100.00	33.33	Not Exceeded	2.Ulb.Pt. A	Pb	0.02	100.00	33.33	Not Exceeded
168	Ulb.Pt.B	Pb	0.02	100.00	33.33	Not Exceeded	2.Ulb.Pt.B	Pb	0.03	200.00	100.00	Not Exceeded
169	Kl.R.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.R.Wt .A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
170	Kl.R.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.R.Wt .B	Hg	0.001	Not Exceeded	Not Exceeded	Not Exceeded
171	Kl.U.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Wt .A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
172	Kl.U.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Wt .B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
173	Kl.U.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
174	Kl.U.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kl.U.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
175	Bns.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bns.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

176	Bns.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bns.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
177	Cns.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Cns.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
178	Cns.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Cns.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
179	Cns.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Cns.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
180	Cns.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Cns.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
181	Brn.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Brn.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
182	Brn.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Brn.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
183	Dmd.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Dmd.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
184	Dmd.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Dmd.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
185	Dmd.Wt .A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Dmd.Wt .A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
186	Dmd.Wt .B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Dmd.Wt .B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
187	Nko.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nko.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

188	Nko.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nko.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
189	Fc.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Fc.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
190	Fc.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Fc.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
191	Bds.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bds.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
192	Bds.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bds.Wt. B	Hg	0.001	Not Exceeded	Not Exceeded	Not Exceeded
193	Utp.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Utp.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
194	Upt.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Upt.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
195	Kid.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kid.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
196	Kid.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Kid.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
197	Shb.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
198	Shb.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
199	Shb.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

200	Shb.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Shb.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
201	Nht. Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht. Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
202	Nht.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
203	Nht.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
204	Nht.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Nht.Wt. B	Hg	0.001	Not Exceeded	Not Exceeded	Not Exceeded
205	Mct.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Mct.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
206	Mct.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Mct.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
207	Tng.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
208	Tng.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Pt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
209	Tng.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
210	Tng.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Tng.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
211	Sew.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

212	Sew.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Sew.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
213	SnP.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.SnP.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
214	SnP.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.SnP.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
215	SnP.R.W t.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.SnP.R. Wt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
216	SnP.R.W t.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.SnP.R. Wt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
217	Bbj.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.R.U	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
218	Bbj.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.R.D	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
219	Bbj.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
220	Bbj.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
221	Ulb.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Wt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
222	Ulb.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Wt. B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
223	Ulb.Pt.A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Pt. A	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded

224	Ulb.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded	2.Ulb.Pt.B	Hg	ND	Not Exceeded	Not Exceeded	Not Exceeded
-----	----------	----	----	--------------	--------------	--------------	------------	----	----	--------------	--------------	--------------

The following table sums up the detection scenario of the four metals over the two phases:

TABLE 13: THE NUMBER OF SAMPLES SHOWING DETECTION OF EACH OF THE CONTAMINANTS

Metals	All samples			River water Samples			Drinking Water Samples		
	No. of Samples	No. of Detections		No. of Samples	No. of Detections		No. of Samples	No. of Detections	
		First Phase	Second Phase		First Phase	Second Phase		First Phase	Second Phase
Cd	56	0	0	8	0	0	48	0	0
Cr	56	3	7	8	3	6	48	0	1
Pb	56	51	56	8	8	8	48	43	48
Hg	56	0	3	8	0	1	48	0	2

As can be gleaned from the above table, it is only lead that has been detected in a majority of samples. Detections for other metals are very few and far between. And indeed, once we take the river water samples out of reckoning, detection is confined entirely to the second phase, with two instances of mercury and a solitary instance of chromium. And nowhere have the the different drinking water standards been exceeded, except in the case of lead.

Let us therefore confine ourselves with the data for lead.

The number of laboratory results for lead showing exceedance from the three criteria under consideration is displayed in the table below.

TABLE 14 NUMBER OF WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb)

STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	35	40
EPA	31	38
BIS	4	1

TABLE 15 THE DEGREE OF EXCEEDANCE OF LEAD (Pb)							
FIRST PHASE TOTAL SAMPLES = 56				SECOND PHASE TOTAL SAMPLES = 56			
NUMBER OF SAMPLES SHOWING EXCEEDANCE OF 100% AND ABOVE				NUMBER OF SAMPLES SHOWING EXCEEDANCE 100% AND ABOVE			
	EXCEEDANCE > =100%	EXCEEDANCE >=200%	EXCEEDANCE >= 300%		EXCEEDANCE >=100%	EXCEEDANCE >=200%	EXCEEDANCE >=300%
WHO	29	20	15	WHO	38	17	5
EPA	20	13	4	EPA	17	2	1
BIS	0	0	0	BIS	1	0	0

The above results for lead are for the samples as a whole. However, among the samples there are 8 samples of Hooghly river water for the first and second phases respectively. The following array shows the values for the Hooghly river samples.

TABLE 16 The River Water Samples' results for Lead (Pb)												
Sl. No. in the above list	Code	Metal	Value in Sample (mg/l)	WHO Guideline Value (mg/l) whether exceeded and by what %	EPA Maximum Contaminant Level (mg/l) whether exceeded and by what %	BIS Permissible Limit (mg/l) whether exceeded and by what %	CODES	Metal	Value in Sample(mg/l)	WHO Guideline Value (mg/l) whether exceeded and by what %	EPA Maximum Contaminant Level (mg/l) whether exceeded and by what %	BIS Permissible Limit (mg/l) whether exceeded and by what %
119	Bns.R.U	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bns.R.U	Pb	0.02	100.00	33.33	Not Exceeded
120	Bns.R.D	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bns.R.D	Pb	0.015	50.00	Not Exceeded	Not Exceeded
125	Brn.R.U	Pb	0.05	400.00	233.33	Not Exceeded	2.Brn.R.U	Pb	0.02	100.00	33.33	Not Exceeded
126	Brn.R.D	Pb	0.045	350.00	200.00	Not Exceeded	2.Brn.R.D	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded

139	Kid.R.U	Pb	0.05	400.00	233.33	Not Exceeded	2.Kid.R.U	Pb	0.03	200.00	100.00	Not Exceeded
140	Kid.R.D	Pb	0.03	200.00	100.00	Not Exceeded	2.Kid.R.D	Pb	0.02	100.00	33.33	Not Exceeded
161	Bbj.R.U	Pb	0.05	400.00	233.33	Not Exceeded	2.Bbj.R.U	Pb	0.03	200.00	100.00	Not Exceeded
162	Bbj.R.D	Pb	0.01	Not Exceeded	Not Exceeded	Not Exceeded	2.Bbj.R.D	Pb	0.04	300.00	166.67	Not Exceeded

As these are not drinking water samples the application of drinking water standards is not quite pertinent, except for the fact that such application reveals the extent of background lead contamination. This is important as municipal water supply to taps in large parts of the Kolkata Metropolitan area draws upon Hooghly water. The above array reveals a considerable degree of lead contamination in various samples. Indeed lead is seen to be present in all the samples, above the instrument detection limit of 0.001 ppm. However, it is also important to note that the background lead contamination in Hooghly river water does not exceed the Indian standard. The import of this will be evident as we proceed.

It may be reiterated here that the Hooghly sampling was done at /near specific points where KMA drainage outfalls opened out into the Hooghly. The varying lead contamination of the samples could reflect the contamination profile of the outfalls. Let us take a look at the results more analytically:

TABLE 17 NUMBER OF RIVER WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb)

NUMBER OF SAMPLES = 8

STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	5	7
EPA	5	6
BIS	0	0

TABLE 18 THE DEGREE OF EXCEEDANCE OF LEAD (Pb) IN RIVER WATER SAMPLES							
FIRST PHASE TOTAL SAMPLES = 8				SECOND PHASE TOTAL SAMPLES = 8			
NUMBER OF SAMPLES SHOWING EXCEEDANCE OF 100% AND ABOVE				NUMBER OF SAMPLES SHOWING EXCEEDANCE 100% AND ABOVE			
	EXCEEDANCE >=100%	EXCEEDANCE >=200%	EXCEEDANCE >= 300%		EXCEEDANCE >=100%	EXCEEDANCE >=200%	EXCEEDANCE >=300%
WHO	5	5	4	WHO	6	0	0
EPA	5	4	0	EPA	3	0	0
BIS	0	0	0	BIS	0	0	0

We need to reiterate that the application of drinking water standards to river water is only in the way of getting a feel of the contamination levels and their variation.

An interesting pattern emerges in the above, if one may at all speak of patterns in only eight samples. The number of samples showing exceedance of the WHO and EPA standards, is a little more in the second phase. However the degree of contamination, reflected in degree of exceedance of standards, is noticeably less. We shall dwell on the significance of this pattern later.

As these are not drinking water samples they need to be removed from reckoning in order to get a better idea of the drinking water contamination scenario.

One can now remove the river samples from reckoning and witness the exceedance data with respect to the drinking water samples. The following tables display the data for lead in the drinking water samples.

Table 19 Lead Values for the two phases																			
	I	II	III		I	II	III		I	II	III		I	II	III		I	II	III
Sl	Sample Code	Phase 1 (mg/l)	Phase 2 (mg/l)	Sl	Sample Code	Phase 1 (mg/l)	Phase 2 (mg/l)	Sl. No	Sample Code	Phase 1 (mg/l)	Phase 2 (mg/l)	Sl	Sample Code	Phase 1 (mg/l)	Phase 2 (mg/l)	Sl	Sample Code	Phase 1 (mg/l)	Phase 2 (mg/l)

1	Kl.R.Wt .A	0.01	0.05	11	Dmd.P t.A	0.04	0.01	21	Utp.Pt. A	0.046	0.008	31	Mct.Wt. A	0.01	0.01	41	SnP.R. Wt.A	0.06	0.03
2	Kl.R.Wt .B	0.012	0.025	12	Dmd.P t.B	0.02	0.01	22	Utp.Pt. B	0.032	0.035	32	Mct.Wt. B	0.04	0.015	42	SnP.R. Wt.B	0.06	0.02
3	Kl.U.W t.A	0.009	0.02	13	Dmd. Wt.A	0.05	0.04	23	Shb.Pt. A	0.016	0.01	33	Tng.Pt. A	0.007	0.005	43	Bbj.Pt. A	0.06	0.02
4	Kl.U.W t.B	0.008	0.02	14	Dmd. Wt.B	0.033	0.01	24	Shb.Pt. B	0.02	0.01	34	Tng.Pt. B	ND	0.006	44	Bbj.Pt. B	0.05	0.01
5	Kl.U.Pt. A	0.009	0.02	15	Nko.Pt .A	0.02	0.02	25	Shb.Wt. A	0.017	0.005	35	Tng.Wt. A	0.005	0.01	45	Ulb.Wt .A	0.02	0.02
6	Kl.U.Pt. B	0.011	0.02	16	Nko.Pt .B	0.03	0.03	26	Shb.Wt. B	0.023	0.01	36	Tng.Wt. B	0.005	0.01	46	Ulb.Wt .B	0.01	0.03
7	Cns.Pt. A	0.009	0.03	17	Fc.Pt. A	0.03	0.02	27	Nht. Pt.A	ND	0.02	37	Sew.Wt .A	ND	0.1	47	Ulb.Pt. A	0.02	0.02
8	Cns.Pt. B	0.01	0.02	18	Fc.Pt. B	0.05	0.03	28	Nht.Pt. B	ND	0.02	38	Sew.Wt .B	0.02	0.01	48	Ulb.Pt. B	0.02	0.03
9	Cns.Wt. A	0.014	0.04	19	Bds.W t.A	0.02	0.02	29	Nht.Wt. A	0.009	0.02	39	SnP.Wt. A	0.008	0.03				
10	Cns.Wt. B	0.014	0.03	20	Bds.W t.B	0.06	0.02	30	Nht.Wt. B	ND	0.03	40	SnP.Wt. B	0.05	0.02				

A brief glimpse at Table 19 above will show that in the first phase results lead has been detected in 43 out of 48 samples, while in the second phase results lead has been detected in all 48 samples. It is now important to see how many drinking water samples have exceeded the WHO, EPA and BIS standards for lead, and to what extent. This information may be had from Tables 20 and 21.

TABLE 20 NUMBER OF DRINKING WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb)		
STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	30	33
EPA	26	32
BIS	4	1

Now let us take a look at the contamination load of the two phases respectively.

TABLE 21 THE DEGREE OF EXCEEDANCE OF LEAD IN THE DRINKING WATER SAMPLES							
FIRST PHASE TOTAL SAMPLES = 48				SECOND PHASE TOTAL SAMPLES = 48			
	EXCEEDANCE ≥100%	EXCEEDANCE ≥200%	EXCEEDANCE ≥ 300%		EXCEEDANCE ≥100%	EXCEEDANCE ≥200%	EXCEEDANCE ≥ 300%
WHO	24	15	11	WHO	32	14	4
EPA	15	9	4	EPA	14	2	1
BIS	0	0	0	BIS	1	0	0

Lead (Pb) exceedance information given in Tables 19, 20 and 21 above may be summed up as follows:

FOR THE FIRST PHASE

DETECTION: Lead has been detected in 43 out of 48 samples.

WHO GUIDELINES: The number of samples showing exceedance of WHO guidelines was 30. Out of these 30 samples, lead values in 24 samples showed an exceedance of hundred percent or more. Out of those 24 samples, 15 samples show an exceedance of 200% or more. Of those 15 samples, 11 samples show an exceedance of 300% or more.

EPA MCL: The number of samples showing exceedance of EPA MCL was 26. Out of these 26 samples, lead values in 15 samples showed an exceedance of hundred percent or more. Out of those 15 samples, 9 samples show an exceedance of 200 % or more and 4 samples show an exceedance of 300% or more.

BIS OR INDIAN STANDARD: Only 4 samples showed exceedance of BIS. But in none of these samples the exceedance of lead either exceeded or was even equal to 100%.

The mean value of the samples was 0.0222 mg/l.

FOR THE SECOND PHASE

DETECTION: Lead has been detected in all the 48 samples tested.

WHO GUIDELINES: The number of samples showing exceedance of WHO guidelines was 33. Out of these 33 samples, lead values in 32 samples showed an exceedance of hundred percent or more. Out of those 32 samples, 14 samples show an exceedance of 200 % or more and 4 samples show an exceedance of 300% or more.

EPA MCL: The number of samples showing exceedance of EPA MCL was 32. Out of these 32 samples, lead values in 14 samples showed an exceedance of hundred percent or more. Out of those 14 samples, 2 samples show an exceedance of 200 % or more and 1 sample shows an exceedance of 300% or more.

BIS: Only 1 sample showed exceedance of BIS, and the exceedance was equal to 100% (See also Table 7, Serial No. 155, Column XIII).

The mean value of the samples was 0.0219 mg/l.

FURTHER ANALYSIS

It first needs to be stressed that as in the above, further analysis also will confine itself to lead contamination detected in the samples, because contamination by other metals does not appear to be of significant concern.

Regarding the issue of lead contamination the first thing that must be addressed is that of variation among the standards. It is significant that the EPA action level is placed 50% higher than the WHO guideline. But what is of far greater concern is that the BIS lead standard for drinking water is set at 0.05 mg/l, which is 400% above the WHO guideline value for lead in drinking water. Given this vast difference it is little wonder that in the first phase, while 30 out of 48 samples show exceedance of WHO guideline value, only 4 sample show exceedance of BIS; and in the second phase, while 33 out of 48 samples exhibited WHO guideline exceeded, BIS exceedance was noticed in only one sample.

However, while the above analysis brings out the pattern inherent in the results it does not address the issue of the nature of the results in the two phases.

The second phase of the sampling was carried out in October, at the end of the rainy season (Monsoon in West Bengal – and Bihar – is usually taken to last till around the 10th of October. In 2010, rains had weakened by the end of September but there was a spell of heavy showers in early October both in West Bengal and Bihar). It is the time when the cumulative effect of the rains is at its highest, and aquifers and reservoirs are at their fullest, with contaminant concentration supposed to be at their lowest. Therefore one would expect that contaminant concentrations in water bodies would tend to be lower than in the dry season. It is true of course that monsoon was deficient in Eastern India in 2010. But nothing in the monsoon deficiency reports suggest that the deficiency was large enough decisively offset the dilution effect (actually the deficiency was not more than 20%).¹³

In fact, the river sample data does suggest lower concentration levels. For, while the immediate post-monsoon sampling shows a slight increase in the number of contaminated samples, the degree of contamination is lower across the sample range, as compared to the degree of contamination recorded in the First Phase (the dry season). Moreover the dilution effect is noticeably brought out in the central tendencies of the data from the two phases of river sampling, as shown in the following table:

TABLE 22 MEAN AND MEDIAN VALUES OF RIVER WATER SAMPLES		
	FIRST PHASE (mg/l)	SECOND PHASE (mg/l)
ARITHMETIC MEAN	0.032	0.023
MEDIAN	0.038	0.020

This is exactly what one would expect, with increase in volume of river water in a monsoon-end scenario. So in so far as the small number of samples indicates anything, it indicates that lead concentration in river water had probably decreased in the second phase.

One important feature of the data is that the closeness of the mean and median values indicates that the results are pretty close to “normal distribution”.

However as we have seen earlier, the main source of lead contamination of drinking water is purely local – primarily from plumbing systems in which the pipes, solder, fittings, or service connections to homes contain lead. The amount of lead dissolved from the plumbing system depends on several factors, including the presence of chloride and dissolved oxygen, pH, temperature, water softness, and standing time of the water, soft, acidic water being the most plumbosolvent. Therefore the slightly larger number of samples showing exceedance of WHO and EPA standards in the second phase could be the result of unknown local factors – including the effect of a very hot summer, plus the high temperatures prevailing during a rain deficient monsoon, on the lead in the plumbing.

However the lead concentration in the drinking water samples should also reflect the background contamination level to some extent. And if that be so, the total and average contamination load from second phase should be less than that from the first phase. This is

what is reflected in the mean values of the two phases, 0.0222 mg/l for the first phase and 0.0219 for the second phase. However, the difference between the two is very slight and emerges only when the values are expressed across four decimal places. Perhaps a clearer picture would emerge if one were to display the data arranged according to water sources.

TABLE 23 DRINKING WATER SAMPLES FROM GROUND WATER SOURCES

I	II	III	IV	I	II	III	IV
Sample Code	Water source	First Phase mg/l	Second Phase mg/l	Sample Code	Water source	First Phase mg/l	Second Phase mg/l
Bds.Wt.A	GW	0.02	0.02	Snp.Wt.A	GW	0.008	0.03
Bds.Wt.B	GW	0.06	0.02	Snp.Wt.B	GW	0.05	0.02
Cns.Wt.A	GW	0.014	0.04	Tng.Wt.A	GW	0.005	0.01
Cns.Wt.B	GW	0.014	0.03	Tng.Wt.B	GW	0.005	0.01
Dmd.Wt.A	GW	0.05	0.04	Ulb.Wt.A	GW	0.02	0.02
Dmd.Wt.B	GW	0.033	0.01	Ulb.Wt.B	GW	0.01	0.03
Kl.R.Wt.A	GW	0.01	0.05	Cns.Pt.A	GWMS	0.009	0.03
Kl.R.Wt.B	GW	0.012	0.025	Cns.Pt.B	GWMS	0.01	0.02
Kl.U.Wt.A	GW	0.009	0.02	Dmd.Pt.A	GWMS	0.04	0.01
Kl.U.Wt.B	GW	0.008	0.02	Dmd.Pt.B	GWMS	0.02	0.01
Mct.Wt. A	GW	0.01	0.01	Fc.Pt.A	GWMS	0.03	0.02
Mct.Wt.B	GW	0.04	0.015	Fc.Pt.B	GWMS	0.05	0.03
Nht.Wt.A	GW	0.009	0.02	Kl.U.Pt.A	GWMS	0.009	0.02
Nht.Wt.B	GW	0	0.03	Kl.U.Pt.B	GWMS	0.011	0.02
Sew.Wt.A	GW	0	0.1	Nht. Pt.A	GWMS	0	0.02
Sew.Wt.B	GW	0.02	0.01	Nht.Pt.B	GWMS	0	0.02
Shb.Wt.A	GW	0.017	0.005	Tng.Pt.A	GWMS	0.007	0.005
Shb.Wt.B	GW	0.023	0.01	Ulb.Pt.A	GWMS	0.02	0.02
Snp.R.Wt.A	GW	0.06	0.03	Ulb.Pt.B	GWMS	0.02	0.03
Snp.R.Wt.B	GW	0.06	0.02	Arithmetic Mean		0.0203	0.0231

TABLE 24			
DRINKING WATER SAMPLES FROM			
SURFACE WATER SOURCES			
I	II	III	IV
Sample Code	Water source	First Phase mg/l	Second Phase mg/l
Utp.Pt.A	MS (S)	0.046	0.008
Utp.Pt.B	MS (S)	0.032	0.035
Bbj.Pt.A	SMS	0.06	0.02
Bbj.Pt.B	SMS	0.05	0.01
Nko.Pt.A	SMS	0.02	0.02
Nko.Pt.B	SMS	0.03	0.03
Shb.Pt.A	SMS	0.016	0.01
Shb.Pt.B	SMS	0.02	0.01
Tng.Pt.B	SMS	0	0.006
ARITHMETIC MEAN		0.0304	0.0166

The columns in the above two tables, except Column II, are self-explanatory. Column II indicates the water source of the various samples. GW stands for groundwater and indicates that the water source is a tubewell – private or public, deep or shallow. GWMS stands for Ground Water Municipal Supply – indicating a water source that is ground water supplied to homes from Municipal Sources. SMS indicates Surface Water (actually Hooghly water), supplied to home by Municipal Supply. The code MS(S) is an interesting one. It reflects a situation where the Municipality supplies both ground and surface water, at different times of the day, but in the present case the sample was taken at a time when surface water was being supplied. Thus the various codes pithily, yet completely, reveal the nature of the source. *Since in almost all instances (barring a solitary instance of Chinsurah GWMS) samples of domestic tap water supplied by the municipality were collected from direct source (the pipe bringing in water directly from the municipality), and at a point where it was uncontaminated by the domestic plumbing apparatus* it was possible to ensure that the sample was indeed surface water supplied by the Municipality. And we must bear in mind that when we are talking of lead values found in samples of domestic tap water, we are talking of contamination levels detected in samples *taken from a tap* at the point where the municipal supply has just entered the premises, not after it has passed through or remained for hours in the domestic plumbing system.

Notwithstanding the difference between samples under GW and GWMS both are ground water sources and have been clustered together in one table. Similarly, SMS and MS(S) are surface water (i.e. Hooghly water) samples and have been clustered together in another table. This is the reason of the presence of only two tables.

And a look at the last row will immediately bring out difference in the contamination profile of the two categories. In the case of groundwater there is hardly any difference in the mean value between the two phases. In fact, the mean value in the second phase is slightly higher (noticeable in the third decimal place).

A very different picture emerges when we look at the municipal drinking water supply from surface, i.e. river water. Here the mean value of the first phase results is decisively larger than that of the second phase – a whopping 83% higher.

However the careful reader will have noticed that the strikingly high value of Utp.Pt.A in the first phase (which stands out also because of its very poor showing in the second phase). It is not only the highest value of the first phase, it is way above its nearest rival in this phase. Therefore it may be treated as an outlier, a chance high value that heavily influences the central tendency of a small sample set. So, one can take it out of consideration. One can similarly take out the lowest value in the second phase out of the computation of mean (0.006 mg/l, last result entry). We now have a relatively less imbalanced distribution. We now compute on the basis of 8, instead of 9, readings for each of the two phases.

Computing thus we find that the mean value for the first phase comes to be around 0.0285 mg/l and that for the second phase comes to be around 0.0179 mg/l. This reveals the first phase or dry season mean value as being 59% higher than the mean value of the second or wet phase.

Therefore the lower value for the second phase is not based on any chance high or low values affecting the total contamination load.

How do these drinking water values compare with river water data? As we have already seen, the mean value of river water samples in the first phase was 0.032 mg/l, while that for the second phase was 0.023 mg/l. Therefore the first phase or dry season mean is clearly 39% higher than the second phase or wet season mean.

Why is it that the difference in the mean value of lead contamination is less in river water when tested directly, as compared to the difference in mean value of lead contamination when the testing applies to river water in municipal supply? Let us promptly admit that we do not have a satisfactory answer to the question. But we do have a couple of points to make.

First, one must remember that in talking of direct river water sampling one is talking essentially of unfiltered “total water”, containing suspended particles in abandon. On the other hand in talking of municipal supply of the same water we are talking of water that passed through a great deal of filtration. Therefore there are limits to the extent to which contamination results from the two categories may be compared.

Secondly, we are talking here of very few samples. The total number of direct river water samples is eight and that of municipally supplied river water is nine. It does not do to take analysis very far on the basis of so few samples.

One last item in all this remains unexplained – how to explain the ground water values. As we have seen, the lead contamination load of the samples in the second phase is not one whit less than in the first phase; in fact it is very slightly more. How does one account for this fact, given that with enhanced volumes of water in the second phase the background contamination is bound to be low.

The candid answer is that we are not in a position to provide a fully satisfactory explanation, not the least because we do not have raw underground water data. The usual data on groundwater and our own data is not the basic contamination data for underground

water. Our samples are derived from water pumped to the surface through GI pipes, which are sources of lead contamination. Moreover none of our groundwater samples are from depth less than 100 ft., and are often from tubewells going 600 ft. or more underground.

However it is possible that groundwater, particularly groundwater that is in deep underground aquifers, is generally far freer from heavy metal contamination than surface water. If that is so then we can speculate on a hypothetical contamination scenario in connection with, say, a particular tubewell going sufficiently deep underground:

C is the average lead concentration in groundwater during dry season in a particular year.

C' is the average lead concentration in groundwater during the wet season in a particular year.

$$C > C'$$

$$C - C' = c$$

Both C and C' , as also c , are very low as compared to surface water contamination figures.

M is the average lead contamination load that gets attached to the water while it is being pumped from underground. M varies throughout the year and could acquire values of M' , M'' , M''' , M'''' etc.

When the sample is collected during the dry season the additional contamination load from plumbing etc. is M' ,

When the sample is collected during the immediate post-monsoons the additional contamination from plumbing etc. that attaches to the water has the average value of M'' .

Now average lead concentration in the pumped up water during the dry season will be $C + M'$ and the average lead concentration in the pumped up water during the immediate post monsoon will be $C' + M''$.

Since $C > C'$,

$C' + M'' \geq C + M'$ only if

(i) $M'' > M'$

And

(ii) $M'' - M' \geq c$

This will occur when lead contamination from pipes et al. tends to increase to an extent so as to offset or more than offset the decrease in background contamination concentration. As we have discussed earlier, the amount of lead dissolved from the plumbing system depends on several factors: including the presence of chloride and dissolved oxygen, pH, temperature, water softness, and standing time of the water, soft, acidic water being the most plumbosolvent. Therefore the slightly higher lead contamination load of groundwater could be the result of a number of local factors – including the effect of a very hot summer, plus the high temperatures prevailing during a rain deficient monsoon, on the lead in the plumbing.

SECTION G

STUDY IMPLICATIONS

The Lead Values and PTWI

We have seen that lead values have readily exceeded the WHO standard and a large number of samples have shown high degree of exceedance. This is however not merely the exceedance of an arbitrary value. For the WHO standard is based on the Provisional Tolerable Weekly Intake (PTWI) for lead and its exceedance is a serious issue, particularly for infants and children.¹⁴ And exceedance by 100% or more is a very serious health concern. It would be easy to show by calculation that the PTWI would be exceeded in the case of most of our drinking water samples, given normal water intakes. But that is not necessary as the WHO standard is specifically based on the WHO prescribed PTWI. Therefore we can say that if a particular sample indicates an exceedance of $E\%$ above the WHO guideline value for lead, then drinking that water at rates normal for tropical India would lead to exceedance by *at least* $E\%$ of the PTWI.

The Question of Indian Standard

One issue has remained unaddressed. That is the question of Indian standards raised earlier. We have seen in Table 16 that while the number of samples showing exceedance of WHO standards was 30 and 33, in First and Second Phases respectively, and the number of samples showing exceedance for EPA action level is 26 (First Phase) and 32 (Second Phase) the number of Samples showing exceedance of BIS is 4 in the first phase and only 1 in the second phase.

This of course results from the range of lead values and the fact that the BI Standard for lead in drinking water is pegged 400% above the WHO standard. This degree of difference is somewhat of an anomaly and is not noticed in the case of any other metal contaminant.

For it is not unusual for national standards to differ from WHO standards. But a four hundred percentage exceedance of the WHO standard is certainly an alarming state of affairs. For the WHO standard is based on lead PTWI and is therefore by no means an arbitrary figure. To uphold a drinking water standard far higher than the WHO guideline value can only be defended on the grounds that one finds WHO's PTWI value or associated reasoning unacceptable. But one does not find that viewpoint argued in the official Indian pronouncements on drinking water.

However, there are indications that the BIS regarding lead is going to be changed and the draft BIS, in circulation since 2009, specifies the lead standard in drinking water as 0.01mg/litre and announces that beyond this concentration the water becomes toxic.¹⁵ If one were to apply this draft BIS for lead then BIS exceedance in our study would exactly mirror the WHO exceedance statistics. The implications are obvious.

SECTION H

RECAPITULATION OF THE BASIC FEATURES OF FINDINGS

(i) SAMPLING

The sampling was done twice.

The first phase of sampling was undertaken during the dry season of 2010, between 30th of March and 26th of April, dates inclusive.

The second phase of sampling was undertaken in the immediate post-monsoon situation, between 19th of October and 2nd of November, dates inclusive.

The pattern and details of sampling in the Second Phase, in all its fundamental features, followed almost exactly the contours of the first phase.

During each phase:

A total of 56 water samples were collected.

Of these 56 samples, 8 samples were taken from 4 locales on the river Hooghly.

48 samples of drinking water were taken.

Of these 48 samples 39 samples were of ground water – private or public tubewells or municipal supply.

Another 9 samples were drinking water samples of surface (Hooghly) water, supplied by Municipal services.

(ii) THE RESULTS

The following table shows the detection scenario of the four metals over the two phases:

TABLE C1: THE NUMBER OF SAMPLES SHOWING DETECTION OF EACH OF THE CONTAMINANTS

Metals	All samples			River water Samples			Drinking Water Samples		
	No. of Samples	No. of Detections		No. of Samples	No. of Detections		No. of Samples	No. of Detections	
		First Phase	Second Phase		First Phase	Second Phase		First Phase	Second Phase
Cd	56	0	0	8	0	0	48	0	0
Cr	56	3	7	8	3	6	48	0	1
Pb	56	51	56	8	8	8	48	43	48
Hg	56	0	3	8	0	1	48	0	2

The above data indicates that detections for Cadmium, Chromium and Mercury are few and far between. In fact, these metals have almost wholly been detected in River Water Samples, with no detection in drinking water samples during the first phase and only two drinking water samples showing mercury and one showing chromium during the second

phase. However none of these samples showing detection show exceedance of national or international standards.

However lead has been detected in an overwhelmingly large proportion of the samples. The number of laboratory results for lead in the different water samples exhibiting exceedance from the three criteria under consideration is displayed in the table below.

TABLE C2 NUMBER OF WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb) [NO. OF SAMPLES = 56]

STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	35	40
EPA	31	38
BIS	4	1

TABLE C3 NUMBER OF RIVER WATER SAMPLES SHOWING EXCEEDANCE FOR LEAD (Pb) NUMBER OF SAMPLES = 8

STANDARDS	NO. IN FIRST PHASE	NO. IN SECOND PHASE
WHO	5	7
EPA	5	6
BIS	0	0

Now we must concentrate on the results for lead in the drinking water samples. This has been summed up as follows:

FOR THE FIRST PHASE

DETECTION: Lead has been detected in 43 out of 48 samples.

WHO GUIDELINE for Lead: The number of samples showing exceedance of WHO guidelines was 30. Out of these 30 samples, lead values in 24 samples showed an exceedance of 100% or more. Out of those 24 samples, 15 samples show an exceedance of 200% or more. Of those 15 samples, 11 samples show an exceedance of 300% or more.

EPA MCL (Action Level for Lead): The number of samples showing exceedance of EPA MCL was 26. Out of these 26 samples, lead values in 15 samples showed an exceedance of hundred percent or more. Out of those 15 samples, 9 samples show an exceedance of 200% or more and 4 samples show an exceedance of 300% or more.

BIS OR INDIAN STANDARD for lead: Only 4 samples showed exceedance of BIS. But in none of these samples the exceedance of lead either exceeded or was even equal to 100%.

The mean value of the samples was 0.0222 mg/l.

FOR THE SECOND PHASE

DETECTION: Lead has been detected in all the 48 samples tested.

WHO GUIDELINES: The number of samples showing exceedance of WHO guidelines was 33. Out of these 33 samples, lead values in 32 samples showed an exceedance of hundred percent or more. Out of those 32 samples, 14 samples show an exceedance of 200 % or more and 4 samples show an exceedance of 300% or more.

EPA MCL: The number of samples showing exceedance of EPA MCL was 32. Out of these 32 samples, lead values in 14 samples showed an exceedance of hundred percent or more. Out of those 14 samples, 2 samples show an exceedance of 200 % or more and 1 sample shows an exceedance of 300% or more.

BIS: Only 1 sample showed exceedance of BIS, and the exceedance was equal to 100% (See also Table 7, Serial No. 155, Column XIII).

The mean value of the samples was 0.0219 mg/l.

The dilution effect expected in the second phase was witnessed in the river water samples as follows:

TABLE C4 MEAN AND MEDIAN VALUES OF RIVER WATER SAMPLES

	FIRST PHASE (mg/l)	SECOND PHASE (mg/l)
ARITHMETIC MEAN	0.032	0.023
MEDIAN	0.038	0.020

The dilution effect on the contamination load is also seen in the surface water samples (basically Hooghly water) where the second phase shows a strikingly lower mean (and also median value).

TABLE C5 MEAN AND MEDIAN VALUES OF DRINKING WATER SAMPLES FROM SURFACE (RIVER) WATER SOURCE

	FIRST PHASE (mg/l)	SECOND PHASE (mg/l)
ARITHMETIC MEAN	0.0304	0.0166
MEDIAN	0.0300	0.0100

However the dilution effect is not witnessed in the ground water samples, where in fact the mean value for the second phase is very slightly higher than the mean value for the first phase – 0.0203 mg/l and 0.0231 mg/l respectively.

The explanatory hypothesis advanced to explain this fact is that:

The overwhelming majority of the samples have been collected from private or public tubewells that go deep underground, often to a depth of 600 ft. or more.

The lead contamination of groundwater at sufficient depths is rather low, as compared to surface water. Therefore the dilution of contamination caused by the result of increased volume of water in aquifers in the immediate post monsoon scenario is easily offset by any local factors – including the effect of a very hot summer, plus that of high temperatures prevailing during a rain deficient monsoon, on the lead in the plumbing.

Study Implications

We have seen that lead values have readily exceeded the WHO standard and large number have considerably exceeded it. This is however not merely the exceedance of an arbitrary value. For the WHO standard is based on the Provisional Tolerable Weekly Intake (PTWI) for lead and its exceedance is a serious issue, particularly for infants and children. And exceedance by 100% or 200% is a very serious health concern. It can be readily seen that if a particular sample indicates an exceedance of $E\%$ above the WHO guideline value for lead, then drinking that water at rates normal for tropical India would lead to exceedance by *at least* $E\%$ of the PTWI.

The Question of Indian Standard

While a large number of drinking water samples showed massive exceedance of WHO and EPA standards for lead, the samples showing exceedance of BIS was 4 in the first phase only 1 in the second phase.

This of course is the inevitable result of the fact that the BI Standard for lead in drinking water is pegged 400% above the WHO standard. This degree of difference is somewhat of an anomaly and is not noticed in the case of any other metal contaminant.

A four hundred percentage exceedance of the WHO standard is certainly an alarming state of affairs. For the WHO standard is based on lead PTWI and is therefore by no means an arbitrary figure. To uphold a drinking water standard far higher than the WHO guideline value can only be defended on the grounds that WHO's PTWI value or the associated reasoning unacceptable. But one does not find that viewpoint argued in the official Indian pronouncements on drinking water.

However, there are indications that the revision of IS regarding lead is underway and the draft BIS, in circulation since 2009, specifies the lead standard in drinking water as 0.01mg/litre and announces that beyond this concentration the water becomes toxic. If one were to apply this draft BIS for lead then BIS exceedance for lead in our study would exactly mirror the WHO exceedance statistics. The implications are obvious.

RECOMMENDATION

The obvious recommendation at this point would be to bring the results of this study to concerned authorities and press for further investigation of lead in drinking water. The lead in the water must be tested at various points of the water supply vector. The CPCB and the State PCBs should be immediately lobbied to undertake such investigation in collaboration with independent scientists and civil society groups. And the results of the investigations should be made public. The next phase of action can only be worked out after we have the results of a comprehensive investigation in our hands.

APPENDIX I

FIRST PHASE COLLECTION FROM TUBEWELLS AND TAPS FROM VARIOUS KMA SITES

SAMPLING SITE: Chinsurah Municipal area

SAMPLING DATE: 30th of March 2010

Source: Tubewells

1st Source

Public Tubewell

Location: 5 minutes walk from Gharimorr Crossing. Very close to PWD Hooghly Suburban Division Godown, a Mandir and Ashutosh Mistanna Bhandar and Opposite Bus Syndicate Office, Bus Route No. 23

Collection Time: 13:10 to 13:20

Depth of Tubewell: About 200 ft.

Date of Installation: Could not be determined with certainty

Type of Pipe: - GI Pipe.

Platform condition: - Good

Close to a street drain, but no stagnant water or industry close-by.

Sample Bottles Labelled As: Cns.Pt.A
Cns.Pt.A (Hg)

2nd Source

Public Tubewell:

Location: At Naldanga, Narayanpur, Chinsurah. Technically in the Panchayat area, but actually very urbanized. An extension of the Chinsurah urban area. Near Malancha Shishu Udyan.

Collection Time: - 14:45 to 14:50

Depth of Tubewell: 280 ft. (with Filter).

Date of Installation: Sometime in 2008

Type of Pipe: - GI Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: - Cns.Wt.B
Cns.Wt.B (Hg)

SAMPLING SITE: Chinsurah Municipal area

SAMPLING DATE: 30th of March 2010

Source: Tap

1st Source

Public

Location: Tap inside Bar Association Canteen, at Chinsurah Gharimorr Crossing.

Collection Time: - 13:10 to 13:20

Type of Pipe: - GI Pipe

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Cns.Pt.A
Cns.Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Name of Householder: Mr. Amal Kanti Sarkar
Address: 2 Kapasdanga Lichu Bagan
Near Sarat Sarani Canara Bank
Chinsurah

Collection Time: - 14:15 to 14:25

Type of Pipe: - G.I Pipe.

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Cns.Pt. B
Cns.Pt. B (Hg)

SAMPLING SITE: Kalyani Municipal area

SAMPLING DATE: 1st of April 2010

Source: Tubewell

1st Source

Private Tubewell:

Name of householder: Mr. Hiralal Majumder.

Address: A/ 9/188 Kalyani

Collection Time: 11:15 to 11:25

Depth of Tubewell: Could not be determined despite interrogation of locals.

Date of Installation: Sometime in the middle of 2003.

Type of Pipe: G.I Pipe.

Platform condition: Good

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Kl.U.Wt.A
Kl.U.Wt.A (Hg)

2nd Source

Private Tubewell:

Name of Householder: Mr. Narayan Chandra Bhadra.

Address: A-9/4/S Kalyani

Collection Time: 11:40 to 11:50

Depth of Tubewell: 110 ft. (with Filter).

Date of Installation: 1985.

Type of Pipe: G.I Pipe.

Platform condition: Good

No stagnant water & no industry near the water source

Sample Bottles Labelled As: Kl.U.Wt.B
Kl.U.Wt.B (Hg)

SAMPLING SITE: Kalyani Municipal area**SAMPLING DATE: 1st of April 2010****Source: Tap****1st Source****Domestic Source (Tap)**

Name of Householder: - Mr. Narayan Chandra Bhadra.

Address: - A-9/4/S Kalyani

Collection Time: 11:55 to 12:05**Type of Pipe:** G.I Pipe.

Water sample collection from direct source at house

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Kl.U.Pt. A
Kl.U.Pt. A (Hg)**2nd Source****Domestic Source (Tap)**

Name of Householders: - B. Roy & Smt. D. Roy

Address: -Sebayan Polly clinic,
A-9/203Kalyani**Collection Time:** 12:15 to 12:25**Type of Pipe:** G.I Pipe.

Water sample collection from direct source of house

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Kl.U.Pt. B
Kl.U.Pt. B (Hg)**SAMPLING SITE: Kalyani, Rural area**

SAMPLING DATE: 1st April 2010

Source: Tubewell

1st Source

Public Tubewell:-

Address: Madanpur (Kalyani), opposite *Video Hall Morr Crossing*. (Purbapara)

Collection Time:- 13:22 to 13:30

Depth of Tubewell: - Above 400 ft. (India mark II hand pump)

Date of Installation: - Middle of January 2009.

Type of Pipe: - G.I Pipe.

Platform condition: - Ok

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: - K1.R.Wt.A

K1.R.Wt.A (Hg)

2nd Source

Public Tubewell:

Address: Purba Para High School.

Collection Time: 13:50 to 14:00

Depth of Tubewell: above 400 ft.

Date of Installation: 2001.

Type of Pipe: G.I Pipe.

Platform condition: Good

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: K1.R.Wt.B

K1.R.Wt.B (Hg)

SAMPLING SITE: Dum Dum Municipality

SAMPLING DATE: 5th April 2010

**Source: Tubewell
Number: 2 (two)**

1st Source

PublicTubewell:

Name of club on whose grounds located: - Dum Dum Tarun Samity
Address: - 37 Dum Dum Road, Kol-700074

Collection Time: 14:20 to 14:00.

Depth of Tubewell: 60 ft.

Date of Installation: Sometime in the middle of 2003.

Type of Pipe: G.I Pipe.

Platform condition: Good

A big pond situated near water source within 7-10 ft. & no industry near the water source.

Sample Bottles Labelled As: DmD. Wt. A
DmD. Wt. A (Hg)

2nd Source

PublicTubewell:

Address: G.T.R Chasi math Basti near Baul Bakery
130/7, Dum Dum Rd.
Kolkata- 700074

Collection Time: 14:45 to 15:00

Depth of Tubewell: 110ft (with Filter).

Time of Installation: Sometime in 2002.

Type of Pipe: - G.I Pipe.

Platform condition: - broken

Stagnant water within 2 ft.

Sample Bottles Labelled As: DmD. Wt. B
DmD. Wt. B (Hg)

SAMPLING SITE: Dum Dum Municipality

SAMPLING DATE: 5th April in 2010

Sources: Tap

1st Source

Domestic Source (Tap)

Name of Householder: - Soma Sarkar.
Address: - 41-A Roy Mallick Colony
Kolkata - 30

Collection Time: 13:10 to 13:20

Type of Pipe: G.I Pipe.

Water sample collection from direct source (house)

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Dmd. Pt. A
Dmd. Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Name of Householder: Mr. Arun Das
Address: - 83/63 DumDum Rd.
Kolkata-74

Location: Near Mallick Bagan Pond.

Collection Time: 13:30 to 13:40

Type of Pipe: G.I Pipe.

Water sample collection from Reservoir (PVC Sintex)

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Dmd. Pt. B
Dmd. Pt. B (Hg)

SAMPLING SITE: North Kolkata
SAMPLING DATE: 5th of April 2010

Source: Tap

1st Source

Domestic Source (Tap)

Address: - Homoeo Clinic
Dr. R.N. Dey (Chamber)
9B, Mohanlal Street
Kolkata-700004

Collection Time: 16:05 to 16:15

Type of Pipe: G.I Pipe.

Water sample collected from direct source at premises.

Tala Water KMC Supply (surface)

Sample Bottles Labelled As: Nko. Pt. A
Nko. Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Address: Solanki Sweets
223A, A.P.C Rd.
Kolkata-700004

Location: Opp. P.K Type Chamber.

Collection Time: 16:30 to 16:40

Type of Pipe: G.I Pipe.

Water sample collection from direct source

Tala Water KMC Supply (surface)

Sample Bottles Labelled As: Nko. Pt. B

Nko. Pt. B (Hg)

SAMPLING SITE: Shibpur

Date of Collection: - 6th of April 2010

Source: Tubewell

1st Source

Private Tubewell:

Sanhati Apartment

Address: 23, Naskar Para Lane,

Howrah-3

Location: Near B. E. College Second Gate.

Collection Time: 11:-20 to 11:30

Depth of Tubewell: 200 ft.

Year of Installation: 1999.

Type of Pipe: G.I Pipe.

Platform condition: Good

No stagnant water & no industry close to water source.

Sample Bottles Labelled As: Shb.Wt.A

Shb.Wt.A (Hg)

2nd Source

Public Tubewell:

Address: - B.E. college 3rd gate

37/39/1, Foreshore road.

Location: near 55 Bus Stand.

Collection Time: - 12:20 to 12:30

Depth of Tubewell: - 60 ft.

Date of Installation: - 2009.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

There is stagnant water near the water source but no industry at very close quarters.

Sample Bottles Labelled As: Shb.Wt.B
Shb.Wt.B (Hg)

SITE LOCATION: Shibpur

Date of Collection: - 6th of April, 2010

Source: Tap

1st Source

Domestic

Name: Mr. Manas R. Maity
C/o Sanhati Apartment
Address: 23, Naskar Para Lane,
Howrah-3

Location: Near B. E. College Second Gate.

Collection Time: - 11:40 to 11:50

Type of Pipe: - G.I Pipe.

Water sample collection from direct source at flat

Surface Water (Howrah Municipal Corporation Supply)

Sample Bottles Labelled As: Shb. Pt. A
Shb. Pt. A (Hg)

2nd Source

Public Tap

Address: - B.Garden (56 Bus Stand Opp Basti)

Collection Time: - 12:45 to 12:55

Type of Pipe: - G.I Pipe.

Surface Water (Howrah Municipal Corporation Supply)

Sample Bottles Labelled As: Shb. Pt. B
Shb. Pt. B (Hg)

SITE: Chandannagar Corporation Area

SAMPLING DATE: - 7th of April 2010

Source: Tap

1st Source

Domestic

Name of Householder: Mr. Bhopal Samanta
Address: Bose Para Anandamouee tala
Chandannagar.

Collection Time: - 7:25 to 7:35

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Ground Water (Municipal Corporation Supply)

Sample Bottles Labelled As: FC. Pt. A
FC. Pt. A (Hg)

2nd Source

Domestic

Name of Householder: Mr. Chanchal Nandy
Address: Kholisani Bose para
Chandannagar

Location: Near BSNL Telephone Exchange

Date of Collection: - 7th April in 2010

Collection Time: - 8:50 to 9:00

Type of Pipe: - G.I Pipe.

Ground Water (Corporation Supply)

Sample Bottles Labelled As: - FC. Pt. B
FC. Pt. B (Hg)

SITE: Bhadreswar Municipality

Date of Collection: - 7th of April 2010

Source: Tubewell

1st Source

Public Tubewell:

Address: K.G.R Spot, Bangasree Pally,

Location: Near Sonali Tailor & Kali Mandir

Collection Time: 10:20 to 10:30

Depth of Tubewell: - 200 ft.

Date of Installation: - 1998.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water but a drain within 2ft & no industry very close to the water source.

Sample Bottles Labelled As: Bds.Wt.A
Bds.Wt.A (Hg)

2nd Source

Public Tubewell:

Address: - Bhadreswar K.G.R. road

Location: Inside 1No. Bangashree Pally

Collection Time: - 10:35 to 10:45

Depth of Tubewell: - 152 ft.

Date of Installation: - 2003.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry close to the water source.

Sample Bottles Labelled As: Bds. Wt. B
Bds. Wt. B (Hg)

Uttar Para Municipality

Date of Collection: 7th of April 2010

Source: Tap

1st Source

Domestic

Name: Laltu Da
Address: Acupuncture Center
Uttarpara 170A, Amarendra Sarani

Collection Time: - 11:40 to 11:55

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Surface & Ground both Water supplies at different time (Municipality Supply). But at the time of present collection the supply was that of surface water.

Sample Bottles Labelled As: Utp. Pt. A
Utp. Pt. A (Hg)

2nd Source

Domestic

Name: Mr. Pradip Mondal
Address: Kholisani Bose para
71, J.K. Street Uttarpara Hooghly (New No. 137)

Collection Time: - 12:00 to 12:15

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Municipality Supply – Both Surface & Ground Water supplied at different times. At the time the sample was collected the supply was that of surface water.

Sample Bottles Labelled As: Upt. Pt. B
Upt. Pt. B (Hg)

SAMPLING SITE: Naihati Municipal area

SAMPLING DATE: 14th of April 2010

Source: Tubewell

1st Source

Public Tubewell:

Address: 17/3 Ganmahammad ghat road
Naihati 24 pgs. (N)

Location: Near Mahakalitala Mandir.

Collection Time: - 11: 00 to 11: 10

Depth of Tubewell: - 210 ft.

Date of Installation: - 1980.

Type of Pipe: - G.I Pipe.

Platform condition: - Broken

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: - Nht. Wt. A
Nht. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - 8, George road
P.O Naihati, 24 Pgs. (N)

Location: In front of State Bank of India ATM Counter.

Collection Time: - 12:15 to 12:25

Depth of Tubewell: - 220ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Nht. Wt. B
Nht. Wt. B (Hg)

SAMPLING SITE: Naihati Municipal area
SAMPLING DATE: - 14th of April

Source: Tap

1st Source

Domestic

Name of Householder: - Mr. Debasish Dey.
Address: - 29, Haridas Ghosh road
Naihati 24 Pgs. (N)

Collection Time: - 11:20 to 11:30

Type of Pipe: - G.I Pipe.

Water sample collection from direct source at premises

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Nht. Pt. A
Nht. Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Name of householder: -Mr. Baidyanath Modok
Address: -47A, Janmahammad ghat road
Naihati 24 Pgs. (N)

Location: Near Pankaj Narayan Apartment.

Collection Time: - 11:40 to 11:50

Type of Pipe: - G.I Pipe.

Water sample collection from direct source at premises.

Ground Water (Municipal Supply)

Sample Bottles Labelled As: Nht. Pt. B
Nht. Pt. B (Hg)

SAMPLING SITE:Barrackpore Municipal area

SAMPLING DATE: 14th April in 2010

Source: Tubewell

1st Source

Public Tubewell:

Address: 2/A1, S.B. Ghosh road Anwasha Apartment,
Barrackpore Kolkata-123.

Location: Near Kerosene Oil shop & Mousumi Jewelers
Collection Time: 9:25 to 9:35

Depth of Tubewell: - 220 ft.

Date of Installation: - 1990.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Mct. Wt. A
Mct. Wt. A (Hg)

2nd Source

PublicTubewell:

Address: - 13 Rail gate, MadhuPandit road
Kumor Para, Barrackpur
Kolkata-123.

Collection Time: - 10: 00 to 10: 15

Depth of Tubewell: - 220ft.

Date of Installation: - 1997.

Type of Pipe: - G.I Pipe.

Platform condition: - Broken

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Mct. Wt. B
Mct. Wt. B (Hg)

SAMPLING SITE: Tangra

SAMPLING DATE: 15th of April 2010

Source: Tube wells

1st Source

Public Tubewell

Address: - Bhutnath Mahamaya High School
56/H/&D.C.Dey road
Kolkata-700005.

Collection Time: - 7: 40 to 7: 55

Depth of Tubewell: - 240ft.

Date of Installation: - 2004.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Tng. Wt. A
Tng. Wt. A (Hg)

2nd Source

Public Tubewell

Address: - 8, Sil Lane Tangra
Kolkata- 700015.

Location: Near Sitala Mandir.

Collection Time: - 8: 40 to 8: 55

Depth of Tubewell: - 192ft.

Date of Installation: - 2006.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Tng. Wt. B
Tng. Wt. B (Hg)

SAMPLING SITE: K.M.C Tangra

SAMPLING DATE: 15th of April 2010

Source: Tap

1st Source

Domestic

Name of Householder: - Mr. Anil Majhi
Address: - 10, Chingrighata Lane
Kolkata-700015

Location: Near Birla Gass Company & Tangra Primary School)

Collection Time: - 7: 20 to 7: 25

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Ground Water KMC Supply

Sample Bottles Labelled As: Tng. Pt. A
Tng. Pt. A (Hg)

2nd Source

Domestic

Name of Householder: - Ms. Kakali Chatterjee
Address: - 20/4 Sil Lane
Kolkata-700015

Location: Near Sil Lane Post Office.

Date of Collection: - 15th April in 2010

Collection Time: - 8:55 to 9:05

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Tala Water KMC Supply (surface)

Sample Bottles Labelled As: Tng. Pt. B
Tng. Pt. B (Hg)

SAMPLING SITE: KMA Bantala

SAMPLING DATE: 15th of April 2010

Source: Tube wells

1st Source

Public Tubewell:

Address: Purana Bazar Bantala
P.O Dhapa, P.S Tilzala
Kolkata-105

Location: Near M/s S.P. Singh & Brothers H.P Gass Center.

Collection Time: 12:00 to 12:15

Depth of Tubewell: - 120 ft.

Date of Installation: - 2003.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

This water source was situated near a big pond.

Sample Bottles Labelled As: Sew. Wt. A
Sew. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - Bantala Kalitala Primary School.
Purana Bazar Bantala
P.O Dhapa, P.S Tilzila
Kolkata-105

Collection Time: - 12:50 to 13:00

Depth of Tubewell: - 160ft.

Date of Installation: - 2009.

Type of Pipe: - G.I Pipe.

Platform condition: - Without Platform.
No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Sew. Wt. B
Sew. Wt. B (Hg)

SAMPLING SITE: Sonarpur Municipality

SAMPLING DATE: 20th of April 2010

Note: Pipe water supply system presently not functioning in Sonarpur. Therefore people use deep tubewell water for drinking purpose

Source: Tube wells

Public Tubewell:

Address: Ghasiara High School (H.S)
 Ghasira, Sonarpur
 Kolkata-700150.

Collection Time: 10:20 to 10:35

Depth of Tubewell: - Above 600 ft.

Date of Installation: - Not Known.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

This water source was situated near a big pond.

Sample Bottles Labelled As: Snp. Wt. A
 Snp. Wt. A (Hg)

2nd Source**Public Tubewell:**

Address: - Maddhya Para
 Ghasiara Sonarpur
 Kolkata-700150

Date of Collection: - 20th April in 2010

Collection Time: - 10:40 to 10:55

Depth of Tubewell: - Above 600 ft.

Date of Installation: - 1996.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: Snp. Wt. B
 Snp. Wt. B (Hg)

Sonarpur Rural Area

SAMPLING DATE: 20th of April 2010

Source: Tube wells

1st Source

Public Tubewell:

Address: Purba Sitalapara (Khalpar)
Sonarpur,

Collection Time: 11:20 to 11:35

Depth of Tubewell: - 1000 ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Without Platform.

This water source sited opposite a big Canal.

Sample Bottles Labelled As: Snp. R. Wt. A
Snp. R. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - Hasanpur
Sonarpur

Location: Beside a wooden foot bridge.

Date of Collection: - 20th April in 2010

Collection Time: - 11:50 to 12:00

Depth of Tubewell: - 1000 ft.

Date of Installation: - 2004.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

This water source sited beside a big Canal.

Sample Bottles Labelled As: Snp. R. Wt. B
Snp. R. Wt. B (Hg)

SAMPLING SITE: Budge-Budge Municipality

SAMPLING DATE: 22nd April in 2010

Note: Tubewell water quality in Budge Budge rural area is not potable on account of high salinity. Source of drinking water for the people is *timekal* (public tap with supply at certain times of the day) whose water comes from extended municipal supply, from a great distance. Therefore the decision was taken to collect municipal supply water only, from Budge Budge Municipality.

Source: Tap

1st Source

Domestic

Name of Householder: - Mr. Joydip Bhakta
Address: - 30, Haldar para road
Kolkata-700137

Collection Time: - 16: 20 to 16: 25

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Gardenreach Water Municipality Supply (surface)

Sample Bottles Labelled As: Bbj. Pt. A
Bbj. Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Name of Householder: - Mr. Nilambar Bhuniya
Address: - 37/1 Adhar Das road
Kolkata-700137

Location: Near Budge Budge Rail Station

Collection Time: - 17:10 to 17:15

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Gardenreach Water Municipality Supply (surface)

Sample Bottles Labelled As: - Bbj. Pt. B
Bbj. Pt. B (Hg)

SAMPLING SITE: Uluberia Municipality

SAMPLING DATE: 26th April in 2010

Source: Tubewell

1st Source

Public Tubewell:

Address: Uluberia Mayra para
Word No. 05

Location: Near swimming pool & Charulata Press.

Collection Time: 10:50 to 11:05

Depth of Tubewell: - More than 600 ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

This water source sited near a big pond.

Sample Bottles Labelled As: - Ulb. Wt. A
Ulb. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - Uluberia Rabindra bhavan
Word No.05

Location: Behind Rabindra bhavan & In front of Irrigation Office

Collection Time: - 11:20 to 11:30

Depth of Tubewell: - Above 600 ft.

Date of Installation: - 1999.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

No stagnant water & no industry near the water source.

Sample Bottles Labelled As: - Ulb. Wt. B
Ul. Wt. B (Hg)

SAMPLING SITE: Uluberia Municipality

SAMPLING DATE: 26th April in 2010

Source: Tap

1st Source

Domestic

Name of Householder: - Sanat Sarkar
Address: - Uluberia Mayra Para
Word No. 05
Charulata Press

Location: Near Swimming Pool

Collection Time: - 13: 05 to 13: 20

Type of Pipe: - G.I & P.V.C Pipe.

Water sample collected from direct source at premises.

Municipality Water Supply (Ground)

Sample Bottles Labelled As: Ulb. Pt. A
Ul. Pt. A (Hg)

2nd Source

Domestic

Name: - Mr. Sailen Chandra
Address: - 331/295/260, Uluberia Mayra Para
Ward No. 05

Location: Near Rabindra Bhavan.

Collection Time: - 12:45 to 13:00

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises

Municipality Water Supply (Ground)

Sample Bottles Labelled As: Ulb. Pt. B
Ul. Pt. B (Hg)

APPENDIX II
COLLECTION FROM TUBEWELLS AND TAPS FROM
VARIOUS KMA SITES

Chandannagar Corporation

Date of Collection: 19th of October, 2010

[Source: Tap]

Domestic Source (Tap)

Name: Mr. Bhopal Samanta
Address: Bose para Anandamouee tala
Chandannagar.

Collection Time: - 7:55 to 8:05 am

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at residence.

Ground Water (Municipal Corporation Supply)

Bottle Marking: - 2.FC.Pt.A
2.FC.Pt.A(Hg)

2nd Source

Domestic Source (Tap)

Name: Mr. Chanchal Nandy
Address: Kholisani Bosepara
Chandannagar

Location: Near BSNL Telephone Exchange

Collection Time: - 8:35 to 8:45 am

Type of Pipe: - G.I Pipe.

Ground Water (Corporation Supply)

Bottle Marking: - 2.FC.Pt.B
2.FC.Pt.B (Hg)

Chinsurah Municipal area
Date of Collection: 19th of October, 2010

[Source: Tubewell]

1st Source

Public Tubewell:

Location: 5 minutes walk from Gharimorr Crossing. Very close to PWD Hooghly Suburban Division Godown, a Mandir and Ashutosh Mistanna Bhandar and Opposite Bus Syndicate Office, Bus Route No. 23

Collection Time: - 10:40 to 10:55 am

Depth of Tubewell: - About 200 ft. (with Filter).

Date of Installation: - Could not be determined with certainty

Type of Pipe: - G.I Pipe.

Platform condition: - Good

Close to a street drain, but no stagnant water or industry close-by

Bottle Marking: - 2.Cns.Wt.A
 2.Cns.Wt.A (Hg)

2nd Source

Public Tubewell:

Location: At Naldanga, Narayanpur, Chinsurah. Technically in the Panchayat area, but actually very urbanized. An extension of the Chinsurah urban area. Near Malancha Shishu Udyan.

Collection Time: - 11:15 to 11:30 am

Depth of Tubewell: - 280 ft. (with Filter).

Date of Installation: - Sometime in 2008.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source

Bottle Marking: - 2.Cns.Wt.B
2.Cns.Wt.B (Hg)

[Source: Tap]

1st Source

Public Tap

Location: Tap inside Bar Association Canteen, at Chinsurah Gharimorr Crossing.

Date of Collection: - 19th Oct, 2010

Collection Time: - 10:20 to 10:35 am

Type of Pipe: - G.I Pipe

(Ground Water Municipal Supply)

Bottle Marking: - 2.Cns.Pt.A
2.Cns.Pt.A (Hg)

2nd Source

Domestic Source (Tap)

Name of Householder: Mr. Amal Kanti Sarkar

Address: 2 Kapasdanga Lichu Bagan

Near Sarat Sarani Canara Bank

Chinsurah

Date of Collection: - 19th Oct, 2010

Collection Time: - 11:40 to 11:55 am

Type of Pipe: - G.I Pipe.

Ground Water (Municipal Supply)

Bottle Marking: - 2.Cns.Pt.B
2.Cns.Pt.B (Hg)

Bhadreswar Municipality
Date of Collection: - 20th Oct, 2010

[Source: Tubewell]

1st Source

Public Tubewell:

Address: K.G.R Spot, Bangasree Pally,

Location: Near Sonali Tailor & Kali Mandir

Collection Time: 08:02 to 08:15 am

Depth of Tubewell: - 200 ft.

Date of Installation: - 1998.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

There were no industries and no stagnant water nearby but there was a drain within 2ft of the water source.

Bottle Marking: - 2.Bds.Wt.A
2.Bds.Wt.A (Hg)

2nd Source

Public Tubewell:

Address: - Bhadreswar K.G.R. road

Location: Inside 1No. Bangashree Pally

Collection Time: - 08:25 to 08:40 am

Depth of Tubewell: - 152 ft.

Date of Installation: - 2003.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water or industrial establishment near the water source.

Bottle Marking: - 2.Bds.Wt.B
2.Bds.Wt.B (Hg)

Uttar Para Municipality
Date of Collection: - 20th Oct in 2010

[Source: Tap]

1st Source

Domestic Source (Tap)

Name: Laltu Da. (Cont. 033-2118-0854)

Address: Acupuncture Center
Uttarpara 170A, Amarendra Sarani

Location: Gouri Cinema Morr.

Collection Time: - 11:20 to 11:30 am

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at residence.

Surface & Ground both Water supplies at different time (Municipality Supply). But at the time of present collection the supply was that of surface water.

Bottle Marking: - 2.Utp. Pt. A
2.Utp. Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Name: Mr. Pradip Mondal

Address: Kholisani Bose para
71, J.K. Street Uttarpara Hooghly (New No. 137)

Location: Near ATM Center ICICI Bank.

Collection Time: - 11:50 am to 12:05 pm

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at the premises

Surface & Ground both Water supplies in different time. (Municipality Supply)

Bottle Marking: - 2.Upt. Pt. B
2.Upt. Pt. B (Hg)

KMC North Kolkata
Date of Collection: - 20th Oct in 2010

[Source: Tap]

1st Source

Domestic Source (Tap)

Address: - Homoeo Clinic
Dr. R.N. Dey (Chamber)
9B, Mohanlal Street
Kolkata-700004

Location: Near SRA-BONI Hearing Aid Center & physiotherapy

Collection Time: - 03:30 to 03:45 pm

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at the premises.

Tala Water Kolkata Municipal Corporation (KMC) Supply (surface water)

Bottle Marking: - 2.Nko.Pt.A
2.Nko.Pt.A (Hg)

2nd Source

Domestic Source (Tap)

Address: - Solanki Sweets
223A, A.P.C Rd.

Kolkata-700004

Location: Opp. P.K Type Chamber.

Collection Time: - 04:00 to 04:15 pm

Type of Pipe: - G.I Pipe.

Water sample collection from direct source
Tala Water KMC Supply (surface)

Bottle Marking: - 2.Nko.Pt.B
2.Nko.Pt.B (Hg)

Naihati Municipal area
Date of Collection: - 21st Oct in 2010

[Source: Tube well]

1st Source

PublicTubewell:

Address: 17/3 Ganmahammad ghat road
Naihati 24 pgs. (N)

Location: Near Mahakalitala Mandir.

Collection Time: - 07:25 to 07:40 am

Depth of Tubewell: - 210 ft.

Date of Installation: - 1980.

Type of Pipe: - G.I Pipe.

Platform condition: - Broken

No stagnant water and no industry near the water source.

Bottle Marking: - 2.Nht.Wt.A
2.Nht.Wt.A (Hg)

2nd Source**Public Tubewell:**

Address: - 8, George road
P.O Naihati, 24 Pgs. (N)

Location: In front of State Bank of India ATM Counter.

Collection Time: - 07:50 to 08:05 am

Depth of Tubewell: - 220ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Nht.Wt.B
2.Nht.Wt.B (Hg)

[Source: Tap]

1st Source**Domestic Source (Tap)**

Name: - Mr. Debasish Dey.
Address: - 29, Haridas Ghosh road
Naihati 24 Pgs. (N)

Collection Time: - 06:40 to 06:50 am

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at premises.

Ground Water (Municipal Supply)

Bottle Marking: - 2.Nht.Pt.A
2.Nht.Pt.A (Hg)

2nd Source**Domestic Source (Tap)**

Name: -Mr. Baiddyanath Modok
 Address: -47A, Janmahammad ghat road
 Naihati 24 Pgs. (N)

Location: Near Pankaj Narayan Apartment.

Collection Time: - 07:05 to 07:15

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at premises.

Ground Water (Municipal Supply)

Bottle Marking: - 2.Nht.Pt.B
 2.Nht.Pt.B(Hg)

Kalyani Municipal area (East bank of Hooghly)

Date of Collection: - 21st October 2010

[Source: Tube well]

1st Source**Private Tubewell:**

Name: Mr. Hiralal Majumder.
 Address: A/ 9/188 Kalyani

Location: Near Railway Station & opposite statues of Vivekananda & Lenin.

Collection Time: 09:15 to 09:25 am

Depth of Tubewell: - Not known.

Date of Installation: - Middle of 2003.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Kl.U.Wt.A
2.Kl.U.Wt.A (Hg)

2nd Source

Private Tubewell:

Name: - Mr. Narayan ch. Bhadra.
Address: - A-9/4/S Kalyani

Location: This building situated close to & opposite statues of Vivekananda & Lenin.

Collection Time: - 09:35 to 09:45 am

Depth of Tubewell: - 110ft (with Filter).

Date of Installation: - 1985.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source

Bottle Marking: - 2.Kl.U.Wt.B
2.Kl.U.Wt.B (Hg)

[Source: Tap]

1st Source

Domestic Source (Tap)

Name: - Mr. Narayan ch. Bhadra.
Address: - A-9/4/S Kalyani

Location: This building situated close to and & opposite statues of Vivekananda & Lenin.

Collection Time: - 08:30 to 08:40 am

Type of Pipe: - G.I Pipe.

Water sample collection from direct source of house

Ground Water (Municipal Supply)

Bottle Marking: - 2.Kl.U.Pt.A
2.Kl.U.Pt.A(Hg)

2nd Source

Domestic Source (Tap)

Name: - B. Roy & Smt. D. Roy
Address: -Sebayan Poly-clinic,
A-9/203Kalyani

Location: Near Vivekananda & Lelin statue opposite lane.

Collection Time: - 08:55 to 09:05 am

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at premises.

Ground Water (Municipal Supply)

Bottle Marking: - 2.Kl.U.Pt.B
2.Kl.U.Pt.B(Hg)

Kalyani, Rural area

Date of Collection: - 21st Oct in 2010

_[Source: Tube well]

1st Source

Public Tubewell:-

Address: Madanpur (Kalyani) near Video hall more opposite site. (Purba para)

Collection Time: - 10:45 to 11:00 am

Depth of Tubewell: - More than 400 ft. (India Mark II hand pump)

Date of Installation: - Middle of January 2009.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Kl.R.Wt.A
2.Kl.R.Wt.A(Hg)

2nd Source

Public Tubewell:

Address: Purba para High School, Video More opposite gali, Brick soiling road. Near Mr. Samir Das's House.

Collection Time: - 11:20 to 11:35 am

Depth of Tubewell: - More than 400 ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Kl.R.Wt.B
2.Kl.R.Wt.B (Hg)

H.M.C Shibpur

Date of Collection: - 24th Oct in 2010

[Source: Tube wells]

1st Source

Private Tubewell:

Name: Mr. Manas Ranjan Maity
C/o Sanhati Apartment
Address: 23, Naskar Para Lane,
Howrah-3

Location: Near B. E. College Second Gate.

Collection Time: 10:40 to 10:55 am

Depth of Tubewell: - 200 ft.

Date of Installation: - 1999.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Shb.Wt.A
2.Shb.Wt.A (Hg)

2nd Source

Public Tubewell:

Address: - B.E. college 3rd gate
37/39/1, Foreshore road.

Location: near 55 Bus Stand.

Collection Time: - 11:20 to 11:35 am

Depth of Tubewell: - 60 ft.

Date of Installation: - 2009.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

There is stagnant water, near water source but no industry near the water source.

Bottle Marking: - 2.Shb.Wt.B
2.Shb.Wt.B (Hg)

[Source: Tap]

Domestic Source (Tap)

Name: Mr. Manas R. Maity
C/o Sanhati Apartment
Address: 23, Naskar Para Lane,
Howrah-3

Location: Near B. E. College Second Gate.

Collection Time: - 12:15 to 12:25 pm

Type of Pipe: - G.I Pipe.

Water sample was collected from direct source at premises.

Surface Water (Howrah Municipal Corporation Supply)

Bottle Marking: - 2.Shb. Pt. A
2.Shb. Pt. A (Hg)

2nd Source

Public Source (Tap)

Address: - B.Garden (56 Bus Stand Opp Slum)

Collection Time: - 12:35 to 12:45 pm

Type of Pipe: - G.I Pipe.

Surface Water (Howrah Municipal Corporation Supply)

Bottle Marking: - 2.Shb. Pt. B
2.Shb. Pt. B (Hg)

Dum Dum Municipality
Date of Collection: - 25th of October, 2010

[Source: Tubewell]

1st Source

Public Tubewell:

Name: - Dum Dum Tarun Samity
Address: - 37 Dum Dum Road, Kol-700074

Location: Near Brotochari, Yoga & Scout Center.

Collection Time: 11:25 to 11:40 am

Depth of Tubewell: - 60 ft.

Date of Installation: - Middle of 2003.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

A big pond situated near water source within 7-10 ft & no industry near the water source.

Bottle Marking: - 2.DmD. Wt. A
2.DmD. Wt. A (Hg)

2nd Source

PublicTubewell:

Address: G.T.R Chasi math Basti near Baul Bakery
130/7, Dum Dum Rd.
Kolkata- 700074

Collection Time: - 11:50 am to 12:05 pm

Depth of Tubewell: - 110ft (with Filter).

Date of Installation: - 2002.

Type of Pipe: - G.I Pipe.

Platform condition: - broken

Stagnant water within 2 ft near water source

Bottle Marking: - 2.DmD. Wt. B
2.DmD. Wt. B (Hg)

[Source: Tap]

1st Source

Domestic Source (Tap)

Name: - Soma Sarkar.
Address: - 41-A Roy Mallick Colony
DumDum- 30

Collection Time: - 12:10 to 12:20 pm

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Ground Water (Municipal Supply)

Bottle Marking: - 2.Dmd. Pt. A
2.Dmd. Pt. A (Hg)

2nd Source

Domestic Source (Tap)

Name: - Mr. Arun Das
Address: - 83/63 DumDum Rd.
Kolkata-74

Location: Near Mallick Bagan Pond.

Collection Time: - 12:30 to 12:40 pm

Type of Pipe: - G.I Pipe.

Water sample collection from Reservoir (P.V.C Sintex)

Ground Water (Municipal Supply)

Bottle Marking: - 2.Dmd.Pt.B
2.Dmd. Pt. B (Hg)

Barrackpore Municipal area

Date of Collection: - 25th of October
[Source: Tubewell]

1st Source

Public Tubewell:

Address: 2/A1, S.B. Ghosh road Annwasha Apartment,
Barrackpore Kolkata-123.

Location: Near K. Oil shop & Mousumi Jewelers

Collection Time: 01:45 to 01:55 pm

Depth of Tubewell: - 220 ft.

Date of Installation: - 1990.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Mct. Wt. A
2.Mct. Wt. A (Hg)

2nd Source

PublicTubewell:

Address: - 13 Rail gate, MadhuPandit road
Kumor Para, Barrackpur
Kolkata-123.

Collection Time: - 02:10 to 02:25 pm

Depth of Tubewell: - 220ft.

Date of Installation: - 1997.

Type of Pipe: - G.I Pipe.

Platform condition: - Broken

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Mct. Wt. B
2.Mct. Wt. B (Hg)

Tangra

Date of Collection: - 26th of October, 2010

[Source: Tubewell]

1st Source

Public Tubewell

Address: - Bhutnath Mahamaya High School
56/H/&D.C.Dey road
Kolkata-700005.

Collection Time: - 06: 40 to 06:50 am

Depth of Tubewell: - 240ft.

Date of Installation: - 2004.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Tng. Wt. A
2.Tng. Wt. A (Hg)

2nd Source**Public Tubewell**

Address: - 8, Sil Lane Tangra
Kolkata- 700015.

Location: Near Sitala Mandir.

Collection Time: - 07:20 to 07:35 am

Depth of Tubewell: - 192ft.

Date of Installation: - 2006.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Tng. Wt. B
2.Tng. Wt. B (Hg)

[Source: Tap]

1st Source

Domestic Source (Tap)

Name: - Mr. Anil Majhi

Address: - 10, Chingrighata Lane

Kolkata-700015

Location: Near Birla Gass Company & Tangra Primary School)

Collection Time: - 07:50 to 08:00 am

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Ground Water KMC Supply

Bottle Marking: - 2.Tng.Pt.A

2.Tng.Pt.A(Hg)

2nd Source

Domestic Source (Tap)

Name: - Ms. Kakali Chatterjee

Address: - 20/4 Sil Lane

Kolkata-700015

Location: Near Sil Lane Post Office.

Collection Time: - 08:20 to 08:30 am

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Tala Water KMC Supply (surface)

Bottle Marking: - 2.Tng.Pt.B

2.Tn.g.Pt.B(Hg)

Bantala
Date of Collection: - 26th of October, 2010

Sources: Tubewells
Number: 2

1st Source

Public Tubewell:

Address: Purana Bazar Bantala
P.O Dhapa, P.S Tilzila
Kolkata-105

Location: Near M/s S.P. Singh & Brothers H.P Gas Center.

Collection Time: 04:25 to 04:40 pm

Depth of Tubewell: - 120 ft.

Date of Installation: - 2003.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

This water source situated near a big pond.

Bottle Marking: - 2.Sew. Wt. A
2.Sew. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - Bantala Kalitala Primary School.
Purana Bazar Bantala
P.O Dhapa, P.S Tilzila
Kolkata-105

Collection Time: - 05:00 to 05:15 pm

Depth of Tubewell: - 160ft.

Date of Installation: - 2009.

Type of Pipe: - G.I Pipe.

Platform condition: - Without Platform.

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Sew. Wt. B
2.Sew. Wt. B (Hg)

PH. Reading: - 7 (Before adding solution) (Note: Solution added each bottle near about 30 drops)

KMA Sonarpur Municipality

Date of Collection: - 28th of October, 2010

Note: Pipe water supply system was not functioning at Sonarpur during time of sampling. Therefore the people in that area used Deep Tubewell water for drinking.

[Source: Tubewell]

Public Tubewell:

Address: Ghasiara High School (H.S)
Ghasira, Sonarpur
Kolkata-700150.

Collection Time: 10:25 to 10:40 am

Depth of Tubewell: - Above 600 ft.

Date of Installation: - Not Known.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

This water source is situated near a big pond.

Bottle Marking: - 2.Snp. Wt. A
2.Snp. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - Maddhya Para
Ghasiara Sonarpur
Kolkata-700150

Date of Collection: - 28th Oct in 2010

Collection Time: - 10:55 to 10:10 am

Depth of Tubewell: - More than 600 ft.

Date of Installation: - 1996.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Snp. Wt. B
2.Snp. Wt. B (Hg)

Sonarpur (Rural area)

Date of Collection: - 28th of October, 2010

[Source: Tubewell]

1st Source

Public Tubewell: (Note: Purba Sitalapara water source, used during the first phase, was found to be defunct. Therefore water was collected from the following source, situated in the same locality, but at a distance of about half a kilometer.)

Address: -Hasanpur Viddyapur abaitanik Primary School
Sonarpur,

Collection Time: 11:40 to 11:55 am

Depth of Tubewell: - 600 ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Without Platform.

This water source sited opposite a big Canal.

Bottle Marking: - 2.Snp. R. Wt. A
2.Snp. R. Wt. A (Hg)

2nd Source

Public Tubewell:

Address: - Hasanpur

Sonarapur

Location: Beside a wooden foot bridge.

Collection Time: - 12:10 to 12:25 pm

Depth of Tubewell: - 1000 ft.

Date of Installation: - 2004.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

This water source sited beside a big Canal.

Bottle Marking: - 2.Snp. R. Wt. B
2.Snp. R. Wt. B (Hg)

KMA Uluberia Municipality

Date of Collection: - 30th Oct in 2010

[Source: Tubewell]

1st Source

Public Tubewell:

Address: Uluberia Mayrapara

Ward No. 05

Location: Near swimming pool & Charulata Press.

Collection Time: 11:25 to 11:40 am

Depth of Tubewell: - Above 600 ft.

Date of Installation: - 2001.

Type of Pipe: - G.I Pipe.

Platform condition: - Good

This water source situated near a big pond.

Bottle Marking: - 2.Ulb.Wt.A
2.Ulb.Wt.A (Hg)

2nd Source

Public Tubewell:

Address: - Uluberia Rabindra bhavan
Word No.05

Location: Behind Rabindra bhavan & In front of Irrigation Office

Collection Time: - 12:00 to 12:15 pm

Depth of Tubewell: - Above 600 ft.

Date of Installation: - 1999.

Type of Pipe: - G.I Pipe.

Platform condition: - Good.

No stagnant water & no industry near the water source.

Bottle Marking: - 2.Ulb.Wt.B
2.Ulb.Wt.B (Hg)

[Sources 2 Nos. Tap]

1st Source

Domestic Source (Tap)

Name: - Sanat Sarkar
Address: - Uluberia Mayra Para
Word No. 05
Charulata Press

Location: Near Swimming Pool.

Date of Collection: - 30th Oct in 2010

Collection Time: - 12:45 to 12:55 pm

Type of Pipe: - G.I & P.V.C Pipe.

Water sample collected from direct source at premises.

Municipality Water Supply (Groundwater)

Bottle Marking: - 2.Ulb.Pt.A
2.Ulb.Pt.A (Hg)

2nd Source

Domestic Source (Tap)

Name: - Mr. Sailen Chandra
Address: - 331/295/260, Uluberia Mayra Para
Word No. 05

Location: Near Rabindra Bhavan.

Collection Time: - 01:10 to 01:20 pm

Type of Pipe: - G.I Pipe.

Water sample collection from direct source of House

Municipality Water Supply (Ground)

Bottle Marking: - 2.Ulb.Pt.B
2.Ulb.Pt.B (Hg)

Collection from Budge-Budge (Urban area)

Date of Collection: - 2nd of November, 2010

Note: Tubewell water quality is not good (salinity), therefore not used for drinking. Source of drinking water for the people is *timekal* (public tap with supply at certain times of the day) whose water comes from extended municipal supply, from a great

distance. Therefore the decision was taken to collect municipal supply water only, from Budge Budge Municipality.

[Sources: Tap]

1st Source

Domestic Source (Tap)

Name: - Mr. Joydip Bhakta
Address: - 30, Haldar para road
Kolkata-700137

Collection Time: - 07:30 to 07:40 am

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Gardenreach Water Municipality Supply (surface)

Bottle Marking: - 2.Bbj.Pt.A
2.Bbj.Pt.A (Hg)

2nd Source

Domestic Source (Tap)

Name: - Mr. Nilambar Bhuniya
Address: - 37/1 Adhar Das road
Kolkata-700137

Location: Near Budge Budge Rail Station.

Collection Time: - 08:00 to 08:10 am

Type of Pipe: - G.I Pipe.

Water sample collected from direct source at premises.

Garden Reach Water Municipality Supply (surface)

Bottle Marking: - 2.Bbj.Pt.B
2.Bbj.Pt.B (Hg)

NOTES AND REFERENCES

¹ *Methods for Chemical Analysis of Water and Wastes*, U. S. Environmental Protection Agency, Cincinnati, Ohio, 1983; Graeme E. Batley, *Trace Element Speciation: Analytical Methods and Problems*, CRC Press, 1989; *Water Quality Manual Part 1*, see http://www.internationalwaterinstitute.org/forms/water_quality_manual_part1.pdf; Leo M.L. Nollet, *Handbook of water analysis*, CRC Press, 2007; *Standard Methods for the Examination of Water and Wastewater*, 21st Edition, American Public Health Association, 2005.

² *Standard Methods for the Examination of Water and Wastewater*, op.cit. Part 3010 B.

³ *ibid.*

⁴ *Cadmium in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality*, WHO, Geneva, 2004, pp. 1-6; *Drinking water contaminants, US EPA*, in <http://water.epa.gov/drink/contaminants/index.cfm>; IS:10500:1991

⁵ *Chromium in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality*, WHO, Geneva, 2003, pp. 1-6; *Guidelines for Drinking Water Quality*, Third Edition, WHO, Geneva, 2008, pp. 334-35; *Drinking water contaminants, US EPA*, op.cit.; IS:10500:1991

⁶ *Lead in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality*, WHO, Geneva, 2003, pp. 1-10; *Guidelines for Drinking Water Quality*, Third Edition, WHO, Geneva, 2008, pp. 392-94; *Drinking water contaminants, US EPA*, op.cit.; IS:10500:1991

⁷ *Mercury in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality*, WHO, Geneva, 2005, pp. 1-8; *Guidelines for Drinking Water Quality*, Third Edition, WHO, Geneva, 2008, pp. 402-03; *Drinking water contaminants, US EPA*, op.cit.; IS:10500:1991

⁸ This is as per the First Revision of IS:10500. The second revision is underway, but apparently not been completed and made official.

⁹ *Drinking water contaminants, US EPA*, op.cit

¹⁰ *ibid*

¹¹ *ibid*

¹² *Guidelines for Drinking Water Quality*, Third Edition, WHO, Geneva, 2008, p. 186 & p. 334 ff

¹³ For the nature of 2010 monsoons, particularly for Eastern India see for example, *Annual Climate Summary 2010* in http://www.imdpune.gov.in/research/ncc/climatebulletin/annual_climate_summary_2010.pdf; *South West Monsoon 2010: A Review*, RBI Monthly Bulletin, November 2010, pp. 2373-2381; also *Monsoon ends, one-third country rain deficient*, in <http://www.ndtv.com/article/india/monsoon-ends-one-third-country-rain-deficient-60444>; Dr. Swadesh Mishra, *Weather and Climate of West Bengal* in West Bengal, Volume XLVIII, June 2006.

¹⁴ *Lead in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality*, WHO, Geneva, 2003, p. 10

¹⁵ Draft Indian Standard, *Second Revision* of IS 10500, Doc: FAD 25(2047)C