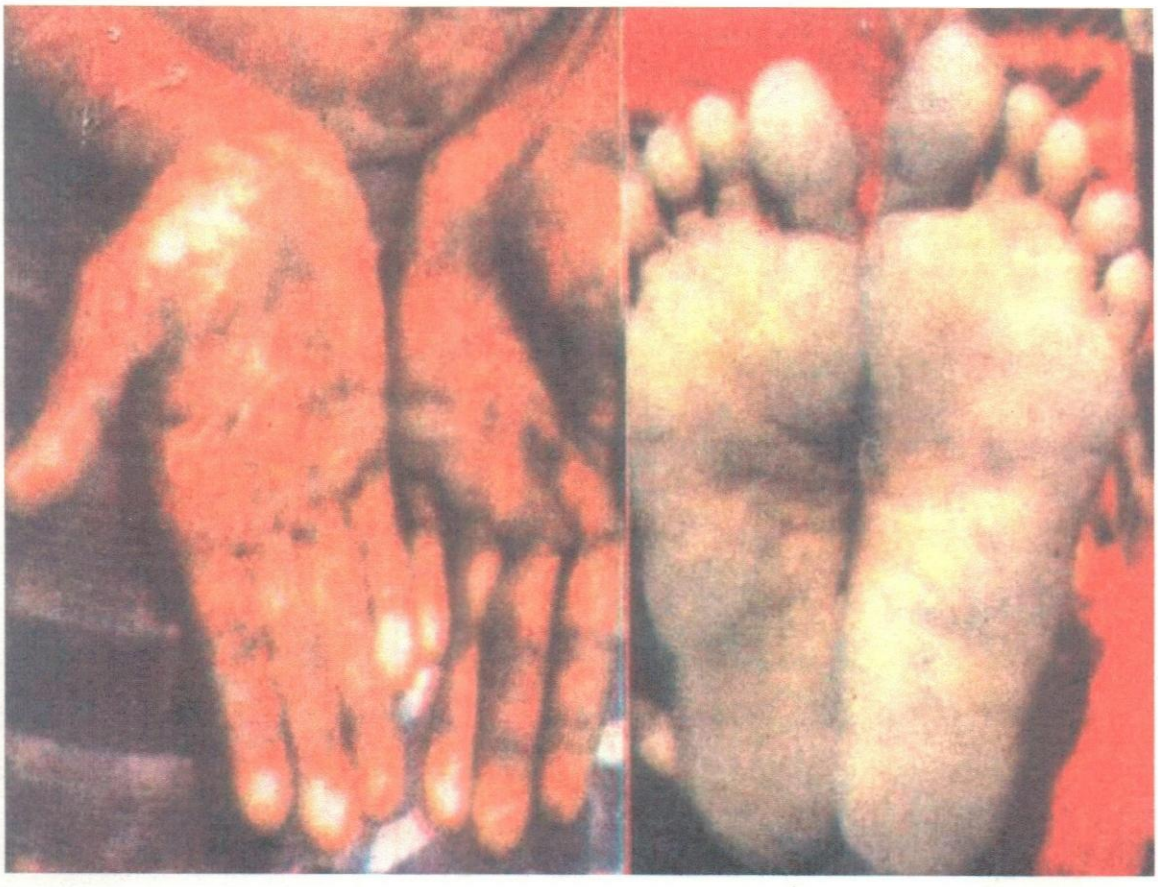
ARSENIC INVESTIGATION OF DRINKING WATER IN THE AREAS ADJACENT TO RRI



RESEARCH REPORT

REPORT NO. RES-1 (2002)

JUNE 2002

RIVER RESEARCH INSTITUTE, FARIDPUR

Ministry of Water Resources

Government of the People's Republic of Bangladesh

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RES-07/5

PREFACE

The arsenic contamination in drinking water is now one of the most vital problem in Bangladesh. At present people of many countries of the world have been suffering from the problem of arsenic. During the last three decade a large number of tube wells had been drilled though out the country by the Department of Public Health Engineering and other Non Government Organizations with the financial aid of UNICEF and many other donors to save the people from the water borne diseases. Now this drinking water has become poisonous by arsenic contamination. High concentration of arsenic in ground water has created serious problem in recent years. Arsenic has contaminated in the ground water of 61 districts out of 64 districts of Bangladesh. At present about 35 million of people of Bangladesh are at high risk at present due to consumption of arsenic contaminated water.

Faridpur is one of the worst arsenic affected areas of Bangladesh. Under this circumstance RRI had under taken a research project by its own fund to find out the level of arsenic in drinking water in the areas adjacent to RRI. Accordingly a four-member research team with a supervisor was formed to carry out activities of the project. The team members collected water samples of tube well in different areas adjacent to RRI of Faridpur and arsenic had been tested with the help of arsenic kit in RRI laboratory. Findings of this study will provide the information about arsenic situation of the study areas. The conclusion and recommendations presented in this report may be useful to policy makers and planners for mitigation of arsenic problem of the people of the study area.

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LIST OF ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BGS	British Geological Survey
BWDB	Bangladesh Water Development Board
DANIDA	Danish International Development Agency
DCH	Dhaka Community Hospital
DFID	Department for International Development
DPHE	Department of Public Health Engineering
DTW	Deep Tube Well
NIPSOM	National Institute of Preventive and Social Medicine
NGO	Non Government Organization
SDC	Swidish Development Corporation
STW	Shallow Tube Well
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Emergency Fund
WB	World Bank
WHO	World Health Organization

CHAPTER ONE

Introduction

Background

The arsenic contamination in drinking water is now one of the most vital problem in Bangladesh. In Bangladesh the contamination of arsenic in ground water was detected at first by DPHE at Chapai Nawabgang in 1993. The earlier discovery of arsenic in ground water in west Bengal followed the diagnosis of arsenic poisoning in 1978. The location of affected villages in West Bengal led many conclusion that the border districts of Bangladesh must also be contaminated to some degree. Various surveys during 1995 and 1996 confirmed these opinions, but more surprisingly found that contamination extended across large parts of the country, perhaps affecting even more people than in India (British Geological Survey, 1998). Government Non Government and International sector like DPHE, UNICEF, UNDP, WHO, DFID, WB, BWDB, GSB, BGS, DANIDA, NIPSOM, DCH, BAEC, DGHS, SDC etc. are taking program to detect the level, identify the source, extent , degree of contamination and mitigation of arsenic.

During the last three decade a large number of tube wells had been drilled through out the country by the Department of Public Health Engineering and other Non Government Organizations with the financial aid of UNICEF and many other donors to save the people from the water borne diseases. Now this drinking water has become poisonous by arsenic contamination. High concentration of arsenic in ground water has created serious problem in recent years. Specialists and Scientists suspect that the arsenic contamination in drinking water in Bangladesh is probably the largest mass poisoning case in the world now. An International Workshop for mitigation of arsenic problem was arranged by the ministry of the local government, Rural Development and Co-operative during the period of 14-16 January, 2002. In this workshop Specialists and Scientists opined that arsenic has contaminated in the ground water of 61 districts out of 64 districts of Bangladesh

(Source : The Daily Ittefaq, 14th January, 2002). They also suspect that about 35 million of people of Bangladesh are at high risk at present due to consumption of arsenic contaminated water. In the International Workshop the Chief Engineer, DPHE referred to a study report on "Contamination of arsenic in ground water of Bangladesh and its remedy" that the supply of arsenic free drinking water to every body has became now a serious problem in Bangladesh. Also mentioned in the report that the number of tube-wells drilled by Government and Private sector are 13 and 80 lacs respectively. Now it is required firstly, to test the water of all the tube-wells and detect arsenic level in each of the tube-wells. Secondly, to supply drinking water from alternative sources where arsenic level in drinking water is beyond permissible limit. Thirdly, to find out the sources of arsenic contamination in drinking water.

Faridpur is one of the worst arsenic affected areas of Bangladesh. Under this circumstance RRI had under taken a research project by its own fund to find out the level of arsenic in drinking water in the areas adjacent to RRI.

Objectives: The objectives of this project were:

- To detect the arsenic level in the drinking water of tube well in the areas adjacent to RRI.
- To develop awareness among the people about the adverse effect of drinking arsenic contaminated water.
- To put some suggestions and recommendations for mitigation of arsenic problem.

CHAPTER TWO

Arsenic contamination of Ground Water: A Global Perspective

Arsenic and its Dissemination

Arsenic is the twentieth most abundant element in the earth's crust. It has an average crust abundance of approximately 2 mg / kg (British Geological Survey, 1998). Arsenic comes in two forms namely organic and inorganic. Elevated levels of inorganic arsenic, the more harmful form to human. Organic arsenic is not found in ground water. Arsenic and its compounds are mobile in the environment. Weathering of rocks convert arsenic sulphides to arsenic trioxide which enters the arsenic cycle as dust or by dissolution in rain, river or ground water (Sobhan, et.al, 1999). Human exposure of arsenic occurs primarily from air, food and water. Ground water contains highest arsenic, especially where geo-chemical condition favors arsenic dissolution. It is highly toxic and is normally found in surface and ground water at the micrograms per litre level. Under certain condition it can occur at considerably higher concentrations. After fluoride arsenic is the naturally occurring chemical constituent of ground water that causes most health-related problem. Investigations over the last few years have identified problems with arsenic in ground water in a number of different hydro-geological environments and more investigations increase the areas of known occurrence. Arsenic has long been a recognised problem in sulphide mining areas in many parts of the world (BGS, 1998). Recent studies of arsenic in ground waters from major aquifers have shown that the occurrence can be wide spread depending on regional geological and environmental conditions. Arsenic concentrations significant higher than drinking water standards have been found in ground water of large parts of Argentina, Chile, Taiwan, Inner Mongolia, Mexico, Western USA, Thailand, Japan, India and Bangladesh. Many of the worst cases of arsenic contamination arise in reducing ground water where anaerobic condition favour mobilisation of arsenic substantially as arsenite. Examples of reducing aquifers include Taiwan and Inner Mongolia as well as Bangladesh and west Bengal. In other aquifers, arsenic may

be mobilised as arsenate under entirely oxidizing condition where ground water Ph is high. Examples include Argentina and parts of western USA.

Arsenic Affected Population of Some Countries

At present the drinking water of Bangladesh is not only polluted by arsenic but also the drinking water of many countries of the world are polluted by arsenic. Arsenic poisoning leading eventually to death, as worldwide poisoning out breaks shown as follows (Pearce, 1995, Chakroborti, 1997, Anwar, 2000):

Country	Arsenic poisoned population
Taiwan	20000
Inner Mongolia	50000
Obuasi Ghana	Unknown
Cordoba Argentina	10000
Antofagasta Chile	20000
Lagunera Mexico	20000
Cornwall Britain	Effect unknown
W. Bengal, India	38000000
Bangladesh	50000000

Health effects due to arsenic

At present disease from arsenic contaminated drinking water creates a major health hazard in the world.

(WHO, 1981,Pershgen, 1983, Anwar, 2000)

Organ affected	Effects
Skin	Hyperpigmentation Hyperkeratosis, skin tumours
Lungs	Lung cancer
Liver	Liver dysfunction Haemangioendothelioma
Cardiovascular system	Peripheral vascular disturbances Leading to gangrene
Nervous system	Peripheral neuropathy hearing defects
Haematopoietic system	Disturbed erythropoiesis with anaemi
Reproductive system	Increased frequency of spontaneous abortions

One early report described the death of fallow deer (Dama Dama) due to arsenic emissions from a silver foundry in Germany in 1887 (Hoffman, et. al, 1995). Studies of several affected populations, Particularly those in Argentina and chile (0.25 million people exposed for several decades), have revealed a close association between skin cancer and arsenic exposure. Similarly the incidence of Black foot disease in Taiwan, manifested by gangrene of extremities, was found to increase in a dose-dependent manner with arsenic (Tseng, 1977, anwar, 2000). A mass out break of arsenic poisoning occurred in young children in summer of 1955 in Japan (Kitamura, et., al., 1956, Anwar, 2000).

Arsenic is the most environment polluting element. Arsenic & its compounds are mobile in environment. Amount of arsenic present in different media and amount of arsenic enter into human body (WHO, 1996):

Media	Arsenic level in media	Taken per day	Arsenic taken per day	Remarks
Air	0.4-30 ngm/m^3	20 m^3	0.01-.6 µgm	May be more in industrial area
Food	0.4-120 µgm/kg	1kg	0.4-120 µgm	75%organic arsenic 25% Inorganic arsenic
Water (normaly)	1-2 µgm/l	2 litre	2-4 µgm	Inorganic arsenic is risky
Water (some cases)	12000 µgm/l	2 litre	24000 µgm	Arsenic affected area

CHAPTER THREE

Possible Source of Arsenic Contamination in Ground Water

Arsenic contamination in ground water occurs by anthropogenic or from natural sources.

Anthropogenic Sources

The following anthropogenic hypotheses are:

- Agro chemicals, either as an active elements in pesticides or as impurities in fertilizer
- Wood preservatives, principally in electricity pylons
- Industrial sources
- Mineral processing
- Acid mine drainage
- Enhance leaching beneath irrigated lands
- Burning of fossil fuels
- Other miscellaneous sources

Natural Sources

In the world literature, there have been a number of natural explanations for the occurrence of arsenic contamination. The following natural sources are:

- Extraction of ambient arsenic in ground water from deep wells screened in sedimentary, igneous or metamorphic rocks containing arsenic bearing minerals
- Leaching and percolation of arsenic in soils
- Atmospheric fall out

According to the British Geological Survey and MML (1998, 1999) predict that sources of arsenic is geological, in other words, naturally occurring arsenic contaminated the ground water. Based on the analysis of 51 bore hole samples in the affected districts of West Bengal, Mandal et al. (1996) deduce that the source of arsenic is Geological.

Mechanism of Release of Arsenic to Groundwater

Pyrite Oxydation

The role of pyrite oxidation as an explanation for both surface and ground water pollution has been demonstrated in many mining areas around the World (Welch et al. 1988, BGS, 1998). Various authors have sought to apply this hypotheses to arsenic Contamination in ground water in the Bengal Basin.

Arsenic is assumed to be present in certain sulphide minerals that are deposited with the aquifer sediments. Prior to ground water development the water in the aquifer is presumed to be reducing. In response to pumping, air or water containing dissolved oxygen penetrates deeper into the ground, leading to the decomposition of the sulphide minerals and the release of arsenic into the ground water. With continued pumping the arsenic is drawn down into the intake zones of shallow drinking water tube wells. The greater the volume abstracted and the greater the draw down of the water table, the greater will be the release of arsenic into ground water.

Oxyhydroxide Reduction

Arsenic is transported and deposited adsorbed into fine-grained iron or manganese and manganese oxyhydroxides which after burial, slowly break down as the pore waters of the sediment become more reducing over time. In this perspective, the origin of arsenic rich ground water is a natural process. Bhattacharya et al. (1997) suggested that arsenic in West Bengal ground water is mobilised by the release of adsorbed arsenic from iron oxyhydroxide present as coatings on sediment grains. This release takes place under reducing conditions. They state that currently it is not known whether the arsenic concentration in the ground water have always been high in the aquifer or whether the concentrations have increased as a consequence of ground water development. The bed rock sources of arsenic are inferred to be in eastern Bihar in the Chottonagpur-Rajmahal hills. Arsenic contained in pyrite or arsenopyrite has been deposited in the sediments and partly redistributed there. That fraction contained in clays may have remained in its initial form while that in the sandy sediments has been oxidised and adsorbed into iron and manganese rich coatings on sand grains.

Nickson (1997) and Nickson et al. (1998) have shown that in Bangladesh arsenic distribution in groundwater is related to geology of the aquifers. The Dupi Tila aquifer is generally free from arsenic contamination (in most cases less than 0.0003 mg/l) higher concentrations are found in the recent alluvial aquifers. The high concentrations of arsenic were associated with high concentrations of iron all cases. Sulphate concentrations were very low and are not correlated with arsenic. High arsenic waters always contained very low or no dissolved oxygen. At Tungipara, Faridpur and Manikganj arsenic concentrations were found to increase with depth (BGS, 1998).

Highly contaminated areas are found in the catchment of the Ganges, Brahmaputra and Meghna rivers and strongly suggesting that there were multiple source areas for the arsenic. The types of sediment deposited in the delta region

have been strongly influenced by global changes in sea level during the Pleistocene glaciations (anwar, 2000).

Different Parameters relating to the Mechanism of Arsenic Release are summarised bellow:

Hydrochemical Parameters

Dissolved oxygen	• High arsenic is found in oxygen-poor ground water
Redox conditions	• High arsenic occurs predominantly in strongly reducing water
Sulphate	• Very low concentration in general and no correlation with arsenic.
Bicarbonate	• Concentration is generally high and correlates positively with arsenic
Iron	• All most all high arsenic water contain high iron but high iron does not necessarily indicate high arsenic.
chloride	• Generally low all over the country, an apparent positive correlation with arsenic in the coastal areas
Phosphate	• Positively correlates with arsenic

Sedimentology and Mineralogy

SEM stydies	• A very strong positive correlation between iron and leaching tests confirms that arsenic is diagenetically available. Sulphur phases are rare and no arsenic – sulphur correlation exists. Finer fractions high amounts of arsenic.

Sediment Chemistry	• A very strong positive correlation between iron and leaching tests confirms that arsenic is diagenetically available. Sulphur phases are rare and no arsenic – sulphur correlation exists. Finer fractions high amounts of arsenic.
Optical microscopy	• Detrial grains of pyrite or arsenopyrite are vary rare. Conspicuous ferruginous coatings on the quartz and feldspar grains in contaminated aquifers.

Field Relations

Depth distribution	• Very shallow aquifers (<10 m) generally cntain low arsenic in most cases, whilst very high arsenic concentrations (> 0.5mg / l) are almost entirely restricted to the upper 50 m, and below 100 m few wells exceed 0.1 mg /l • At specific localities (e.g. Faridpur, Tungipara and Manikganj) concentration has been observed to increase with depth down to depths of up to 70 m. • Deep aquifers (>200 m) in the coastal area contain low arsenic , generally below the WHO Guideline, but may locally exceed the Bangladesh standard.
Water level	• There is no relationship between arsenic occurrence and depth of water level

Abstraction	• No relationship between amount of pumping and arsenic concentration
Geographical distribution	• That highest arsenic concentrations are found in the lower part of the delta suggests a secondary enrichment process.
Geological distribution	• Arsenic occurs in the Recent Alluvial aquifers not in the plio-pleistocene aquifers

Sources: British Geological Survey and MML (UK),(1998)

CHAPTER FOUR

Arsenic Problem in Bangladesh

The contamination of ground water by arsenic in Bangladesh is largest poisoning of population in history. Arsenic contamination in drinking water was first detected by DPHE at Chapai Nawabgonj in 1993 in our country. DPHE with assistance from UNICEF and British DFID carry out two surveys during 1997 to 2000 and obtain a figure of arsenic contaminated ground water in Bangladesh. Water of in total of 53500 nos. of tube wells have been tested and found the arsenic contamination in the ground water of 61 district out of 64 district of Bangladesh (The daily Ittefaq, date 14.01.02). But level of contamination of ground water is different in different areas. 268 upazilla 61 district have been found arsenic contamination in ground water. It has been found that 28% of the tube well have arsenic concentration exceeding the acceptable limit (0.05 mg/l) in Bangladesh (The daily Ittefaq, date 14.01.02). This contamination mainly found in shallow tube well (STW). Arsenic contamination in deep tube well which is (0.7%) as much less than STW.

The high risk arsenic polluted districts of Bangladesh are Chapai Nawabgonj, Rajshahi, Kushtia, Meherpur, Chuadanga, Satkhira, Bagerhat, Faridpur, Pabna, Jessore etc.

The areas vulnerable to arsenic contamination are the Ganges floodplain, the tidal region, the coastal plain and the Meghna flood plain (Sobhan, et., al., 1999). Some specialists opine that the arsenic problem in ground water particularly in southern region of Bangladesh is probably due to arsenic rich deltaic deposition and hydraulic connection with contaminated region of west Bengal province of India. But from the analysis of initial studies, it is clear that the main areas of contamination are the Ganges dependent areas of Bangladesh (Sobhan, et., al., 1999). The survey of the British Geological Survey and MMM (UK) (1998) shows that the deep aquifers that occurs mainly in the southern region of Bangladesh is

arsenic free, where as the surface aquifers are highly contaminated. South and south - east districts are most affected arsenic contaminated areas of Bangladesh (Paribesh patra, 2002). The percentage of the people of safe drinking water decrease from 98% to 80% because of arsenic presence in drinking water (Paribesh patra, 2002). It has been found that water in about 61.1% of the tube wells in the north-eastern zone have arsenic concentration exceeding the acceptable limit set by the WHO (0.01 mg / l) for drinking water and about 33.2% exceed the Bangladesh standard value (0.05 mg / l) (Badruzzaman et., al., 1998).

Arsenic contaminated ground water has been mainly detected in the upper and main aquifer and possibly deep aquifer is also contaminated in areas where it is hydraulically connected with the over lying main aquifer (Anwar, 2000). As the river flows in the down ward gradient, relatively ground water also moves slowly down ward layer if it is not closed by unpermeable layers. Most of the upper ground water of Bangladesh has almost the same flow direction as the rivers. At high stream stage during monsoon, there may be direct recharge into the upper aquifer if it is not saturated with rainwater. At low-stream (dry-season) stage, there is a discharge from the aquifer into the stream. There is also possible of moving contaminated ground water from upper catchment source.

About 80 million people in Bangladesh and the Indian state of west Bengal are now exposed to arsenic poisoning as most of the people still have been drinking arsenic contaminated water at levels between 5 and 100 times the WHO guide line (Observer Magazine, January 12, 2001).

There are many reports of death and serious infection relating arsenic poisoning. It is reasonable to believe that wide spread areas of Bangladesh have been contaminated. In Bangladesh most of the population does not know health effects of arsenic poisoning, even the doctors of the rural areas treat arsenic affected persons for skin disease. Allan H Smith, professor of epidemiology at the University of California at Berkely, USA, et. al. report that a long term epidemic of

cancers and other fatal disease is facing Bangladesh because of supply of naturally occurring arsenic contaminated water. Based on information from visit to Bangladesh by professor Smith between 1997 and 1998, this issues (The September issue of the Bulletin of the World Health Organisation) lead article predicts a major increase in the number of cases of disease caused by arsenic if the population continues to drink arsenic - contaminated water. These range from skin lesions to cancers of the bladder, kidney, lung and skin, neurological effects, cardiovascular and pulmonary disease and diabetes. The disease may develop slowly over many years for continue intake of arsenic contaminated drinking water (Observer Magazine, January 12, 2001).

Effect of arsenic is also creating problem in social life. The arsenic affected people are facing the following problems:

- Wives are sent back to their parents even sometimes together with their children.
- Many marriages are collapsing soon after the detection of arsenic cases in brides.
- In villages it becomes a headache for parents to get their affected daughters married.
- Arsenic affected people do not get chance to get job.
- None from other villages want to establish any marital or social relations with the people of arsenic affected villages.
- Ignorant villagers often confused skin manifestation with leprosy and therefore avoid the person socially.

CHAPTER FIVE

Arsenic contamination in drinking water of Faridpur

Faridpur is one of the worst arsenic affected areas of Bangladesh. In Faridpur and many places in Bangladesh deaths due to arsenic poisoning has been reported, Shahidul Islam of Harshava, Faridpur recently died at the age of 25 due to drinking water containing arsenic more than 1.7 mg/l. The whole family and others like Usha Rani Sutrodhor, Momta Begum, Mubarak Hossain of Dhakin Tapakhola and many other places are now waiting painful end of their life without getting any help or advise or knowing the reasons of this misery (Anwar,2000).

Table 1 Information about arsenic contamination in ground water of various upazilla under Faridpur district:

Upazilla	Total no. of tube well	No. of tube well of arsenic test	No. of arsenic contaminated tube well	Arsenic contamination in %
Faridpur sadar	21203	1160	513	44.22 %
Bhanga	22320	21003	19113	91 %
Sadorpur	8335	551	370	67.15 %
Nagarkanda	18919	1475	875	59.32 %
Boalmari	6813	830	330	39.75 %
Modhukhali	4116	638	52	8.15 %
Alfadanga	2509	964	654	67.84 %
Char Bhadrason	2673	287	58	20.20 %
Total	86888	26908	21965	49.70 %

Source: Department of Public Health

Table 2 Testing report on indication of drinking/non drinking water:

Union	Tested total no. of tube well	Green (drinking)	Red (non drinking)	Arsenic contaminated tube well in %
Ambikapur	3088	2492	596	19.3
Dikrir char	1294	1148	146	11.28
Gerda	1499	835	664	44.30
Koizuri	1988	795	1193	60.0
Char madhobdia	1493	1362	131	8.77
Aliabad	1495	660	835	55.85
Eshan gopalpur	995	867	128	12.86
Total	11852	8159	3693	31.16

(Source: World Vision, 2002)

CHAPTER SIX

Methodology

Study Area

The study areas under taken by the River Research Institute , Faridpur for arsenic investigation were Dangi, Kaita Kalibari under Nagar Kanda thana, Gerdha, Harukandi, Khabaspur, Alipur, Mahmudpur, Char Kamlapur, Ambikapur, Char Tepakhola, Gandia, Mallikpur, Goal Chamot, Kamlapur under sadar thana and Baksipur under Modhukhali thana of Faridpur district.

Method of Data Collection

Each sample collected in plastic container, was labeled separately with a unique identification number. A register khatha was maintained with the same unique number of each sample with the information on the owner of the tube well, village, mouza, union and thana. It also included the information on the collection date, depth of the tube well, description of disease and previously arsenic test was done or not.

Testing Procedure

The samples were tested using MERCK Arsenic Test Kit no. 1.17926.0001. Zinc and sulfuric acid were added to compounds of arsenic (iii) and arsenic (v), arsenic hydried is liberated, which in turn reacts with mercury (ii) bromide contained in the reaction zone of the analytical test strip to form yellow – brown mixed arsenic mercury halogenides. The concentration of arsenic (iii) and arsenic (v) were measured by visual comparison of the reaction zone of the analytical test strip with the fields of a colour scale. Measuring range/colour scale graduation were **0.00 - 0.01 - 0.025 - 0.05 - 0.1 - 0.5 mg / l $As^{3+/5+}$.**

Removed 1 analytical test strip and immediately reclosed the tube. With the reaction zone first inserted the test strip about half way through the slot in the stopper of the reaction vessel. By means of the syringe, transferred 10 ml of the solution to be tested to the reaction vessel and added 2 measuring spoonfuls of reagent As–1(zinc). Rapidly added 10 drops of reagent As-2 (sulfuric acid), immediately closed the reaction vessel with the stopper and swirled gently. The sample solution was not come in to contact with the test strip. Leave to stand for 30 minute, gently swirled two or three times. Removed the test strip, briefly dip into water, shaked off excess liquid and determined with which colour field on the label the colour of the reaction zone coincides most exactly. Read off the corresponding concentration value in mg / l $As^{3+ / 5+}$. If an exact colour match could not be achieved, estimated an intermediate value.

If the colour of the reaction zone is equal to or more intense than the colour field for 0.5 mg / l $As^{3+ / 5+}$, use the Merckoquant Arsenic Test cat. no. 1.10026.0001 (measuring range 0.1-3 mg / l $As^{3+ / 5+}$).

CHAPTER SEVEN

Results and Discussion

Arsenic Concentration Under Faridpur Pourashava Area

A total of 305 nos. tube well water samples were tested of Faridpur district. Among these 275 samples were under Faridpur Pourashava and 30 samples were outside the Pourashava.

Table 3 represents the distribution of arsenic in tube wells located in Faridpur pourashava area. Under Pourashava area, the arsenic concentration of about 44.36% of the tube wells were under WHO guideline (0.01 mg/l), about 32% of tube wells within the permissible limit of Bangladesh standard (0.05 mg/l) and about 23.64% of tube wells exceeding permissible limit (> 0.05 mg/l).

Table 3 Arsenic concentration under Faridpur Pourashava

No of well	Arsenic level under WHO guideline (0.01 mg/l)	Arsenic level within permissible limit (0.05 mg/l)	Arsenic level exceeding permissible limit (>0.05 mg/l)
275	122 (44.36%)	88 (32%)	65 (23.64%)

Arsenic Concentration Outside the Pourashava Area

Table 4 represents the distribution of arsenic in tube wells located outside the Faridpur pourashava area. Only 30 samples were collected from the outside of Pourashava area. Outside the Pourashava area, the arsenic concentration of about 13.33% of the tube wells were under WHO guideline (0.01 mg/l), about

6.67% within permissible limit of Bangladesh standard (0.05 mg/l) and about 80% of tube wells exceeding permissible limit (> 0.05 mg/l)

Table 4 Arsenic concentration out side the Pourashave area

No of well	Arsenic level under WHO guideline (0.01 mg/l)	Arsenic level within permissible limit (0.05 mg/l)	Arsenic level exceeding permissible limit (>0.05 mg/l)
30	4 (13.33%)	2 (6.67%)	24 (80%)

Arsenic Contamination of Faridpur as a Function of Depth

Table 5 shows the arsenic contamination increase with the increase of depth. Depth bellow 50 ft total of 41 no. of tube well samples were tested. Out of tested samples 92.68% of tube wells were arsenic level under WHO guideline (0.01 mg/l), 4.88% within permissible limit (0.05 mg/l) and 2.44% exceeding permissible limit (>0.05 mg/l). Depth between 50 to 100 ft total of 94 no. of tube well samples were tested. Out of tested samples 40.43% of tube wells were arsenic level under WHO guideline (0.01 mg/l), 34.04% within permissible limit (0.05 mg/l) and 25.53% exceeding permissible limit (>0.05 mg/l). Depth between 101to 150 ft total of 51 no. of tube well samples were tested. Out of tested samples 25.49% of tube wells were arsenic level under WHO guideline (0.01 mg/l), 39.22% within permissible limit (0.05 mg/l) and 35.29% exceeding permissible limit (>0.05 mg/l). Depth between 151to 250 ft total of 51 no. of tube well samples were tested. Out of tested samples0% of tube wells were arsenic level under WHO guideline (0.01 mg/l), 40% within permissible limit (0.05 mg/l) and 60% exceeding permissible limit (>0.05 mg/l).

Table 5 Arsenic Contamination of Ground Water in Faridpur as a Function of Depth

Depth range in ft	No. of wells	Arsenic level under WHO guideline (0.01 mg/l)	Arsenic level within permissible limit (0.05 mg/l)	Arsenic level exceeding permissible limit (>0.05 mg/l)
<50	41	38 (92.68%)	2 (4.88%)	1 (2.44%)
50 - 100	94	38 (40.43%)	32 (34.04%)	2 (4.88%)
101 – 150	51	13 (25.49%)	20 (39.22%)	18 (35.29%)
150 – 250	25	0 (0%)	10 (40%)	15 (60%)

CHAPTER EIGHT

Conclusion and Recomendations

Conclusion

Arsenic concentration in drinking water is a serious problem in Bangladesh. About 35 million people of the country is at the risk due to the presence of excess arsenic in ground water. The implication of public health are critical.

The case of Faridpur most of the areas are arsenic affected. Pourashava area has been less affected than the outside of the Pourashava. Among the area under Pourashava, Char Kamlapur have the higher percentage of tube wells contaminated with arsenic. Arsenic contamination increase with the increase of depth. Under Pourashava area, the arsenic concentration of about 44.36% of the tube wells are under WHO guideline (0.01 mg/l), about 32% of tube wells within the permissible limit of Bangladesh standard (0.05 mg/l) and about 23.64% of tube wells exceeding permissible limit (> 0.05 mg/l).

Out side the Pourashava area, the arsenic concentration of about 13.33% of the tube wells are under WHO guideline (0.01 mg/l), about 6.67% within permissible limit of Bangladesh standard (0.05 mg/l) and about 80% of tube wells exceeding permissible limit (> 0.05 mg/l).

From the table 1 showing the information about arsenic contamination in ground water of various upazilla under Faridpur district obtained from DPHE, it is seen that the percentage of arsenic contamination in tube well is highest in Bhanga (91%) and lowest in Char Bhadrason (20.20%). From the table 2 showing the arsenic contamination statistics of World Vision, it is observed that the percentage of drinking / non drinking tube well due to contamination of arsenic are 60% and 8.77% in Koizuri union and Charmadhobdia union of Faridpur district respectively.

Recommendations

The following recommendations can be taken for remedy of arsenic:

- Alternative source of water like rain water harvesting, water of pond with treatment can be used for prevention of arsenic contamination.
- In affected area treatment plant should be constructed for removal of arsenic in order to supply arsenic free water.
- In arsenic affected areas if possible piped water supply scheme should be taken up to supply treated water from surface water source.
- In order to identify the sources of arsenic in affected areas drilling is necessary to investigate the geochemistry and hydrology of the affected aquifer.
- Approprite and sophisticated equipments for detection of arsenic with maximum accuracy should be supplied from the Government to different research organizations those are engaged in arsenic related problem.
- News media should be taken active part to aware the people about the adverse effect of arsenic through advertising.
- Non Government Organization should come in forward with all efforts to mitigate the arsenic problem and aware the people about the adverse effect of arsenic.
- Multi mass media should take active part to aware the people about disease due to arsenicosis.
- Arsenic affected people should consume huge amount of vegetables and nutricious food (like meat, fish, egg, milk, pulse etc.) to prevent arsenic related disease.
- Rain water harvesting, storing and utilizing may reduce the intake of arsenic in human body.
- For detail investigation of arsenic situation of Faridpur, it is required to test the water samples of all the tube wells of this area.

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APPENDIX

List of tube wells with owner, depth of tube well and obtained arsenic level of study area :

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
Dangi										
1	04.02..02	Syed Abdus Sobhan Atail, Nogorkanda	150				>0.05 <0.1			
2	04.02..02	Shekh Zoinaddin Atail, Nogorkanda	150				>0.05 <0.1			
3	04.02..02	Syed Abdus Sobhan Atail, Nogorkanda (Beside Mosque)	150				>0.05 <0.1			
4	04.02..02	Md. Altaf Hossain Chousara, Nogorkanda	165					>0.1	< 0.5	
5	04.02..02	Md. Shekh Sohrab Chousara, Nogorkanda	165				>0.05	< 0.1		
6	04.02..02	Md. Lal Mia Atail, Nogorkanda	160				>0.05	< 0.1		
7	04.02..02	Ronjit Kumar Naruahati, Nagarkanda	245					0.1		
8	04.02..02	Sankar Biswas Naruahati, Nogorkanda	140					>0.1	< 0.5	
9	04.02..02	Khirot Chandra Mondol Naruahati, Nogorkanda	150					0.1		
10	04.02..02	Ashrafia Etimkhana Shankar Pasa, Nagarkanda	150					>0.1	<0.5	
Kaita kalibari										
11	04.02.02	Syed Abdus Subhan Konagram, Mohila Road, Kaita Kalibari, Nagarkanda	120				0.05			
12	04.02.02	Pachu Driver Konagram, Mohila Road, Kaita Kalibari, Nagarkanda	120			>0.025 < 0.05				
13	04.02.02	Profulla Bishwas Konagram, Mohila Road, Kaita Kalibari, Nagarkanda	120				0.05			
14	04.02.02	Ramoni Bishwas Konagram, Mohila Road, Kaita Kalibari, Nagarkanda	120		0.01					

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
15	04.02.02	Dulal Shill Konagram, Mohila Road, Kaita Kalibari, Nagarkanda	105	0.00						
16	04.02.02	Shekh Hasem Konagram, Mohila Road, Kaita Kalibari, Nagarkanda	120					0.1		
17	27.02.02	Khandakar Jakaria Ahmed Chagaldi, Nagarkanda		0.00						
18	08.04.02	Md. Mahfuzul Haque Nagarkanda, Faridpur		0.00						

Gerdha

19	04.02.02	Hasem Ali Keshobnagar, Gerda	120			0.025				
20	04.02.02	Zohur Ali Keshobnagar, Gerda	105					0.1		
21	04.02.02	Md. Ainal Mollik Keshobnagar, Gerda	80				0.05			
22	04.02.02	Md. Samad Mollik Keshobnagar, Gerda	80				>0.05 <0.1			
23	04.02.02	Md. Afsar Matabbar Keshobnagar, Gerda	80				>0.05 <0.1			
24	04.02.02	Shekh Hatem Uddin Keshobnagar, Gerda						>0.1 <0.5		
25	04.02.02	Shekh Hatem Keshobnagar, Gerda					>0.05 <0.1			
26	10.02.02	Md. Joynal Mondol Keshobnagar, Gerda	125			>0.025 <0.05				
27	10.02.02	Md.Shekh Moniruddin Keshobnagar, Gerda	130				0.05			
28	10.02.02	Ahmed Munsi Keshobnagar, Gerda	125					0.1		
29	10.02.02	Md. Shahjahan Fakir Keshobnagar, Gerda	125				>0.05 <0.1			
30	10.02.02	Md. Nurul Islam Keshobnagar, Gerda	125				0.05			
31	10.02.02	Md. Nurul Islam (Salo Pump) Keshobnagar, Gerda	195				>0.05 <0.1			
32	10.02.02	Md. Nurul Islam (Master Sabur) Keshobnagar, Gerda	120				>0.05 <0.1			
33	10.02.02	Moszid Keshobnagar, Gerda	120			0.025				
34	10.02.02	Md. Nurul Islam Mulla Keshobnagar, Gerda	120				>0.05 <0.1			

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
35	10.02.02	Md. Mazibur Mulla Keshobnagar, Gerda	130				>0.05 <0.1			
36	10.02.02	Md. Abdul Latif Mallik Keshobnagar, Gerda	150			0.025				
37	10.02.02	Md. Aynal Mallik Keshobnagar, Gerda	160				0.05			
38	10.02.02	Md. Nabab Ali Matubbar Keshobnagar, Gerda	250				>0.05 <0.1			
39	10.02.02	Md. Ali Ajgar Matubbar Keshobnagar, Gerda	200			0.025				
40	10.02.02	Md. Siddique Molla Keshobnagar, Gerda	170					0.1		
41	10.02.02	Md. Abdus Sattar Molla Keshobnagar, Gerda	125	0.00						
42	10.02.02	Md. Abdus Sattar Molla Keshobnagar, Gerda	190				0.05			
43	10.02.02	Md. FormanMolla Keshobnagar, Gerda	86			0.025				
44	10.02.02	Shekh Anwar Uddin Baughata, Gerda	210				0.05			
45	10.02.02	Md. Khidir Sarder Baughata, Gerda	160				>0.05 <0.1			
46	10.02.02	Md. Sorhab Sekh Baughata, Gerda	95				>0.05 <0.1			
47	10.02.02	Md. Samchu Baughata, Gerda	130				>0.05 <0.1			
48	10.02.02	Bakhunda Govt. Primary School Bakhunda, Gerda	130				>0.05 <0.1			
49	10.02.02	Md. Aziruddin Bakhunda, Gerda	140			0.025				
50	10.02.02	Md. Moniruddin Miah Bakhunda, Gerda	148				0.05			
51	10.02.02	Md. Aynal Mrida Bakhunda, Gerda	150		0.01					
52	10.02.02	Baughata Bazar Nikhurdi, Gerda	100	0.00						
53	10.02.02	Nikhurdi Jame Moszid Nikhurdi, Gerda	180				>0.05 <0.1			
54	10.02.02	Md. Jamir Molla Nikhurdi, Gerda	200				>0.05 <0.1			
55	10.02.02	Md. Nurul Haque (Teacher) Nikhurdi, Gerda	200					0.1		
56	10.02.02	Nur Muhammad Nikhurdi, Gerda	180			>0.025 <0.05				
57	10.02.02	Md. Yasin Fakir Nikhurdi, Gerda	90				>0.05 <0.1			

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
58	10.02.02	Md. Harun Miah Bakhunda, Gerda	90			0.025				
59	10.02.02	Md. Fazlul Haque Bakhunda, Gerda	90			0.025				
60	10.02.02	Md. Moslem Miah Bakhunda, Gerda	90			0.025				
61	10.02.02	Md. Lokman Miah Bakhunda, Gerda	120				0.05			
62	10.02.02	Md. Lal Miah Bakhunda, Gerda	120			>0.025 <0.05				
63	10.02.02	Riksaw-stand Moszid Bakhunda, Gerda	170			0.025				
64	10.02.02	Ali Ahmed Bakhunda, Gerda	170				0.05			
65	10.02.02	Bakhunda Bazar Bakhunda, Gerda	170			>0.025 <0.05				
66	10.02.02	Bakhunda Bazar Moszid Bakhunda, Gerda	170			0.025				
67	10.02.02	Bakhunda Bazar Moszid (Beside of Gaterang Rice-mill) Bakhunda, Gerda			0.01					
68	10.02.02	Mir Moksed Ali Bakhunda, Gerda	90			>0.025 <0.05				
69	10.02.02	Md. Rajat Mia Kafura, Gerda	90			>0.025 <0.05				
70	10.02.02	Md. Nasir Mia Kafura, Gerda	90		0.01					
71	10.02.02	Kafura Moszid Kafura, Gerda	90	0.00						
72	10.02.02	Md. Faruque Mia Kafura, Gerda	90	0.00						
73	10.02.02	Md. Karim Matubbar Kafura, Gerda	200					0.1		
74	10.02.02	Anil Matubbar Kafura, Gerda	220				>0.05 <0.1			
75	10.02.02	Munsi-Bazar School Kafura, Gerda			>0.01 <0.025					
76	10.02.02	Munsi-Bazar Jame-Moszid Kafura, Gerda		0.00						
Mahmudpur										
77	05.03.02	Bismillah-Shah Darga Madrasa Muhammadpur, Faridpur					>0.05 <0.1			
78	05.03.02	Opposite of Bismillah-Shah Darga Madrasa Muhammadpur, Faridpur				>0.025 <0.05				
79	05.03.02	Muhammadpur Jame-Moszid Muhammadpur, Faridpur				>0.025 <0.05				

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
80	05.03.02	Miss. Hasina Begum Muhammadpur, Faridpur	110	0.00						
81	05.03.02	Md. Khorshed Molla Muhammadpur, Faridpur	120	0.00						
82	05.03.02	Md. Salim Sekh Muhammadpur, Faridpur	200			0.025				
83	14.03.02	Md. Shahin Bill Muhammadpur, Faridpur	75						0.5	
84	30.03.02	Mst. Runu Bill Mohammadpur, Faridpur, Harukandi Bazar	65						0.5	
85	30.03.02	Mr. Dulal Bill Mohammadpur, Faridpur	44						0.5	
86	08.04.02	Md. Janaab Ali Bill Muhammadpur, Faridpur						>0.1 <0.5		
87	15.04.02	Md. Wahid Shekh Bill Muhammadpur, Faridpur						>0.1 <0.5		
88	20.04.02	Mst. Nurzahan Begum Bill Muhammadpur, Faridpur	140					>0.1 <0.5		
Khabaspur										
89	18.03.02	Md. Niamot Ullah West Khabaspur, Faridpur				>0.025 <0.05				
90	18.03.02	Md. Sardar Abul Bashar West Khabashpur, Faridpur	0.00							
91	18.03.02	Md. Jalal Uddin Khan West Khabashpur, Faridpur	0.00							
92	18.03.02	Engr. Shakhawat Hossain West Khabashpur, Faridpur	25			0.025				
93	18.03.02	Zubaida Gulshanara Khanam West Khabashpur, Faridpur	25	0.00						
94	18.03.02	Monwara Begum West Khabaspur, Faridppur						>0.1 <0.5		
95	23.03.02	Md. Shahid West Khabaspur, Faridpur			0.01					
96	27.03.02	Md. Niamot Ullah West Khabaspur, Faridpur				0.025				
97	27.03.02	Md. Kayedee Millat East Khabaspur, Faridpur							0.5	

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
Harukandi										
98	04.03.02	Md. Motaleb Mridha Harukandi, Faridpur				>0.025 <0.05				
99	06.03.02	Tarun Tapan Basu Harukandi, Faridpur	120	0.00						
100	06.03.02	Md. Shariful Islam Harukandi, Faridpur	120	0.00						
101	10.03.02	Md. Abdul Mannan Harukandi, Faridpur	80			>0.025 <0.05				
102	10.03.02	Md. Mizanur Rahman Harukandi, Faridpur				0.025				
103	10.03.02	Md. Murad Hossain Harukandi, Faridpur			0.01					
104	10.03.02	Md. Kuddus Talukder Harukandi, Faridpur	105	0.00						
105	10.03.02	Md. Chunnu Talukder Harukandi, Faridpur	85	0.00						
106	10.03.02	Md. Siddique Talukder Harukandi, Faridpur	75	0.00						
107	10.03.02	Md. Gafur Talukder Harukandi, Faridpur	58	0.00						
108	10.03.02	Md. Abdur Rahim Khan Harukandi, Faridpur	95			0.025				
109	10.03.02	Md. Shafiuddin Mondol Harukandi, Faridpur				0.025				
110	12.03.02	Md. Abul Kalam Shekh Harukandi, Faridpur	120			0.025				
111	12.03.02	Md. Abdul Malek Harukandi, Faridpur	120				0.05			
112	17.03.02	Md. Jamal Uddin Harukandi, Faridpur	135	0.00						
113	17.03.02	Md. Mizan Shekh Harukandi, Faridpur	135	0.00						
114	19.03.02	Md. Ismail Hossain Harukandi, Faridpur.	195			>0.025 <0.05				
115	31.03.02	Md. Ratan Shekh Harukandi, Faridpur	135	0.00						
116	03.04.02	Md. Nurul Islam Harukandi, Faridpur		0.00						
117	03.04.02	Tapan Kumar Boas Harukandi, Faridpur	70	0.00						
118	16.04.02	Md. Abdur Rahman Harukandi, Faridpur		0.00						
119	16.04.02	Moni Mohan Das Harukandi, Faridpur		0.00						
120	16.04.02	Md. Abdul Gafur Harukandi, Faridpur		0.00						
121	16.04.02	Md. Shekh Khalil Harukandi, Faridpur		0.00						
122	16.04.02	Md. Nazimuddin Shekh Harukandi, Faridpur		0.00						

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
123	16.04.02	Md. Abdul Halim Harukandi, Faridpur		0.00						
124	20.04.02	Shree Nikhil Shil Harukandi, Faridpur	85	0.00						
125	20.04.02	Mr. Mithu Harukandi, Faridpur		0.00						
Alipur										
126	05.03.02	Desh Clinik South Alipur, Faridpur	70	0.00						
127	05.03.02	Firuza Begum South Alipur, Faridpur	60	0.00						
128	05.03.02	Md. Mamun South Alipur, Faridpur	60				>0.05 <0.1			
129	05.03.02	Haran Kumar Dey South Alipur, Faridpur	60				>0.05 <0.1			
130	05.03.02	Anil Kumar Sarker South Alipur, Faridpur	60				>0.05 <0.1			
131	05.03.02	Ulfatul Karim South Alipur, Faridpur	60				0.05			
132	05.03.02	Rizaul Karim South Alipur, Faridpur	60			>0.025 <0.05				
133	05.03.02	Director, F.F.F. South Alipur, Faridpur	60					>0.1 <0.5		
134	05.03.02	Mrs. Jebunnesa Khanam South Alipur, Faridpur	60	0.00						
135	05.03.02	Md. Shah Alam South Alipur, Faridpur	60	0.00						
136	05.03.02	Mrs. Hosneara Begum South Alipur, Faridpur	100	0.00						
137	05.03.02	Mr. Rafique/Jahanara South Alipur, Faridpur	100	0.00						
138	05.03.02	Md. Litu (Daroga saheb-bari) South Alipur, Faridpur	100	0.00						
139	05.03.02	Md. Jane Alam South Alipur, Faridpur	60		0.01					

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
140	05.03.02	Mr. Uzzal South Alipur, Faridpur	60					0.1		
141	05.03.02	Md. Nurul Islam Khan South Alipur, Faridpur	62	0.00						
142	05.03.02	Md. Firuz Khan South Alipur, Faridpur	70	0.00						
143	05.03.02	Md. Kazi Belayet Hossen South Alipur, Faridpur	90	0.00						
144	05.03.02	Mrs. Asirunnesa South Alipur, Faridpur	90	0.00						
145	05.03.02	Mrs. Asirunnesa South Alipur, Faridpur	90	0.00						
146	05.03.02	Topayel Ahmed South Alipur, Faridpur	90	0.00						
147	05.03.02	Md. Reja South Alipur, Faridpur	60	0.00						
148	05.03.02	Md. Gias Biswas South Alipur, Faridpur	70			0.025				
149	05.03.02	Md. Gias Biswas (Motor) South Alipur, Faridpur	70			0.025				
150	05.03.02	Md. Benzin Ayan South Alipur, Faridpur	70	0.00						
151	05.03.02	Mrs. Khadiza Hossen South Alipur, Faridpur	60					0.1	0.5	
152	05.03.02	Md. A. Razzaque Khan South Alipur, Faridpur	60	0.00						
153	05.03.02	A.H.M. Shafiuddin South Alipur, Faridpur	60			0.025				
154	05.03.02	Md. Mostak Rabbani South Alipur, Faridpur	60	0.00						
155	05.03.02	Md. Bakhtar Hossen (Hiru) East Alipur, Faridpur	60					>0.1	<0.5	
156	10.03.02	Md. Kamrul Islam Omar West Alipur, Faridpur	90				0.05			

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
157	10.03.02	Syed Abdul Alim West Alipur, Faridpur	90					>0.1	<0.5	
158	10.03.02	Mr. Sawpan South Alipur, Faridpur	70	0.00						
159	10.03.02	Md. Woazed South Alipur, Faridpur	70	0.00						
160	10.03.02	Mr. Babla South Alipur, Faridpur	50			>0.025	<0.05			
161	10.03.02	Md. Saheb Sorwar (Mach) South Alipur, Faridpur	60		0.01					
162	10.03.02	Md. Saheb Sorwar (Home) South Alipur, Faridpur	60		0.01					
163	10.03.02	Md. Omar South Alipur, Faridpur	60	0.00						
164	10.03.02	Md. Morshed Ali South Alipur, Faridpur	60			>0.025	<0.05			
165	10.03.02	Md. Habib South Alipur, Faridpur	105			0.025				
166	10.03.02	Md. Ishak Mia South Alipur, Faridpur	100		0.01					
167	10.03.02	Md. Alimuzzaman South Alipur, Faridpur	100		0.01					
168	10.03.02	Syed Md. Delwar Hossain South Alipur, Faridpur	100			>0.025	<0.05			
169	10.03.02	Aftab Uddin Ahmed Middle Alipur, Faridpur	100				0.05			
170	10.03.02	Md. Akram Hossain Middle Alipur, Faridpur					>0.05	<0.1		
171	10.03.02	Shafiuddin Ahmed (motor) Middle Alipur, Faridpur	190				>0.05	<0.1		
172	10.03.02	Shafiuddin Ahmed (T-well) Middle Alipur, Faridpur			>0.01	<0.025				
173	10.03.02	Alauddin Ahmed Middle Alipur, Faridpur	80		0.01					
174	10.03.02	S.M. Shahjahan Middle Alipur, Faridpur	100			0.025				

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
175	10.03.02	Mrs. Jahurunnesa Middle Alipur, Faridpur	100			0.025				
176	10.03.02	Md. Abdul Karim Mia Middle Alipur, Faridpur						>0.1	<0.5	
177	10.03.02	Md. Tara Mia Middle Alipur, Faridpur						>0.1	<0.5	
178	10.03.02	Md. Abdul Halim Middle Alipur, Faridpur						>0.1	<0.5	
179	10.03.02	Mrs. Jobayda Begum Middle Alipur, Faridpur				0.025				
180	10.03.02	Md. Abdul Gani Middle Alipur, Faridpur						0.1		
181	10.03.02	Md. Abdus Sattar Molla Middle Alipur, Faridpur						0.1		
182	10.03.02	Md. Akbar Ali Molla Middle Alipur, Faridpur		0.00						
183	10.03.02	Md. Jamal Mia Middle Alipur, Faridpur		0.00						
184	10.03.02	Md. Shipu Middle Alipur, Faridpur		0.00						
185	10.03.02	Md. Sirajul Haque Middle Alipur, Faridpur		0.00						
186	10.03.02	Md. Samsul Haque Bepary Middle Alipur, Faridpur					>0.05	<0.1		
187	10.03.02	Md. Abdur Rahman Middle Alipur, Faridpur				0.025				
188	13.03.02	Md. Saheb Sorwar (motor) South Alipur, Faridpur			0.01					
189	31.03.02	Md. Gias Biswas (TW-1) South Alipur, Faridpur		0.00						
190	31.03.02	Md. Gias Biswas (TW-2) South Alipur, Faridpur				0.025				
191	31.03.02	Md. Gias Biswas (TW-3) South Alipur, Faridpur				>0.025	<0.05			
192	31.03.02	Md. Gias Biswas (TW-4) South Alipur, Faridpur				>0.025	<0.05			
193	31.03.02	Md. Gias Biswas (TW-5) South Alipur, Faridpur					0.05			
194	04.04.02	Md. Ratan Munsi (TW-1) Alipur, Faridpur	80			0.025				
195	04.04.02	Md. Ratan Munsi (TW-2) Alipur, Faridpur	75			0.025				
196	04.04.02	Md. Ratan Munsi (TW-3) Alipur, Faridpur	70	0.0						
197	07.04.02	Md. Ilius, Khandaker Loz West Alipur, Faridpur	70					>0.1	<0.5	
198	07.04.02	Syed Abdul Alim (Machine), Khandaker Loz West Alipur, Faridpur	70			0.025				

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
199	07.04.02	Md. Zalu, Khandaker Loz West Alipur, Faridpur	70						0.5	
Char kamlapur										
200	10.03.02	Md. Hiru Mia S. Char-Kamalapur, Faridpur	80					>0.1 <0.5		
201	10.03.02	Uma Das Char Kamalapur, Faridpur						>0.1 <0.5		
202	08.04.02	South Char-Kamalapur Govt. Primary School Char-Kamalapur, Faridpur						>0.1 <0.5		
203	08.04.02	Sikder-Para Jame Moszid Char-Kamalapur, Faridpur						>0.1 <0.5		
204	08.04.02	Md. Mustafa Char-Kamalapur, Faridpur					>0.05 <0.1			
205	08.04.02	Md. Foysal Char-Kamalapur, Faridpur	180			0.025				
206	08.04.02	Miss. Happy Char-Kamalapur, Faridpur				0.025				
207	08.04.02	Md. Eusuf Ali Munsi South Char-Kamalapur, Faridpur						>0.1 <0.5		
208	08.04.02	Mst. Nurun Nahar Char-Kamalapur, Faridpur	110					0.1		
209	08.04.02	Nazim Shekh Char Kamalapur, Faridpur						0.1		
210	08.04.02	Forhad Hossain Char Kamalapur, Faridpur						>0.1 <0.5		
211	08.04.02	Md. Noman Char Kamalapur, Faridpur						0.1		
212	13.04.02	Md. Abdul Mazed Mridha Kamalapur, Faridpur	80				>0.05 <0.1			
Ambikapur										
213	10.03.02	Jasim Foundation (East) Ambikapur, Faridpur				0.025				
214	10.03.02	Jasim Foundation (Middle) Ambikapur, Faridpur						>0.1 <0.5		
215	10.03.02	Kabi Jasim Uddin (Home) Ambikapur, Faridpur				0.025				
216	10.03.02	Jasim Uddin (Front of Home) Ambikapur, Faridpur				0.025				
217	10.03.02	Sujan Mahmud Ambikapur, Faridpur				0.025				
218	10.03.02	Md. Abdur Rashid Ambikapur, Faridpur			0.01					
219	10.03.02	Md. Abdul Kader Ambikapur, Faridpur				0.025				

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
220	10.03.02	Md. Akram Molla Ambikapur, Faridpur		0.00						
221	10.03.02	Md. Habib Molla Ambikapur, Faridpur					>0.05	<0.1		
222	10.03.02	Md. Sabuj Ambikapur, Faridpur				0.025				
Char Tepakhola										
223	01.04.02	Md. Hossain Molla West Char-Tepakhola, Faridpur	105			0.025				
224	01.04.02	Md. Hassem Molla West Char-Tepakhola, Faridpur	80	0.00						
225	01.04.02	Md. Joynal Molla West Char-Tepakhola, Faridpur	40					>0.1	<0.5	
226	01.04.02	Md. Samsuddin Molla West Char-Tepakhola, Faridpur	115		0.01					
227	01.04.02	Md. Jamal Pramanic West Char-Tepakhola, Faridpur	24	0.00						
228	01.04.02	Md. Abdul Aziz West Char-Tepakhola, Faridpur	21	0.00						
229	01.04.02	Md. Jamir Molla West Char-Tepakhola, Faridpur	35	0.00						
230	01.04.02	Md. Mayn Uddin Molla West Char-Tepakhola, Faridpur	35	0.00						
231	01.04.02	Md. Bazlur Rashid West Char-Tepakhola, Faridpur	35	0.00						
232	01.04.02	Md. Shekh Afazuddin West Char-Tepakhola, Faridpur	35	0.00						
233	01.04.02	C & B Ghat Bazar (South) Tepakhola, Faridpur	60	0.00						
234	01.04.02	C & B Ghat Bazar (North) Tepakhola, Faridpur				>0.025	<0.05			
235	01.04.02	Mst. Rawshan-ara-Begum C & B Ghat, Faridpur				0.025				
236	01.04.02	Jabeda Begum C & B Ghat, Faridpur				0.025				

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
Gandia										
237	01.04.02	Md. Eunus Ali (Cashier) Gaandia, Faridpur	60					>0.1	<0.5	
238	01.04.02	Md. Razib Gaandia, Faridpur	65	0.00						
239	01.04.02	Md. Shohan Gaandia, Faridpur	45	0.00						
240	01.04.02	Md. Mamun Gaandia, Faridpur	45			0.025				
241	01.04.02	Md. Muazzem Munshi Gaandia, Faridpur	85				0.05			
242	02.04.02	Md. Muazzem Munshi Gaandia, Faridpur	75			0.025				
Mallikpur										
243	06.04.02	Md. Ali Ashraf Fakir Uzan-Mallikpur, Faridpur				0.025				
244	06.04.02	Md. Abdul Ali Fakir Uzan-Mallikpur, Faridpur						>0.1	<0.5	
245	06.04.02	Fakir-Bari Mosjid Uzan-Mallikpur, Faridpur			0.01					
246	06.04.02	Md. Eunus Gazi Uzan-Mallikpur, Faridpur		0.00						
Goal Chamot										
247	07.04.02	Md. Abdul Halim Molla Bari Sarak, Goalchamat, Faridpur				0.025				
248	07.04.02	Md. Motaleb Pramanic Molla Bari Sarak, Goalchamat, Faridpur		0.00						
249	07.04.02	Md. Sayed Mallik Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
250	07.04.02	Md. Sher Ali Bhuyan Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
251	07.04.02	Md. Naba Kasai Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
252	07.04.02	Md. Jahangir Tagor Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
253	07.04.02	Md. Sher Ali Bhuyan Molla Bari Sarak, Goalchamat, Faridpur	21		0.01					
254	07.04.02	Md. Rahim Shekh Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
255	07.04.02	Abdul Jalil Molla Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
256	07.04.02	Md. Hossain Shekh Molla Bari Sarak, Goalchamat, Faridpur	21			0.025				
257	07.04.02	Md. Shafi Fakir Molla Bari Sarak, Goalchamat, Faridpur	230			0.025				
258	07.04.02	Mst. Taslima Akter Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
259	07.04.02	Md. Abdul Motaleb Molla Bari Sarak, Goalchamat, Faridpur	40	0.00						
260	07.04.02	Mst. Ripa Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
261	07.04.02	Md. Siraj Shekh Molla Bari Sarak, Goalchamat, Faridpur	30	0.00						
262	07.04.02	Md. Kajem Mia Molla Bari Sarak, Goalchamat, Faridpur	80			0.025				
263	07.04.02	Md. Majibar Biswas Molla Bari Sarak, Goalchamat, Faridpur	80	0.00						
264	07.04.02	Md. Shekh Shahjahan Molla Bari Sarak, Goalchamat, Faridpur	190					0.1		
265	07.04.02	Md. Adel Shekh Molla Bari Sarak, Goalchamat, Faridpur				0.025				
266	07.04.02	Md. Ayub Ali Shekh Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
267	07.04.02	Md. Manik Shekh Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
268	07.04.02	Md. Tota Mia Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
269	07.04.02	Md. Shekh Lokman Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
270	07.04.02	Md. Shekh Alauddin Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
271	07.04.02	Md. Shekh Rafiq Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
272	07.04.02	Md. Harunur Rashid Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
273	07.04.02	Md. Rezaul Karim Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
274	07.04.02	Md. Manik Talukder Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
275	07.04.02	Md. Lokman Jamaddar Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
276	07.04.02	Md. Anwar Hossain Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
277	07.04.02	Md. Milon Khan Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
278	07.04.02	Md. Rafiq Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
279	07.04.02	Mst. Mukta Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
280	07.04.02	Md. Nuru Mia Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
281	07.04.02	Md. Shamser Fakir Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
282	07.04.02	Md. Kabir Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
283	07.04.02	Md. Hamed Ali Bhuyan Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
284	07.04.02	Md. Muzahir Shekh Molla Bari Sarak, Goalchamat, Faridpur	21	0.00						
285	07.04.02	Md. Jumar Bihari Kolony, Molla Bari Sarak, Faridpur		0.00						
286	07.04.02	Md. Jalal Shekh Bihari Kolony, Molla Bari Sarak, Faridpur	110	0.00						
287	07.04.02	Md. Shamim Bihari Kolony, Molla Bari Sarak, Faridpur	110	0.00						
288	07.04.02	Md. Pachu Shekh Bihari Kolony, Molla Bari Sarak, Faridpur	55	0.00						
289	07.04.02	Mohammad Ali Bihari Kolony, Molia Bari Sarak, Faridpur		0.00						
290	07.04.02	Md. Shekh Selim Bihari Kolony, Molla Bari Sarak, Faridpur		0.00						
291	07.04.02	Md. Bashir Bihari Kolony, Molla Bari Sarak, Faridpur		0.00						
292	07.04.02	Md. Ismail Ali Bihari Kolony, Molla Bari Sarak, Faridpur	80			0.025				
293	07.04.02	Md. Hafiz Goal Chamat, Faridpur.				>0.025	<0.05			
Madhukhali										
294	30.03.02	Mr. Sunil Das Madhukhali, Faridpur	90					>0.1	<0.5	
295	30.03.02	Mr. Modhusudhan Das Madhukhali, Faridpur	90						0.5	

Cont.

Sl. No.	Date	Address	Depth in ft.	Range of Arsenic						Comments
				0.00	0.01	0.025	0.05	0.1	0.5	
296	30.03.02	Mr. Manik Das Madhukhali, Faridpur	90					>0.1	<0.5	
297	30.03.02	Mr. Ronen Das Madhukhali, Faridpur	80						0.5	
298	30.03.02	Mr. Sadhan Das Madhukhali, Faridpur	75						0.5	
299	30.03.02	Mr. Ajit Das Madhukhali, Faridpur	70						0.5	

Pukiria (Bhanga)

300	23.03.02	Jooti Mridha-Kanda, Pukuria, Bhanga, Faridpur				0.025	0.05			
301	23.03.02	Momrej Mridha Mridha-Kanda, Pukuria, Bhanga, Faridpur						>0.1	<0.5	
302	28.03.02	Md. Mizan Pukuria, Faridpur					0.05	0.1		
303	28.03.02	Md. Arif Pukuria, Faridpur					0.05	0.1		
304	06.04.02	Md. Siraj Mridha-Kanda, Pukuria, Bhanga, Faridpur						>0.1	<0.5	
305	06.04.02	Md. Tipu Mridha-Kanda, Pukuria, Bhanga, Faridpur	0.00							