

A Report on Fluorosis mitigation program in Dhar District (M.P.)



(November, 2008 to Feb 2011)

A Joint Study By-

People's Science Institute, Dehra Doon

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1. Introduction:

About 62 million people in India suffer from dental, skeletal and / or non-skeletal fluorosis. Of these, 6 million are children below the age of 14. Fluorosis is a disease caused by fluoride concentrations above 1.5 mg/L in drinking water. In India about 20 states have been identified with the problem of excess fluoride in groundwater. Rural populations who are mainly dependent on groundwater for drinking purposes, are the worst affected. Since the late 1980s, government and non-government agencies have launched efforts to control the spread of fluorosis. Despite these efforts, reports continue to appear indicating an increasing spread of fluorosis. This can be either due to identification of the known problem in a new area, or a fresh incidence striking a hitherto unaffected population due to local environmental changes.

Dhar district lies in the tribal southern part of Madhya Pradesh. Already a drought prone area, the Dhar district suffers from severe water scarcity from January to June every year. The district extends over three physiographic divisions, the Malwa in the north, the Vindhya range in central zone and the Narmada valley along the southern boundary. However, the valley is again closed up by the hills in the south-western part. The majority of the population in Dhar District belongs to the Scheduled Tribes (total population of Dhar district 1128399, schedule tribes is 920412). The groundwater level in these districts is too low and whatever little water is available is highly contaminated with fluoride. The water table has fallen from an average of 10 meters to 80 meters. This has led to higher concentration of contaminants like fluoride, arsenic and iron in groundwater. A total of 324 villages are affected with this problem in tribal-dominated Dhar district alone. According to PHED, 3763 drinking water sources of 13 blocks of Dhar district was monitored by PHED department of Dhar, showed 1683 sources fluoride affected and 2080 sources as safe. The block wise higher fluoride concentration was found by PHED is given bellow-

S.No.	Name of Block	Maxium fluoride concentration (mg/L)
1	Dhar	10.2
2	Nalanda	28.5
3	Tirla	18.1
4	Sardarpur	4.56
5	Badnawar	9.81
6	Kukshi	8.6
7	Bagh	17.2
8	Nisarpur	6.69
9	Dahi	13.2
10	Manawar	9.52
11	Gandhwani	19.4
12	Dharampuri	23.0
13	Umarban	19.2

The area is located in between of Malwa hill and the Alluvial valley of River Narmada. The hilly region consists of fractured basaltic rocks, enriched with upper regolith, formed by volcanic activities in the past and gets fractured because of tectonic movements of earth. Basaltic rocks contain fluoride in combined form with either Aluminium or with Calcium. Rather than basaltic rocks there are fractured sedimentary rocks in the region that contains sandy silt with variable amount of calcium and aluminium bound with some amount of Fluoride. One another factor for high fluoride concentration in undulation in the region and excessive exploitation of underground water for irrigation purposes resulting the scarcity of water in aquifer and hence increase in fluoride concentration in ground water.

Vasudha Vikas Sansthan with the help of WaterAid and with technical Support of Peoples' Science Institute, Dehra Doon undertook fluoride testing and fluorosis mitigation Programme in Tirla, Dharampuri and Umarban bloks of Dhar district. The program began in November 5th, 2008. The major findings and description of the activities carried out under the programme is presented in this report.

1.1 Objectives:

- To identify the fluoride affected villages.
- To assess the prevalence of dental fluorosis in the selected schools.
- To undertake water quality testing of all the drinking water sources in selected villages.
- Prepare plans to reduce the prevalence of fluorosis in the selected villages through bringing down concentrations of fluoride in drinking water with full involvement of the communities and government.
- Provide safe drinking water in selected villages.
- Assessment of effectiveness of safe water supply by using Urinary fluoride data as indicator.
- Identification of best operations and maintenance practices for safe water supply schemes for fluoride affected areas.
- Assessment of effectiveness of Small rain water harvesting structures for HP's and observation of dilution mechanics by big ponds for its downstream command areas.

1.2 Expected Advantages From the Study:

- (i) The study will help increase the scientific knowledge regarding fluoride in water and its effect on human beings. It shall also inform the people about different fluoride mitigation options at regional and national level.
- (ii) Study will help to implementing agencies to monitor the implemented schemes.
- (iii) It shall thus help Vasudha Vikas Sansthan and local administration to prepare control and mitigation strategies for fluorosis.
- (iv) The study may catch attention of the Govt. representatives and local administration on the seriousness of fluoride pollution and its effect in the area.
- (v) Data and information generated by the study will also help villages and local voluntary organizations to plan a program on fluorosis mitigation.

2. Methodology:

2.1 Identification of seriously affected villages and preparation of mitigation plan:

2.1a Health Survey:

A team for health survey was formed; PSI research scientist and VVS staffs were involved in the team. Before undertaking the survey, they underwent orientation sessions on different symptoms of fluorosis.



To choose possible fluorosis affected areas, a meeting of health and social workers of VVS, was organized on 5th November 2008 at the premises of VVS, Dhar. Eight people participated in the meeting. Participants were introduced to different symptoms of fluorosis. They were also given and enquired for information about the prevalence of fluorosis in their area. Based on these information's, certain areas were chosen for the health survey. Later the team carried out health survey on dental fluorosis in children (age 6-16 years) in 31 schools of the targeted area.

The survey was carried out from 6th to 16th November 2008. Children from all the schools were made to fill up a survey protocol.

All Primary and Upper Primary schools located in the targeted area were surveyed. List of the schools surveyed is listed in the table 1.

In mean time a list consisting of villages suffering from varying degrees of fluorosis were prepared.

2.1b Water Quality Monitoring of Drinking Water Sources:

Data gathered from health survey of school children were summarized village wise. Villages that had severe dental fluorosis in more than 40% children were categorised as target village. It was decided to carry out Water quality monitoring for all drinking water sources of 8 villages. These sources include open wells, hand pumps, natural streams and ponds (Bandha). Monitoring was carried out between 8th to 17th November, 08. Water quality for fluoride concentration of 109 water sources in the selected 31 habitations of 8 villages was monitored.

2.1c Sample Collection and Analysis:

All the 31 habitations of 8 shortlisted villages are located in 3 distinct blocks, viz. Tirla, Dharamपुरi and Umarban. A temporary field laboratory was installed in VVS at Dhar. Samples were collected in polyethylene bottles, which were vigorously washed with detergents and rinsed with distilled water prior to sample collection. All the sample bottles were also rinsed vigorously with the water to be tested before filling them with the sample. Samples were analyzed within 24 hours of collection in the field laboratories established in the area.



Battery operated Fluoride ion Meter (Model 290A+ Orion, USA) was used to measure fluoride concentrations. Standard Methods of Water Analysis prescribed by the APHA were followed in analysis of all the parameters.

2.2. Preliminary/base line urinary fluoride concentration observation:

2.2a. Selection of sample:

Samples were selected randomly irrespective of age, sex, living standard or socio-economic conditions. All the type of drinking water sources and individuals benefitting from each type of source were selected for monitoring.

2.2b. Procedure of sample collection:



Pre-labeled 500ml plastic capped disposable bottles (prewashed and dried) indicating the individual's name, father's name, age and village name containing 0.2mg of EDTA were distributed to selected persons of the village in the evening. The individuals were asked to collect their urine samples in the morning when they go for their first urination. The individuals were also explained of the importance of the program and were motivated to cooperate in the study. In addition to this, the selected persons were also asked to collect their urine samples each time they go for

urination in 24 hours of the day in different bottles and also to note the time of the collection.

In the morning, the urine sample bottles were collected from the selected persons and information about the type of drinking water source being used, kind of diet taken and other related data were obtained through a questionnaire.

Samples from all drinking water sources of the villages were collected as according to the guidelines mentioned in APHA.

2.2c. Sample Analysis

The urine samples collected were stored in an ice box and taken to the Dhar based field laboratory, where the samples were analyzed for their fluoride concentration on the same day by the battery operated Fluoride ion meter (Model 290 A+ Orion, USA). The urine samples were analyzed following the NIOSH manual method 8308 and the water samples were analyzed according to the APHA standard methods.

2.3. Assessment of effectiveness of the safe water supply scheme:

2.3a. Selection of sample:

Only five villages were selected for the first round study in feb 2010, four villages (Kali kirai, Ahmad pura, Bahadra and matlab pura) were selected where implementation was done and one control village Anuppura was selected for comparison. Urinary sample were collected from the same individuals who's sample already been monitored at the time of preliminary/base line survey.

In March, 2011, sums of total 12 village's (Kali ki rai, Ahmadpura, Bahadra, Matlabpura, Anuppura, Badpipli, Bhutia, Nelda, Abdulpura, Tarapur, Lohgarpura and Katar) urine sample were collected for either to observe the effectiveness of the safe water supply schemes or to gather the preliminary baseline data.

Procedure of sample collection and sample analysis technique were same as was in preliminary/base line urinary fluoride survey.

3. Result and Discussion:

3.1 IDENTIFICATION OF SERIOUSLY AFFECTED VILLAGES AND PREPARATION OF MITIGATION PLAN:

Health survey was conducted with the help of team for PSI research scientist and VVS staffs. The team carried out health survey on dental fluorosis in children (age 6-16 years) in 31 schools of the targeted areas. The survey was carried out from 6th to 16th November 2008. Children from all the schools were made to fill up a survey protocol. Water quality monitoring for all drinking water sources of 8 villages including open wells, hand pumps, natural streams and ponds (Bandha). Monitoring was carried out between 8th to 17th November, 08. Water quality for fluoride concentration of 109 water sources in the selected 31 habitations of 8 villages was monitored. All the 31 habitations of 8 shortlisted villages are located in 3 distinct blocks, viz. Tirla, Dharampuri and Umarban. Battery operated Fluoride ion Meter (Model 290A+ Orion, USA) was used to measure fluoride concentrations. Standard Methods of Water Analysis prescribed by the APHA were followed in analysis of all the parameters.

A dental survey was conducted for 1300 children in the age group of 6 – 16 yrs of 31 schools in three blocks of Dhar namely Tirla, Dharampuri and Umarban. It was observed that a out of a total of 1300 children, over 436 (33.5%) were affected by mild fluorosis, 105 (8%) by moderate fluorosis and 10 (0.8%) by severe fluorosis. Apart from these figures 297 (22.8%) of children were categorized as suspected, who in later years will develop clear symptoms of Fluorosis. Among the children surveyed in 31 schools over 14.8 % - 96.3% of children had dental fluorosis and out of 31 schools, more than 55 % of children of 10 schools were found to be suffering from dental fluorosis.

After a complete summarization of the surveyed children of 31 schools according to their village and habitation, it was found that in 35 villages more than 10 children and over 5 – 10 children in 15 villages were surveyed out of a total of 126 villages. Out of 50 villages surveyed, which had a sample survey size of more than 5 (i.e. those villages where surveyed children were more than 5), there were 8 villages where more than 75% of the children were effected from Fluorosis, 11 villages which had 51 - 75% of the children effected, over 25 - 50 % of children were effected in 25 villages and only less than 25% of children of 6 villages showed symptoms of Fluorosis.

A repeated monitoring exercise of Fluoride concentration of 109 sources was undertaken in 31 habitations of 8 villages, the fluoride concentration in these sources was found in the range of 0.18 – 11.6 mg/L.

Scenario of fluoride concentration in sources of the region

SN.	Type of the water source	Total number of tested sources	No. of water sources (Fluoride conc. <1.5 mg/l)	No. of water sources (Fluoride conc. >1.5 mg/l)	% of fluoride affected sources
1	Handpump	83	27	56	67%
2	Well	17	17	-	0%
3	Tubewell	03	-	03	100%
4	Pond	06	06	-	0%

Some drinking water sources in nine villages of Dhar had enormously high concentration of fluoride and hence had been completely banned for public use by PHED, but there are many hand pumps are still in use.

Fluoride concentration of this region has been found as high as 11.6 mg/l. Out of 83 hand pumps monitored, 23 hand pumps and 2 tube wells out of total of 3 tube wells monitored have more than 5 mg/L of fluoride concentration, which shows a very dangerous state. As a result of this alarming level of fluoride over 436 children are effected by mild, 105 by moderate and 10 by severe dental Fluorosis out of a total of 1300 children surveyed. Following the severity trend of dental Fluorosis of this region it is found that no cases of skeletal Fluorosis in general



have been observed. This clearly indicates that the numbers of dental Fluorosis cases have been increased due to two main reasons: High rise in dependence on hand pumps since recent years and due to Dietary practices. Presently maximum population of Dhar region depend entirely on hand pump sources for drinking hence the situation here can turn to be grave in future.

It is quite clear from the results of fluoride monitoring that hand pumps and tube wells sources have high fluoride concentration whereas well and nearby surface water sources (ponds) have comparatively acceptable levels of fluoride, which is thus indicative of the presence of fluoride bearing rocks in strata 25 – 30 feet below ground level. This might be a source of fluoride in water. The water policy formulation of this region should be revised, and these points should clearly be included in the

policy. There after planning to supply nearby available surface water should be done and in addition to this use of wells of low depth should be promoted. Last but not the least, complete ban should be imposed on the use of hand pumps and tube wells of the region.

On the basis of outcomes of the study 24 clusters from 8 panchayts have been identified for the implementation program in future, these recommendation are given in following table-

Village wise suggested measures

SN.	Village	Muhalla/Phaliya/Cluster	Recommendation plan
1.	Sitapat	Surajpura	Implementations
		Kankad	Implementations
		Sitapat	Awareness
		Badpipli	Awareness
2.	Lawandi	Bholiapura	Implementations
		Patelpura	Implementations
		Kalalpura	Implementations
3.	Karaundia	Schoolpura	Implementations
		Nayapura	Implementations
		Dodwapura	Implementations
		Patelpura	Awareness
4.	Katar	Katar	Awareness/Implementation
		Lohgarpura	Awareness/Implementation
5.	Surandi	Nirgudia	Implementations
		Surandi	Awareness/Implementation
		Nelda	Awareness
6.	Ahmadpura	Ahmadpura	Implementations
		Kachhuwania	Awareness
7.	Kali Karai	Kali Karai	Implementations
		Chhitari	Awareness
		Kalapani	Awareness
8.	Anuppura-Bahadara	Anuppura	Awareness/Implementation
		Bahadara	Awareness/Implementation
		Matalabpura	Awareness

3.2 PRELIMINARY/BASE LINE URINARY FLUORIDE CONCENTRATION OBSERVATION:

Under this study, in addition to 9 affected villages and 1 control village, urine samples of 432 individuals of 10 more villages were monitored in March, 09, for Urinary fluoride concentration. A detailed list of the village wise water and urine samples collected with their fluoride concentration has been in Annexes.

On the basis of First round Study during March 09, Fluoride concentration in control village Kakadada ranged between 0.01 – 2.21 mg/l, whereas in 9 fluoride affected villages it was found

between 0.51 and 37.9mg/l (abnormally high). In the 9 affected villages, there were 5 such villages (see table: 1) where fluoride concentrations in the urine samples were found to be more than 15mg/l. The mean value of fluoride present in urine samples of all nine studied villages were higher than those found for water samples. Control village- Kakadada too reported mean fluoride concentration of 0.29mg/l in water samples and 0.95mg/l (mean value) fluoride in urine samples.

Minimum and maximum fluoride concentration in water and urine sample

SN	Name of village	Total subject	Water (mg/l)		Urine (mg/l)	
			Min	Max	Min	Max
1	Kalikai	30	3.11	13.4	2.6	37.9
2	Ahmadpura	50	0.36	5.29	0.86	15.9
3	Kakadada	40	0.27	0.32	0.07	2.21
4	Bahadara	50	1.25	4.02	1.84	20.0
5	Matalabpura	22	2.2	2.2	0.51	4.81
6	Anuppura	41	1.4	2.74	1.31	18.2
7	Sitapat	73	0.47	6.79	0.62	11.9
8	Badpipli	40	0.40	11.3	0.68	15.1
9	Talavpura	46	0.67	2.81	0.63	9.25
10	Kalapani	40	0.56	10.8	0.97	18.0

Mean fluoride concentration in urine samples of residents and their drinking water (All figures in mg/l)

S N.	Name of Village	Total		Male		Female	
		Mean F in Water	Mean F in Urine	Mean in Water	Mean in Urine	Mean in Water	Mean F in Urine
1	Kali Kirai	7.59	8.87	7.37	10.18	7.81	7.55
2	Ahmadpura	1.52	4.67	1.48	4.72	1.57	4.6
3	Kakadada	0.29	0.95	0.28	1.1	0.29	0.81
4	Bahadara	2.29	6.12	2.4	6.22	2.17	6.02
5	Matalabpura	2.2	2.54	2.2	2.46	2.2	2.59
6	Anuppura	2.02	5.66	1.88	4.42	2.16	6.83
7	Sitapat	2.73	3.33	3.09	3.62	2.38	3.05
8	Badpipli	4.46	7.1	4.86	6.59	3.84	7.82
9	Talavpura	1.64	2.77	1.62	2.96	1.66	2.54
10	Kalapani	3.65	4.85	3.87	4.96	3.37	4.7
	Mean Total village	2.68	4.58	2.81	4.67	2.54	4.49

Higher fluoride concentration in urine samples in comparison to water samples indicate that besides the other fluoride sources (dietary intake), metabolic activity and seasons also play a major

role in fluctuating the fluoride concentration in the drinking water sources. The other reason for such a variation can be interpreted by the fluoride monitoring study undertaken by PHED, Madhya Pradesh in this region 3 years back, in which some hand pumps of some villages were removed, it can be seen that the mean value difference for fluoride in urine samples are much higher than in the water samples of Ahmadpura, Bahadara and Annupura villages. One reason behind this is the massive awareness generation done under Fluorosis Mitigation Program, in Bahadara the safe drinking water campaign had been initiated one week before this study took place and in other two remaining villages huge awareness campaigns had been organized in support of use of safe alternate drinking water sources. Thus it can be safely stated that due to the campaign held, the intake of fluoride through drinking water became less but the existing fluoride deposits in the body through some other means can still be found in the excreted urine samples.

This is clearly indicated by data, where the standard deviation of fluoride concentration in urine samples is much higher than that of water samples, which besides the reasons mentioned above can also be linked to factors like weather conditions (hot area), physical stress/exertion, drinking water sources and variation in fluoride concentration.

Age wise Standard deviation and correlation coefficient of fluoride concentration in water and urine

A relation of the difference between intake of fluoride (mg/l) by individuals of different age groups and the excretion of the same in mg/l through urine was also studied and the highest difference was recorded among individuals in the age group of 41 – 55yrs.

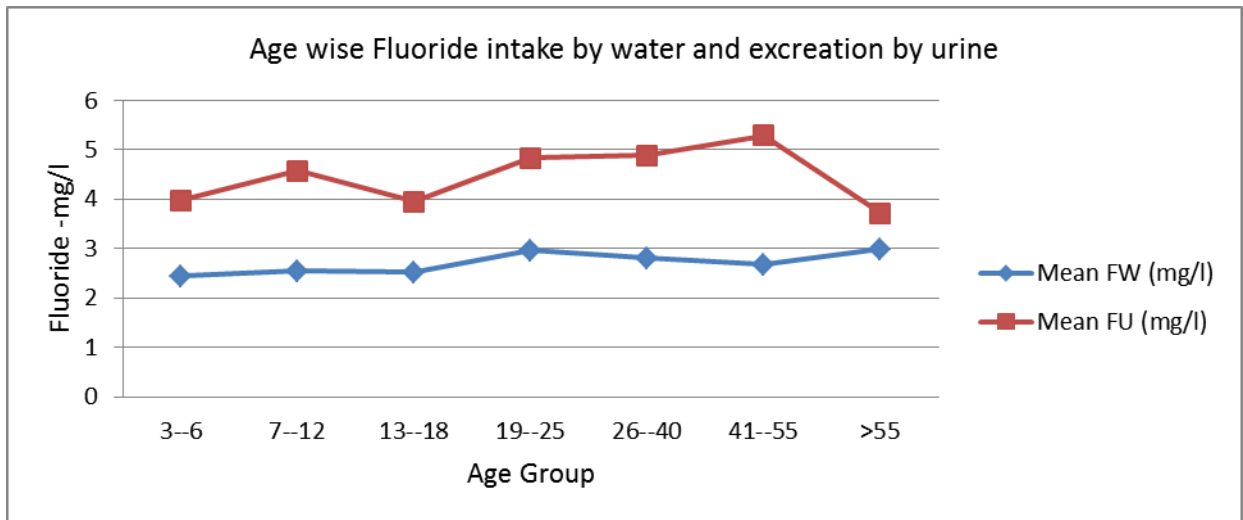
Standard deviation and correlation coefficient of fluoride concentration in water and urine

Age group (years)	Total Sample number	Mean FW (mg/l)	Mean FU (mg/l)	STDEV-F in water	STDEV-F in Urine	Correlation Coefficient
3--6	32	2.44	3.98	1.99	4.41	0.49
7--12	120	2.55	4.57	1.91	3.42	0.63
13--18	57	2.52	3.95	2.23	3.21	0.58
19--25	50	2.96	4.84	2.73	6.4	0.68
26--40	116	2.81	4.88	2.32	4.34	0.59
41--55	38	2.68	5.29	1.99	4.04	0.29
>55	19	2.99	3.72	1.96	2.78	0.44

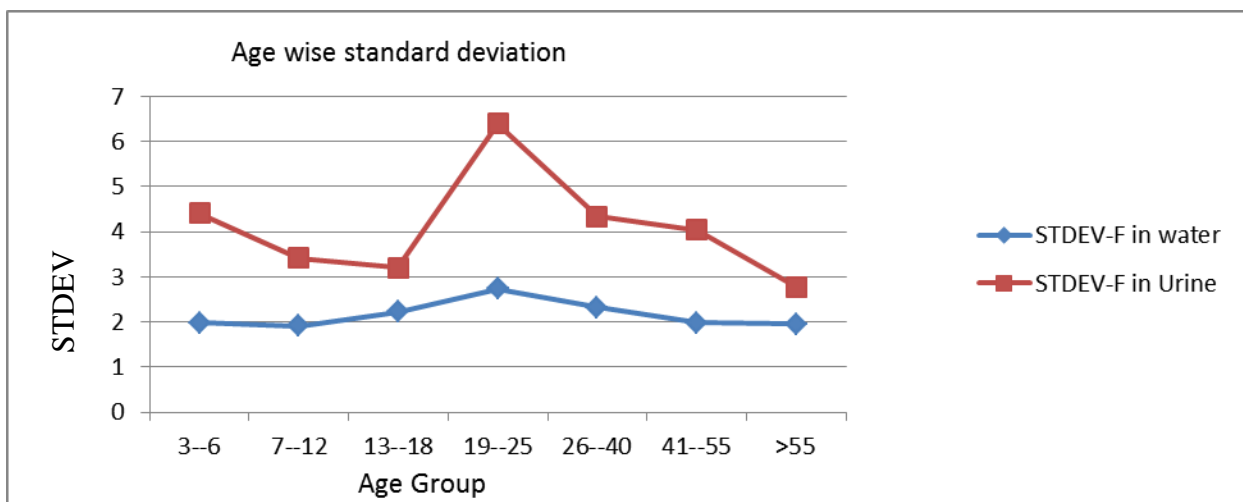
The lowest variation was found in individuals more than 55 yrs and in teenage group of 13 – 18 yrs. The reason for low variation in individuals above 55yrs can be due to the ageing factor when bones become weak due to deterioration of calcium, and fluoride deposits occur in bones whereas in teenage

years the hormonal activity and bone growth formation is high. This can also be observed in the age wise standard deviation graph, where the difference in mean standard deviation of fluoride concentration in water and urine samples was recorded the lowest among individuals more than 55yrs of age and those in between 13 – 18 yrs. At the same time, individuals of 19 – 25 age group showed a substantial difference in the mean standard deviation of fluoride recorded for urine and water samples, it was found here that the standard deviation for fluoride concentration in water and hence subsequently in urine was higher as compared to the other age groups. This can either be due to increase in mobility and change in diet pattern (inclination towards tea, gutkha, colgate etc) with time in individuals of this age group.

Age wise Fluoride intake as water and excretion as urine



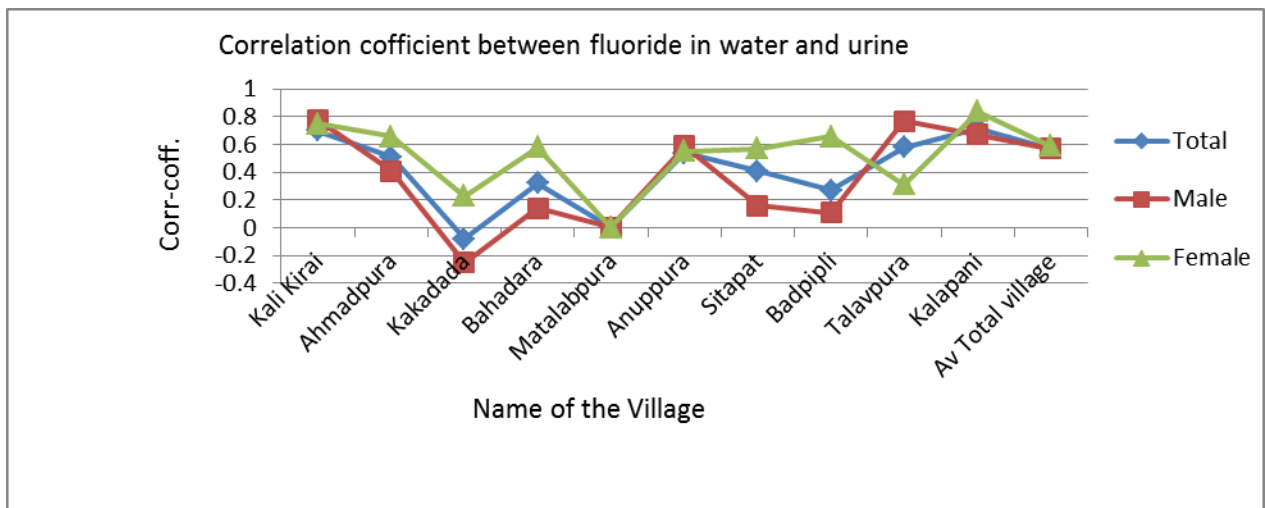
Age wise standard deviation in fluoride concentration of water and urine



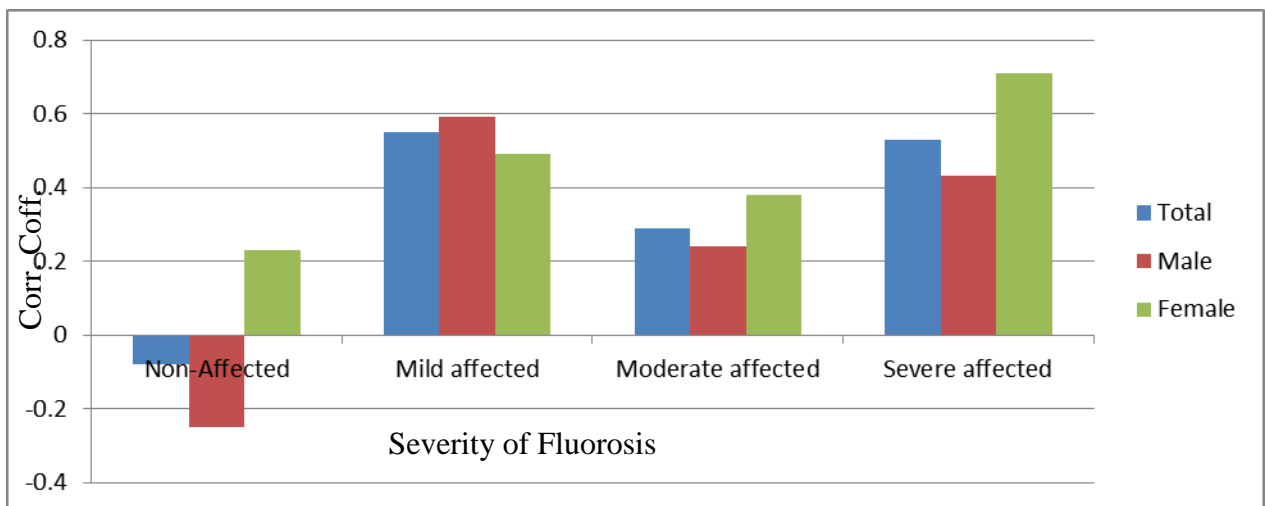
Correlation between fluoride concentration in water and urine

The correlation between fluoride concentration of water and urine samples was lowest in Kakadada – the control village and Matlabpura whereas in villages which had high fluoride concentration in their drinking water showed a comparatively higher coefficient correlation as up to 0.8. This explains that the reason for high fluoride concentration in this region in urine samples is not mainly due to the high fluoride present in drinking water but also the other sources through which fluoride is ingested.

Village wise Correlation coefficient between fluoride concentration in Water and Urine in male and female



Correlation coefficient according to fluorosis severity in male and female



The individual's drinking water having low fluoride concentration are more indicative of the impact than those having more fluoride concentration in their drinking water. The mean correlation coefficient was found in the range between 0.29 – 0.68 in all age groups (see Table-3). If the figure -5, is observed it can be clearly seen that in most of the villages except Talabpura females (6 villages studied out nine villages) as compared to males have either equal or higher correlation coefficient. The individuals who are not affected by fluorosis showed low or negative coefficient correlation between fluoride concentration in water and urine samples whereas those heavily affected by fluorosis showed a higher coefficient correlation see figure-6. Thus it can be finally stated that the source of fluoride is its high concentration in drinking water.

3.3 ASSESSMENT OF EFFECTIVENESS OF THE SAFE WATER SUPPLY SCHEME:

To assess the effectiveness of implemented scheme, urinary fluoride concentration were monitored of those individuals whose sample already monitored earlier in second round study in Feb,2010. Four programme villages(Bahadra, Ahmad pura, Matlab pura and Kali ki rai) and one control village (Anuppura) were taken for impact study. The findings are as follows-

Village Kali ki rai:

Feb 2010:

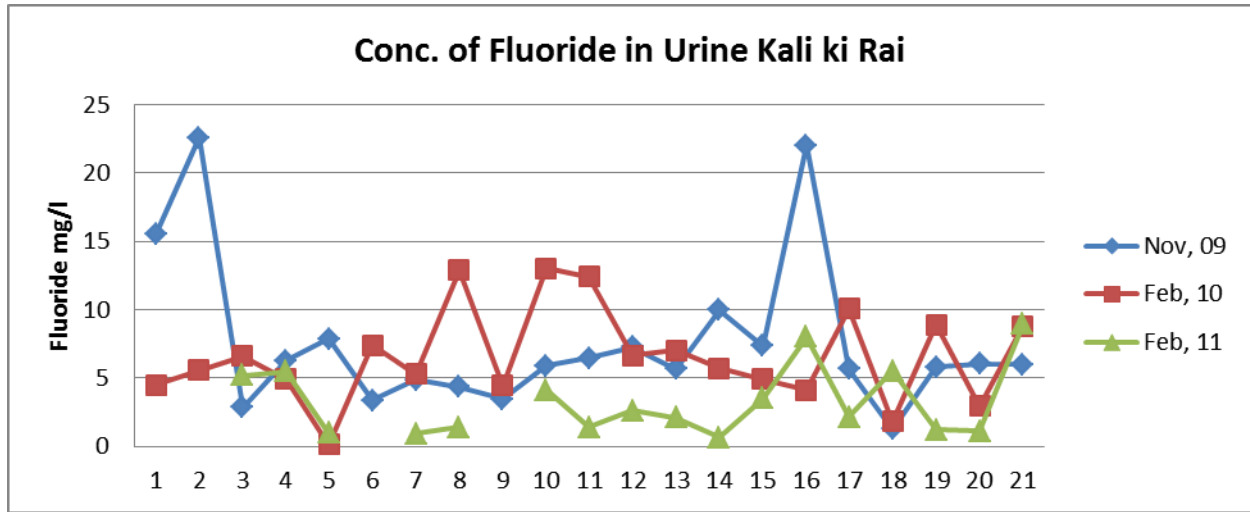
A combined effort made by Vasudha, Water Aid and PHED for safe water supply in village Kali ki



Rai. Only 8 individuals out of 21 are showing improvement in the concentration of urinary fluoride. Although remaining individuals are also drinking the same supply water from the well of Parbat Singh, but the fluoride concentration in their urine is high due to use of Hand Pump (Contaminated with Higher amount of fluoride) water for the cooking of pulses, vegetables and other food stuffs. Some times people are drinking the hand pump water. Both the water are stored in the house without any marking so it is impossible to ensure that individual is drinking safe water each time. The reason behind using HP water for cooking is that the hardness of hand pump water is lower than the well water and hence cooking of food is easy in HP

water. To make effective the water supply there is need of strong motivation and awareness program with community by using pictorial presentations or movies showing the impact of fluoride on human being. Village motive must visit every house hold to ensure that community is using the safe water for

that for this few random samples must be collected and checked for fluoride concentration by using field kit (a simple tool that can give qualitative indication of Fluoride level in form of safe and unsafe).



Feb 2011:

The Average standard deviation in the fluoride concentration in urine in village Kali Ki Rai was 5.65 before the implementation with lower concentration of 1.25 mg/l and higher concentration of 22.6 mg/l, it get reduced to 3.46 with lower and higher conc. of urinary fluoride value from 0.13 to 13 mg/l only after 3 month of water supply, Standard deviation again get reduced to 2.56 with lower and higher concentration of fluoride 0.66 to 8.92 mg/l in next one year. Only 25% individuals are showing the higher concentration of urinary fluoride >4mg/l.

Now it could be concluded for the village Kali Ki Rai that the Safe water supply is working very well and a little attention is needed towards the awareness of those peoples who are still using the hand pump water either in cooking food stuffs or some time for drinking.

Table showing urinary fluoride value before and after intervention in village Kali ki Rai

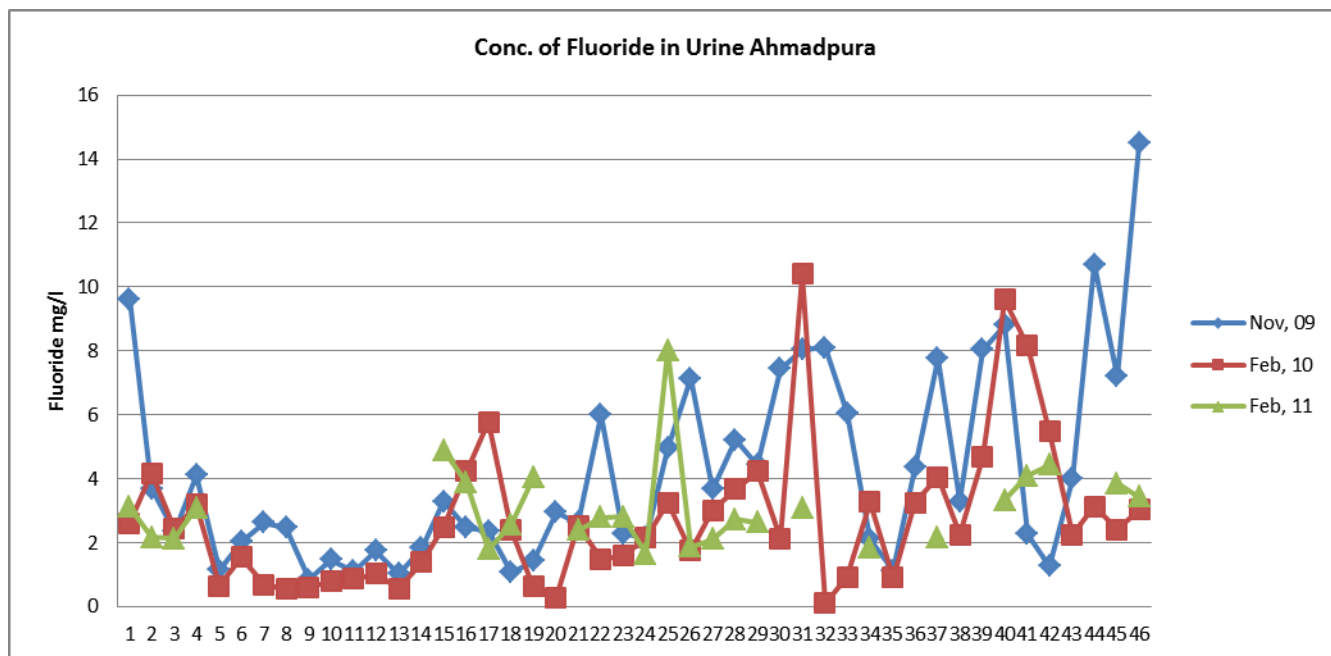
S.No.	Sample Code	Name	Age (years)	Sex	Flouride conc. in Urine Before intervention(mg/l)	Flouride conc. in Urine After intervention (mg/l)	
						Feb 2010	Feb 2011
1	KLR9	Munni Bai	35	F	15.5	4.49	
2	KLR10	Basanti	10	F	22.6	5.57	
3	KLR15	Kali Bai	38	F	2.86	6.58	5.2
4	KLR17	Subhash	20	M	6.25	4.89	5.46
5	KLR19	Dariyab	37	M	7.86	0.13	0.97
6	KLR20	Devka Bai	35	F	3.37	7.37	
7	KLR21	Jitendra	20	M	4.84	5.3	0.9

8	KLR24	Sangeeta	21	F	4.32	12.9	1.38
9	KLR25	Mena Bai	65	F	3.45	4.44	
10	KLR26	Pappu	32	M	5.89	13	4.12
11	KLR27	Mamta	30	F	6.47	12.4	1.41
12	KLR28	Snehlata	9	F	7.27	6.64	2.61
13	KLR29	Premlata	6	F	5.64	7.01	2.09
14	KLR32	Alkesh	15	M	9.96	5.69	0.66
15	KLR36	Devi Singh	35	M	7.35	4.92	3.48
16	KLR39	Ashish	4	M	22	4.13	7.99
17	KLRX1	Lokesh	12	M	5.64	10.08	2.13
18	KLR	Maya	15	F	1.25	1.81	5.51
19	KLR9	Ajay	18	M	5.8	8.89	1.22
20	KLRX1	Komal	10	F	6.01	2.94	1.13
21	KLRX10	Gaabar	11	M	6	8.82	8.92

Village Ahmad Pura:

Feb 2010:

Vasudha, WaterAid and PHED implemented safe water supply in village Ahmadpura. 37 individuals out of 46 are showed improvement in the concentration of urinary fluoride. Few individuals are showing the violation of fluoride concentration in their urine. It might be due to additional fluoride dose by some other means like food material and sometime due to unavailability of safe water due to



interruption in safe water supply due to electricity problem and sometime due to consumption of water

from bore well (Bore well water having excessive amount of fluoride) of Ex. Kailash Sarpanch. Maximum violation has been observed in the urine of Small children who are studying in the village school. There might be a chance of use of School Hand Pump water during mid-day meal. There is need of awareness among the children with their parents to ensure the safe water. To prevent the use of School hand pump water village motivator can motivate the villagers to give water to their children in thermos or in plastic bottles so that children can drink the safe water during the mid-day meal.



Feb, 2011:

The Average standard deviation in the fluoride concentration in urine in village Ahmad Pura was 3.1 before the implementation with lower concentration of 0.86 mg/l and higher concentration of 14.5 mg/l, it get reduced to 2.3 with lower and higher conc. of urinary fluoride value from 0.29 to 9.6 mg/l only after 3 month of water supply, Standard deviation again get reduced to 1.3 with lower and higher concentration of fluoride 1.8 to 8.03 mg/l in next one year. Only 6% individuals are showing the higher concentration of urinary fluoride >4mg/l.

Only awareness programme is now needed in the village Ahmadpura for the proper management of the supply scheme after that the whole structure can be handover to the existing water committee formed by the facilitation of VVS, Dhar.

Table showing urinary fluoride value before and after intervention in village Ahmadpura

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine Before intervention (mg/l)	Flouride conc. in Urine After intervention (mg/l)	
						Feb 2010	Feb 2011
1	AMD6	Nain Singh	5	M	9.62	2.62	3.12
2	AMD8	Sagnath	25	M	3.7	4.17	2.18
3	AMD9	Laxmi	23	F	2.36	2.43	2.13
4	AMD10	Sayvan	17	F	4.12	3.19	3.10
5	AMD12	Ansu	40	F	1.16	0.66	
6	AMD13	Sunil	29	M	2.04	1.55	
7	AMD14	Hukum	25	M	2.64	0.69	
8	AMD16	Genda Bai	30	F	2.47	0.56	
9	AMD17	Suresh	15	M	0.86	0.61	

10	AMD21	Hira Lal	40	M	1.48	0.79	
11	AMD22	Budhi Bai	38	F	1.12	0.87	
12	AMD25	Manisha	7	F	1.76	1.04	
13	AMD26	Bhagitrath	32	M	1.03	0.57	
14	AMD27	Shakuntla Bai	27	F	1.83	1.4	
15	AMD28	kavita	12	F	3.29	2.5	4.89
16	AMD29	Seema	10	F	2.48	4.24	3.88
17	AMD30	Nilesh	7	M	2.37	5.78	1.80
18	AMD32	Salakram	27	M	1.07	2.4	2.58
19	AMD33	Sanju Bai	22	F	1.43	0.63	4.03
20	AMD34	Bhalali	7	F	2.96	0.29	
21	AMD42	Golo	9	M	2.64	2.54	2.40
22	AMD43	Archana	8	F	5.99	1.5	2.79
23	AMD44	Kusum Bai	32	F	2.29	1.6	2.82
24	AMD45	RangLal	40	M	2.15	2.16	1.66
25	AMD46	Jasma Bai	35	F	4.96	3.25	8.03
26	AMD48	Sanju	12	F	7.14	1.75	1.87
27	AMD49	Rakesh	10	M	3.68	3.02	2.12
28	AMD50	Kiran	8	F	5.22	3.68	2.74
29	AMD52	Janglia	45	M	4.44	4.24	2.64
30	AMD53	Gulka Bai	40	F	7.45	2.14	
31	AMD54	Pappu	15	M	8.05	10.4	3.07
32	AMD55	Mallu	12	F	8.11	0.12	
33	AMD56	Dashrath	40	M	6.06	0.93	
34	AMD65	Lakhan	11	M	2.11	3.28	1.84
35	AMD66	Janki	67	F	1.14	0.92	
36	AMD67	Ranchod	40	M	4.35	3.26	
37	AMD X1	Rajmal	10	M	7.77	4.06	2.18
38	AMD X2	Parmanand	10	M	3.3	2.25	
39	AMD X3	Rakesh	9	M	8.05	4.67	
40	AMD X4	Dilip	8	M	8.8	9.6	3.34
41	AMD X5	Bhim	7	M	2.27	8.17	4.09
42	AMD X6	Jitendra	9	M	1.28	5.48	4.44
43	AMD X7	Sanjay	10	M	3.99	2.25	
44	AMD X8	Rakesh	4	M	10.7	3.13	
45	AMD X9	Deepak	7	M	7.2	2.41	3.85
46	AMD X10	Rukma	11	F	14.5	3.03	3.44

Village Bahadra:

Feb, 2010:

In Bahadra village safe water is being supplied by the combined effort of PHED, Vasudha and Water Aid. 13 individuals out of 14 showed improvement in their urinary fluoride concentration in Baidi pura cluster of the village. Although fluoride concentration in urine of maximum individuals showed declined pattern but the ratio as compare to other individuals of other villages is low. This lower decreased urinary fluoride concentration is due to use of Hand pump water during the unavailability of safe supply water i.e. due to problem in electricity and failure of supply tank.

In Patel Pura a cluster of village Bahadra 7 individual's sample of urine were collected and it has been observed that all the individuals showed improvement. Although electricity problem and supply problem is also persists here to but in any problem people are using safe hand pump water for drinking purpose.

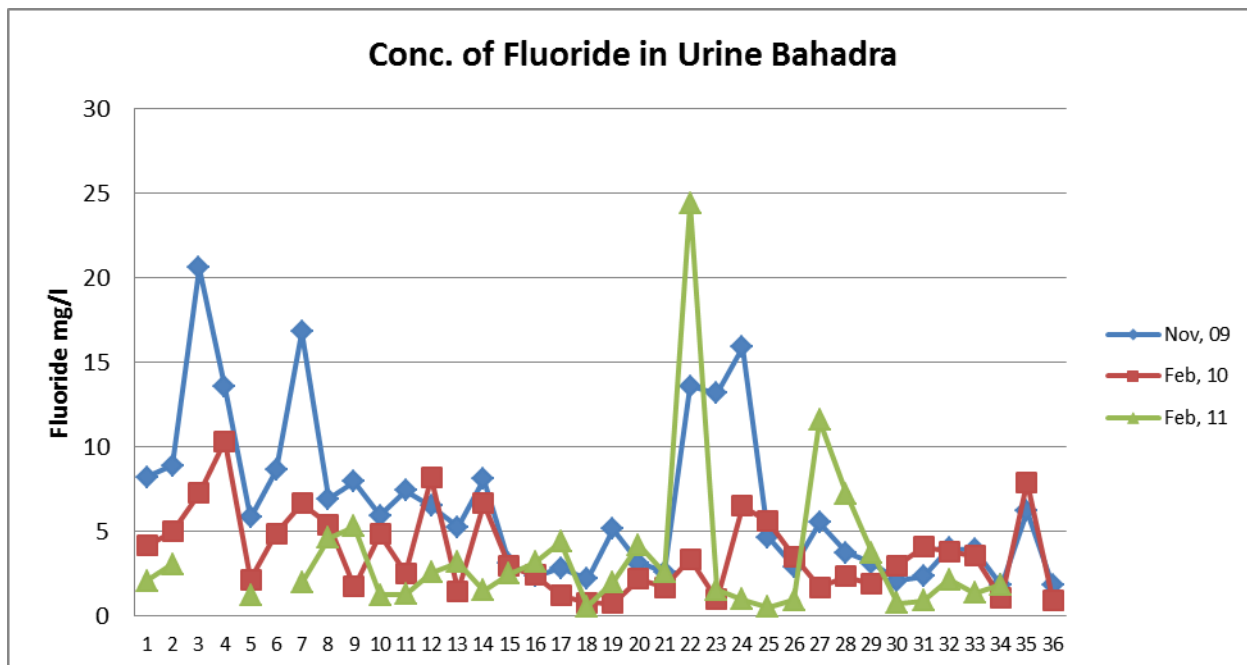
5 individuals of Jamunwala pura cluster out of 10 are showing declined value of fluoride in their urine samples. Although no any safe supply is made for them. The declined value of urinary fluoride is due to use of alternate well water during the field activity and use of hand pump water in Schools. There are two HP in Jamunwala pura in which on near to Rai singh house having fluoride concentration 5 (5.42mg/l) times greater than the prescribed limit although school HP is also contaminated but concentration of fluoride (1.83 mg/l) is lower than the other one. At the time of Urine sample collection during the first visit it has been suggested to the villagers to use School Hand Pump water. Some of has already been adopt this suggestion and showed improvement while some people are residing closer by Rai singh's house are still using water from higher Contaminated source and hence they showed the increased value of fluoride in their urine. There is need of awareness among the community to use water from well in front of Rai singh house having fluoride concentration 0.63 mg/l.



In school pura of Bahadra 5 samples were collected and analysed and 4 were showed improvement in their urinary fluoride concentration.

Feb, 2011:

The Average standard deviation in the fluoride concentration in urine in village Bahadra was 4.71 before the implementation with lower concentration of 1.82 mg/l and higher concentration of 20.6 mg/l, it get reduced to 2.43 with lower and higher conc. of urinary fluoride value from 0.78 to 10.4 mg/l only after 3 month of water supply, Standard deviation further reduced to 1.58 with lower and higher concentration of fluoride 0.56 to 7.24 mg/l in next one year. Only 11% individuals are showing the higher concentration of urinary fluoride >4mg/l.



An awareness programme is now needed in the village Bahadra for the proper management of the supply scheme after that the whole structure can be handover to the existing water committee formed by the facilitation of VVS, Dhar. In Jamun wala Hamlet of village strong awareness programme is necessary so that people can take drinking water from the well near to Hare Singh house.

Table showing urinary fluoride value before and after intervention in village Bahadra

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine Before intervention	Flouride conc. in Urine After intervention	
						Feb 2010	Feb 2011
1	BDRB1	Magan singh	55	M	8.24	4.19	2.09
2	BDRB2	Misri bai	47	F	8.92	5.02	3.08
3	BDRB3	Pappu singh	26	m	20.6	7.28	
4	BDRB4	Tara wati	22	F	13.56	10.35	
5	BDRB5	Shivani	14	F	5.85	2.19	1.21
6	BDRB6	Ashish	13	M	8.64	4.89	

7	BDRB7	Mangilal	50	M	16.8	6.68	1.99
8	BDRB11	Sukhibai	35	F	6.94	5.43	4.65
9	BDRB16	Sukli bai	35	F	7.98	1.75	5.33
10	BDRB20	Fathay singh	44	M	5.95	4.87	1.28
11	BDRB21	Kamla bai	40	F	7.43	2.56	1.31
12	BDRB23	Ganpat	23	M	6.52	8.18	2.58
13	BDRB24	Ghoi singh	17	M	5.26	1.51	3.21
14	BDRB25	Radha bai	68	F	8.11	6.68	1.52
15	BDRP2	Sitaram	22	M	3.12	2.96	2.52
16	BDRP3	Champa bai	19	F	2.38	2.43	3.2
17	BDRP7	Shakuri bai	55	F	2.86	1.21	4.39
18	BDRP8	Amar singh	60	M	2.2	0.83	0.58
19	BDRP9	Gita	13	F	5.17	0.78	2.03
20	BDRP10	Phul singh	30	M	3.16	2.23	4.21
21	BDRP11	Reakha	26	F	2.63	1.71	2.59
22	BDRJ3	Sureash	32	M	13.6	3.39	24.4
23	BDRJ4	Suraj	27	F	13.2	0.99	1.55
24	BDRJ9	Papeeta	22	F	15.9	6.54	1.01
25	BDRJ10	Jhubbu bai	42	F	4.66	5.6	0.56
26	BDRJ11	Dubhan bhuja	29	M	2.94	3.52	0.97
27	BDRJ12	Basu	10	F	5.53	1.73	11.6
28	BDRJ13	Kanchan	12	F	3.76	2.37	7.24
29	BDRJ14	Anju	28	F	3.16	1.91	3.77
30	BDRJ16	Mangi lal	6	M	2.09	3.01	0.77
31	BDRJ18	Sushila	15	F	2.37	4.1	0.93
32	BDRS1	Gokul	40	M	4.02	3.85	2.17
33	BDRS2	Pooja	8	F	3.94	3.57	1.39
34	BDRS4	Narbada bai	35	F	1.84	1.06	1.86
35	BDRS5	Sekari bai	38	F	6.21	7.93	
36	BDRS7	Sobha ram	21	M	1.82	0.96	

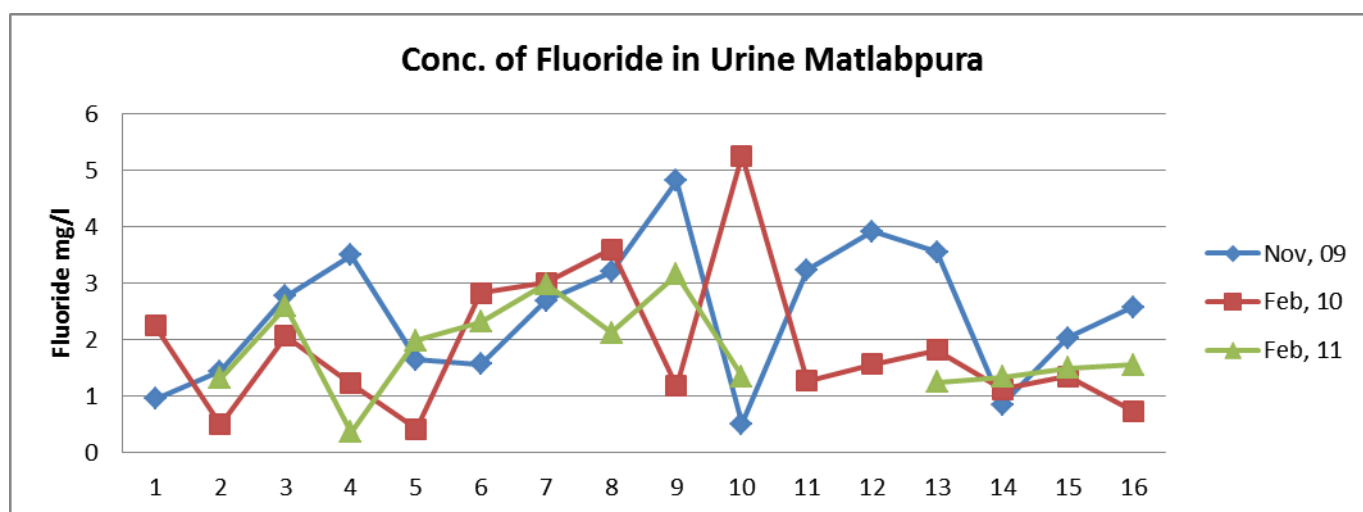
Village Matlabpura:

Feb, 2010:

16 individuals urine sample were collected from the village Matlab pura and the pattern of urinary fluoride concentration was almost same than the previous monitoring. As the villagers are using safe source water either from Aungan Badi HP or from well. 10 individuals showed improvement that might be due to awareness created by Vasudha staff. Some time they were using the school water in past time.



Matlab pura pond Responsible for the dilution of some sources of Bahadra village



Feb, 2011:

The Average standard deviation in the fluoride concentration in urine in village Matlab Pura was 1.2 before the implementation with lower concentration of 0.51 mg/l and higher concentration of 4.81 mg/l, it get increased to 1.27 with lower and higher conc. of urinary fluoride value from 0.42 to 5.26

mg/l after 3 month of water supply, Standard deviation reduced to 0.78 with lower and higher concentration of fluoride 0.36 to 3.16 mg/l in next one year. There was no any subject having urinary fluoride concentration more than 4mg/l. Almost every water source shows a decline in fluoride concentration that might be due to big pond in the upstream of the village.

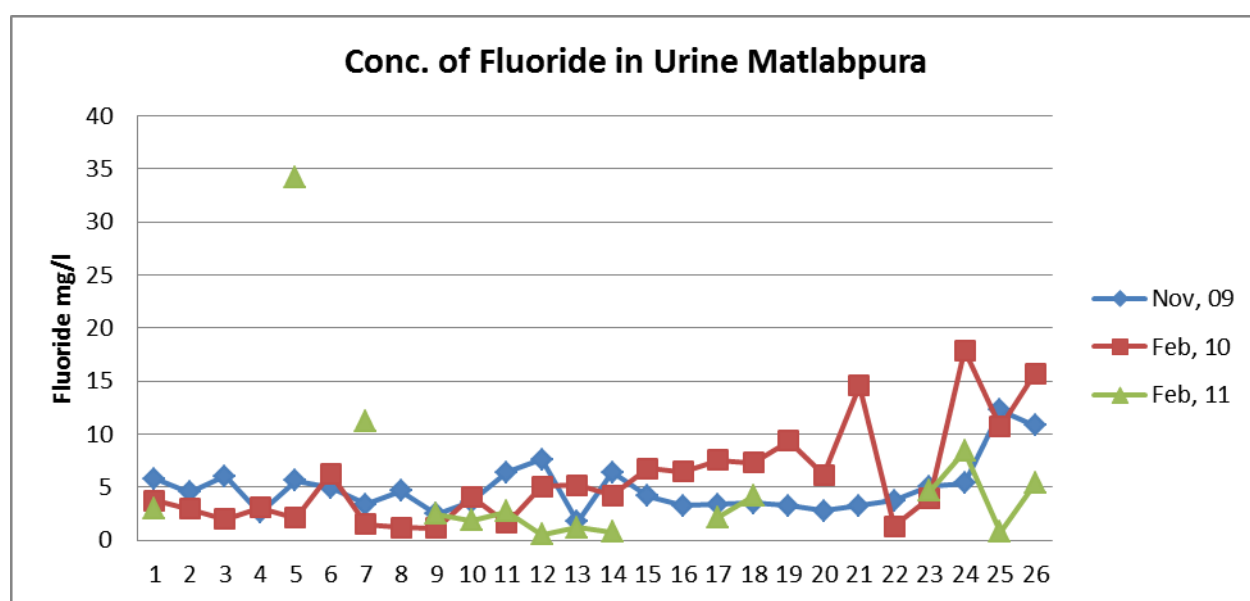
Table showing urinary fluoride value before and after intervention in village Matlabpura

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine Before intervention	Flouride conc. in Urine After intervention	
						Feb 2010	Feb 2011
1	MLT9	Prem	28	F	0.95	2.25	
2	MLT11	Bana bai	65	F	1.44	0.5	1.32
3	MLT12	Champa lal	32	M	2.77	2.07	2.59
4	MLT13	Chottu	27	F	3.5	1.23	0.36
5	MLT35	Balwan	3	M	1.65	0.42	1.98
6	MLT14	Roop singh	23	M	1.57	2.82	2.32
7	MLT20	Santra bai	30	F	2.69	3.01	2.99
8	MLT22	Saventa	8	F	3.2	3.6	2.12
9	MLT24	Phunda bai	40	F	4.81	1.18	3.16
10	MLT30	Sharda bai	38	F	0.51	5.26	1.35
11	MLT31	Gaboo singh	15	M	3.23	1.27	
12	MLT32	Reakha	13	F	3.92	1.56	
13	MLT34	Laxmi	12	F	3.55	1.82	1.25
14	MLT36	Ramesh	32	M	0.85	1.12	1.34
15	MLT37	Rabi bai	32	F	2.03	1.35	1.5
16	MLT40	Ram kuwar	6	F	2.58	0.74	1.55

Village Anuppura: (control village no intervention till now but will be done upto end of March 2011)

Feb, 2010:

10 individuals out of 26 showed improvement in village Anuppura. Improvement was observed in the community who are using the well water due to awareness program conducted by Vasudha. Initially they were consuming water of HP near Mohan House (2.33 mg/l fluoride) and now using well water (0.17mg/l Fluoride). Community that is living near school cum Aungan badi centre is still using HP water (3.73 mg/l fluoride) and hence an increase in urinary fluoride concentration was observed.



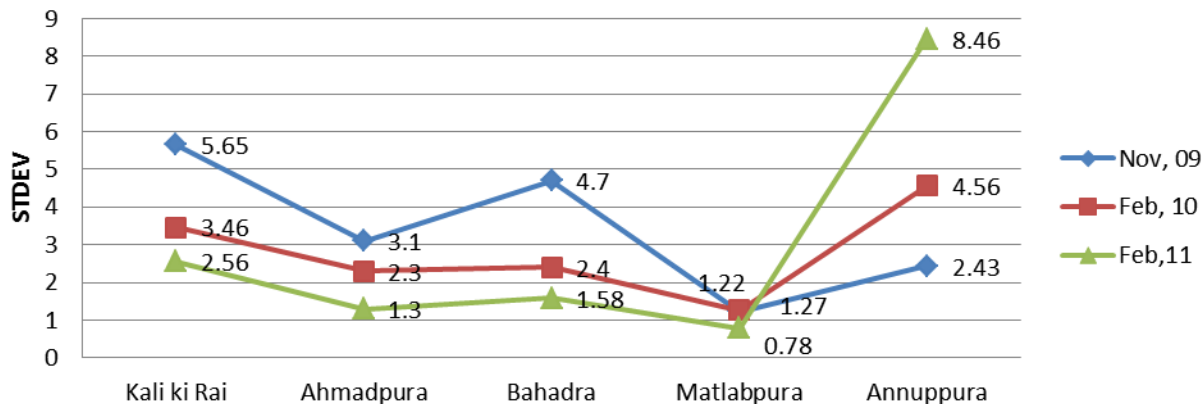
Feb, 2011:

The Average standard deviation in the fluoride concentration in urine in village Anup Pura was 2.4 in Nov, 09, with lower concentration of 1.74 mg/l and higher concentration of 12.3 mg/l, it get increased to 4.6 with lower and higher conc. of urinary fluoride value from 0.42 to 1.15 mg/l in Feb, 10, Standard deviation increased to 8.5 with lower and higher concentration of fluoride 0.56 to 34.2 mg/l in Feb, 11. The higher deviation in the urine sample during the Feb 2011, is due to consumption of newly installed HP by few families, as the concentration of the new source is 10.7mg/l. The urinary fluoride concentration in the remaining subjects are lower than the previous year's data.

Table showing urinary fluoride value before and after intervention in village Anuppura

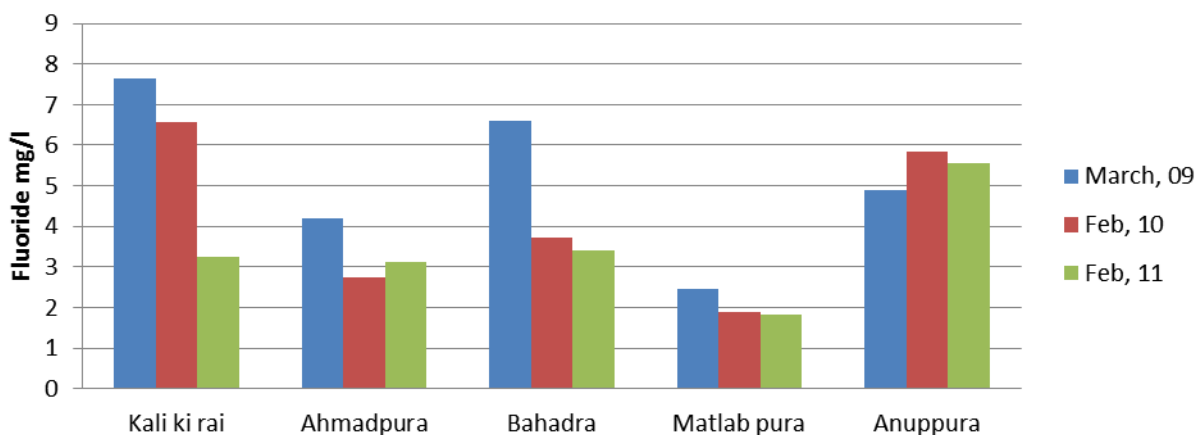
S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine Before	Flouride conc. in Urine After	
						Feb 2010	Feb 2011
1	ANP 6	Subu	13	F	5.83	3.76	2.95
2	ANP8	Subhash	22	M	4.51	2.93	
3	ANP10	Lalita	18	F	6.06	2.01	
4	ANP16	Gagri bai	60	F	2.62	3.06	
5	ANP18	Punjalal	35	M	5.63	2.1	34.2
6	ANP21	Badal	11	M	4.94	6.31	
7	ANP22	Akash	9	M	3.37	1.51	11.2
8	ANP23	Indu	8	M	4.68	1.19	
9	ANP24	Janki	40	F	2.47	1.15	2.46
10	ANP25	Mohan	45	M	3.6	4.11	1.87
11	ANP27	Kaileash	32	M	6.41	1.6	2.69
12	ANP28	Suman	28	F	7.63	5.1	0.56
13	ANP32	Chotiya	40	M	1.74	5.17	1.22
14	ANP33	Laxmi	36	F	6.43	4.23	0.76
15	ANP34	Mahesh	10	M	4.17	6.77	
16	ANP35	Ranjana	9	F	3.28	6.45	
17	ANP36	Bhau singh	37	m	3.41	7.57	2.18
18	ANP39	Abhishek	7	M	3.5	7.29	4.17
19	ANP40	Yuvraj	6	M	3.24	9.34	
20	ANP41	Gaura singh	65	F	2.79	6.19	
21	ANP44	Ganesh	8	M	3.27	14.6	
22	ANP45	Chitra	65	M	3.77	1.34	
23	ANP46	Muni	40	F	5.08	4	4.63
24	ANP50	Chanda	12	F	5.35	17.9	8.41
25	ANP52	Sarita	20	F	12.3	10.7	0.81
26	ANP53	Nanda	10	F	10.8	15.7	5.39

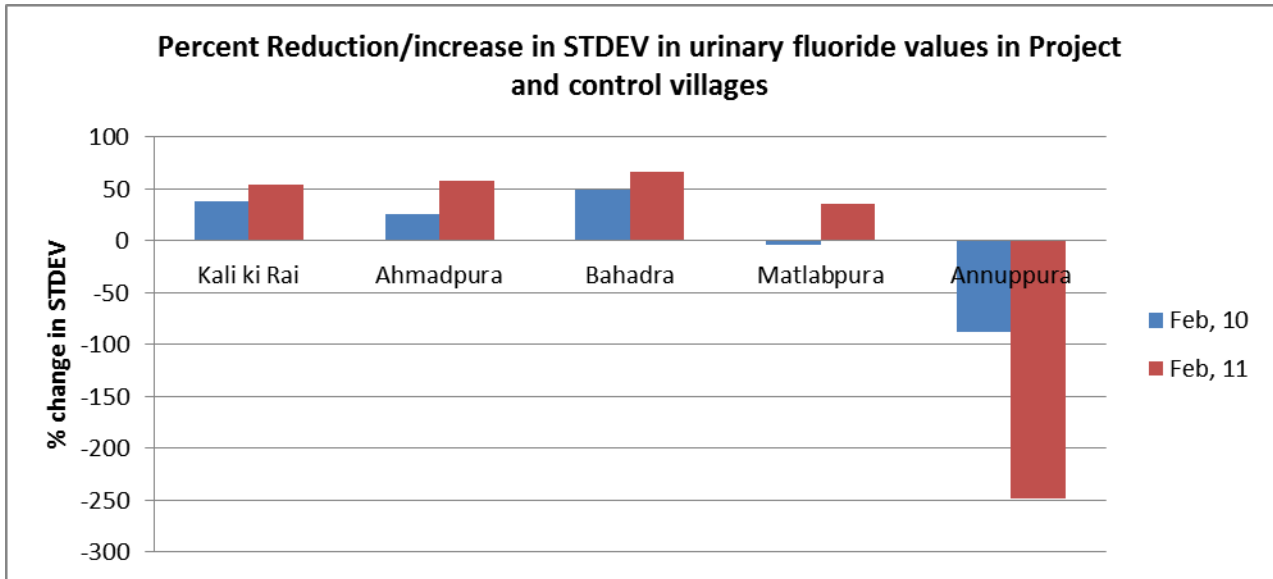
Standard deviation comparison in villages before and after intervention



Mean urinary fluoride value in studied villages before implementation was 7.63, 4.21, 6.6, 2.45 and 4.88 mg/l in villages Kali ki rai, Ahmadpura, Bahadra, Matlabpura and Anuppura respectively, and these values get changed to 6.57, 2.76, 3.73, 1.58 and 5.85 respectively in Feb 2010 and changes to 3.25, 3.11, 3.42, 1.83 and 5.57 respectively in the Feb 2011. In implementation villages Kali ki rai, Ahmad pura and Bahadra reduction observed in mean urinary fluoride concentration while increasing pattern observed in village Matlab pura and Control village Anuppura. Although the increased value of Mean Urinary Fluoride in Village Matlab pura is very low and close to the Stable limit of Urinary Fluoride value.

Mean Urinary fluoride values before and after intervention in Project and control villages





Priliminary Urinary fluoride monitoring for New Safe water supply scheme Villages:

After the Great success of the Four abobe mentioned villages VVS, WaterAid and PHED of Dhar has been decided to Provide safe water to some more villages namely Bad Pipli, Nelda, Abdul Pura, Tara Pur, Lohgar Pura and Katar. In some of the above mentioned villeges the infrastructure has been developed and some software and management straitegies are being carried out and in some vllages schemes are partialy fuctioning.

Bhutia: in village Bhutia 17 individuals urine sample analysed the mean average fluoride concentration was 1.55 mg/l with standard deviation of 1.03, and the minimum urinary fluoride conc. was 0.27 mg/l and maximum 4.41 mg/l only one persons urinary fluoride conc. is higher than 4 mg/l.

All the three Stackholders (VVS, WaterAid and PHED) did a very good job in a village i.e. **Bhutia**. As our Reasearch Institute (Peoples’ Science Institute) is practicing this strateigy in earth quake safe housing and called it as **L0** preparation, which means preparedness before disaster occurs. The same practice were observed in the Bhutia villages where there was no any HP installed yet and people were collecting there water from a very far well, although the well water is safe but it needed time and labour so people were demanding an HP in there village. If the HP were installed the concentration of fluoride might be higher than the prescribed limit as generally happening in other water sources.



Table showing urinary fluoride value before intervention in village Bhutia:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine
					Feb-11
1	BTA1	Basanti bai	35	F	1.26
2	BTA2	Nirmal	7	M	1.7
3	BTA3	Seema	6	F	1.25
4	BTA4	Radha	8	F	0.27
5	BTA5	Deepak	6	M	1.3
6	BTA6	Gori bai	30	F	1.31
7	BTA7	Bhuribai	30	F	2.02
8	BTA8	Guru	4	M	1.16
9	BTA9	Rajubai	27	F	4.41
10	BTA10	Ladlibai	40	F	0.892
11	BTA11	Pintu	9	M	1.87
12	BTA12	Rohit	4	M	3.34
13	BTA13	Heera	13	M	2.33
14	BTA14	Ganesh	2	M	0.66
15	BTA15	Sugna Bai	28	F	0.95
16	BTA16	Basanti Bai	28	F	0.53
17	BTA17	Badri	40	M	1.09

Bad Pipli: In village Bad Pipli, the infrastructure has been created but due to some fault in pipeline the supply was not possible and latter the pumpset had been stolen. So no safe water supply is being done to the villagers. In feb 2010 urinary sample from 40 individuals were collected in which only 11 individuals urinary fluoride was in between 0.86 to 3.42 mg/l the remaining 29 individuals were in the range of 4.07 to 24.3 mg/l. The mean Urinary fluoride concentration was 7.1 mg/l with atandard deviation 4.68 from mean value. In feb 2011 13 old individuals and 14 new individuals urinary sample were observed the mean urinary fluoride concentration in old and new individuals were 6.62 and 3.42 with minimum and maximum fluoride values 1.92 – 15.9 and 1.42 – 5.35 respectively. The standars deviation in old individuals was 3.44 and only 1.27 in new individuals.

Table showing urinary fluoride value before intervention in village Bad Pipli:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine	
					Feb-10	Feb-11
1	BDP54	Rustam	65	M	4.07	
2	BDP5	Moolchand	45	M	5.85	4.75
3	BDP19	Kamal	40	M	6.36	
4	BDP29	Ganesh	8	M	12.5	
5	BDP42	Krishna	8	M	1.28	
6	BDP35	Rajesh	18	M	2.13	
7	BDP55	Vikram	18	M	3.03	
8	BDP7	Rangesh	10	M	7.08	6.13
9	BDP25	Anguri	14	F	8.42	
10	BDP13	Lakhan	8	M	9.79	9.86
11	BDP20	Dharmendra	8	M	7.36	5.22
12	BDP37	Anita	13	F	1.39	
13	BDP36	Dinesh	9	M	2.08	
14	BDP34	Vikram	13	M	2.68	1.92
15	BDP17	Sharad	11	M	7.02	11.9
16	BDP18	Kanha	9	M	7.3	6.23
17	BDP21	Monika	7	F	13.1	
18	BDP15	Gir Dhari	35	M	2.87	
19	BDP22	Sugri Bai	50	F	3.46	
20	BDP47	Dinesh	24	M	4.38	
21	BDP40	Sakri Bai	38	F	4.59	3.08
22	BDP30	Nand Ram	50	M	4.63	
23	BDP31	Dhapu Bai	45	F	6.27	
24	BDP32	Lila Bai	45	F	6.44	
25	BDP8	Dhiraj	9	M	7.11	
26	BDP1	Munni Bai	55	F	7.39	
27	BDP27	Lokesh	6	M	8.49	
28	BDP41	Nannu	45	M	8.52	3.72
29	BDP23	Laxmi	26	F	9.5	8.11
30	BDP14	Sanju Bai	27	F	10.6	3.56
31	BDP11	Sunder Bai	68	F	11.3	
32	BDP26	Arun	4	M	11.7	
33	BDP33	Babita	18	F	12.2	
34	BDP12	Geeta Bai	30	F	13.8	5.62
35	BDP2	Sugan	28	F	15.1	15.9

36	BDP16	Sita Ram	32	M	24.3	
37	BDP38	Mala	9	F	0.86	
38	BDP43	Monika	6	F	1.53	
39	BDP45	Mukesh	25	M	3.32	
40	BDP24	Chindu	4	M	4.34	
41	BDPX1	Gulab Singh	30	M		1.42
42	BDPX2	Rajesh		M		2.69
43	BDPX3	Ramesh		M		2.83
44	BDPX4	Pooja		F		5.35
45	BDPX5	Kamli Bai		F		2.42
46	BDPX6	Yogesh		M		3.32
47	BDPX7	Sapna		F		2.52
48	BDPX8	Shrawan		M		3.88
49	BDPX9	Ramratan		M		4.52
50	BDPX10	Mishrilal		M		5.7
51	BDPX11	Alka		F		3.41
52	BDPX12	Ganesh		M		4.39
53	BDPX13	Dheeraj		M		3.7
54	BDPX14	Suresh		M		1.74

Nelda: In vilage Nelda Urine sample of 35 individuals were monitored, the urinary fluoride value varies in between 0.47 to 5.9 mg/l. the mean urinary fluoride value were 2.33 and the standard deviation was 1.51. Only 7 individuals urinary fluoride level was higher than 4 mg/l. The higher conc. observed was from only 3 families that could indicate the consumption of water from either unsafe source or from dietary variations.

Table showing urinary fluoride value before intervention in village Nelda:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine
					Feb-11
1	NLD1	Ramesh	40	M	2.31
2	NLD2	Kani bai	36	F	1.32
3	NLD3	Jagdeesh	35	M	2.66
4	NLD4	Suraj Bai	32	F	1.04
5	NLD5	Kundan	13	M	1.42
6	NLD6	Suresh	10	M	2.77
7	NLD7	Sitaram	25	M	0.55
8	NLD8	Rekhabai	23	F	1.63

9	NLD9	Monika	4	F	0.47
10	NLD10	Kanhaiya	35	M	4.52
11	NLD11	Chankur Bai	33	F	4.26
12	NLD12	Sangeeta	15	F	1.53
13	NLD13	Raju	13	M	5.88
14	NLD14	Bahadur Singh	8	M	5.9
15	NLD15	Babu Tailor	45	M	2.38
16	NLD16	Kamla Bai	43	F	5.77
17	NLD17	Mamta Bai	22	F	5.21
18	NLD18	Ter Singh	35	M	1.58
19	NLD19	Sukma Bai	33	F	1.57
20	NLD20	Daya Ram	16	M	1.9
21	NLD21	Sita Ram	14	M	1.68
22	NLD22	Bulibai	50	F	5.05
23	NLD23	Savitri bai	43	F	1.41
24	NLD24	Babban	26	M	1.44
25	NLD25	Archana	24	F	1.46
26	NLD26	Savitri Bai		F	1.37
27	NLD27	BhimSingh		M	1
28	NLD28	Pappu Singh		M	3.44
29	NLD29	Sukli Bai		F	1.98
30	NLD30	Madi Bai		F	1.88
31	NLD31	Rukhadia		M	1.25
32	NLD32	Phool Bai		F	1.6
33	NLD33	Raj Kumar		M	1.1
34	NLD34	Radhey Shyam		M	0.55
35	NLD35	Mukesh		M	1.69

Abdulpura: In village Abdulpura urinary sample of 14 individuals were monitored and the value of urinary fluoride varies in between 0.82 to 4.17 mg/l. The mean fluoride value was 2.33 with standard deviation of 1.2. Only 3 individuals urinary fluoride conc. was more than 4 mg/l. in the village people are drinking water from supply scheme or from a safe handpump.

Table showing urinary fluoride value before intervention in village Abdulpura:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine
					Feb-11
1	ABL3	Gora	14	F	1.59
2	ABL6	Jagdeesh	40	M	2.87
3	ABL8	Suresh	40	M	2.18
4	ABL10	Vinod	22	M	1.65
5	ABL12	Dinesh	25	M	3.23
6	ABL13	Durgabai	22	F	4.17
7	ABL14	Amar Singh	35	M	1.6
8	ABL17	Manish	7	M	4.03
9	ABL18	Rakesh	22	M	4.08
10	ABL21	Sohan Singh	45	M	2.51
11	ABL22	Bharat Singh	30	M	0.91
12	ABL23	Manju Bai	27	F	1.38
13	ABL24	Sunil	10	M	1.64
14	ABL25	Gal Singh	10	M	0.82

Tarapur: in village tara pur urinary fluoride of 17 individuals were monitored. The minimum and maximum Urinary fluoride value were 0.71 and 4.48 mg/l. The mean value was 2.3 mg/l with standard deviation of 1.2. Only two individuals urinary fluoride level was higher than 4 mg/l, and was of two brothers severely affected with dental fluorosis. They are now using the safe water but higher conc.might be due to excretion of previously accumulated fluoride in their body.

Table showing urinary fluoride value before intervention in village Tarapur:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine
					Feb-11
1	TRP1	Durga	12	F	1.64
2	TRP2	Barsha	10	F	3.32
3	TRP3	Gayatri	13	F	1.89
4	TRP4	Rajvanti	15	F	0.71
5	TRP5	Sona	15	F	1.36

6	TRP7	Sarita	10	F	3.62
7	TRP8	Ranu	8	F	3.76
8	TRP9	Latif	40	M	2.37
9	TRP10	Kherun Bai	35	F	2.45
10	TRP11	Nikita	15	F	0.82
11	TRP12	Ahmad	13	M	2.39
12	TRP13	Balwan Singh	40	M	1.53
13	TRP14	Suman Bai	38	F	1.2
14	TRP17	Totaram	40	M	2.01
15	TRP18	Kiran bai	35	F	1.58
16	TRP19	Prakash	22	M	4.48
17	TRP20	Jitendra	20	M	4.22

Lohgar Pura: In village Lohgar Pura samle of 10 individuals from two clusters have been collected. The minimum urinary value was 1.35 mg/l and the maximum conc. was 2.79 mg/l. The mean fluoride value was 1.8 mg/l with standard deviation of 5.3. All the individuals urinary conc. is in the safe limit as they are using the safe water as unsafe sources were demortilised by the PHED.

Table showing urinary fluoride value before intervention in village Lohgarpura:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine
					Feb-11
1	LGR1	Mayaram	50	M	1.6
2	LGR2	Kuwar	45	F	1.55
3	LGR3	Dinesh	35	M	2.2
5	LGR5	Rinku	10	M	2.21
6	LGR6	Dayaram	55	M	2.79
7	LGR7	Devkabai	50	F	1.7
8	LGR8	Jalal	50	M	1.35
9	LGR9	Kagurbai	45	F	1.84
10	LGR10	Pramila	18	F	2.79

Katar: In village Katar urinary sample of 26 individuals were analysed and the value was found in between 0.56 to 10.6 mg/l. The mean urinary fluoride value was 2.9 mg/l with standard deviation of 2.4. Only 4 individuals urinary fluoride level is >4 mg/l in which 3 are the member of same family. The higher concentration of fluoride in there urine may be due to consumption of probably unsafe water.

Table showing urinary fluoride value before intervention in village Tarapur:

S.No.	Sample Code	Name	Age	Sex	Flouride conc. in Urine
					Feb-11
1	KTR1	Shantilal	30	M	1.27
2	KTR2	Prembai	28	F	0.571
3	KTR3	Sonu	16	F	1.32
4	KTR4	Subhadra	14	F	0.93
5	KTR5	Bharat	12	M	1.16
6	KTR6	Jhamribai	60	F	1.17
7	KTR7	Nandram	45	M	0.56
8	KTR8	Mamubai	35	F	2.42
9	KTR9	Mugut	25	M	2.32
10	KTR10	Mirabai	22	F	2.24
11	KTR11	Jitendra	15	M	1.73
12	KTR12	Jabar Singh	35	M	3.36
13	KTR13	Sanju Bai	32	F	1.86
14	KTR14	Suresh	16	M	2.66
15	KTR15	Chandni	14	F	2.21
16	KTR16	Roshani	12	F	2.39
17	KTR17	Kiran	8	F	2.82
18	KTR18	Chanda	2.5	F	1.05
19	KTR19	Mohan	40	M	3.01
20	KTR20	Radha Bai	35	F	2.7
21	KTR21	Rakhi	16	F	2.73
22	KTR22	Sarita	12	F	4.34
23	KTR23	Banti	10	M	3.5
24	KTR24	Ravina	8	F	7.43
25	KTR25	Nandram	3	M	8.12
26	KTR26	Gaurabai	28	F	10.6

Note: maximum Safe urinary fluoride value is 4 mg/l as on assumption that if any person is drinking water of fluoride conc. 1 ± 0.2 mg/l and if excretion of urine is one fourth of consumed water.

Fluoride concentration of different drinking water sources of the villages of Dhar District M.P.

S.No.	Name of the village/identity of source	Type of source	Ownership	Longitude Latitude N/E	Fluoride concentration (mg/l)	
					Nov,08	Feb,11
Anuppur						
1	Ter Singh	Well	Private	22°18'02.3" 75°21'48"	0.36	
2	Near Augan badi	HP	Govt	22°18'02.2" 75°21'51.1"	3.19	2.06
3	Madi Singh	Well	Pri	22°18'04.9" 75°21'52.3"	0.28	0.23
4	Near Primary school	HP	Govt	22°17'51.3" 75°21'45.8"	2.63	2.35
5	Near Punjalal Shop	HP	Govt			10.7
Bahadara						
6	Near Middle school	HP	Govt	22°17'39.6" 75°21'35.8"	2.08	0.59
7	HP in the middle School	HP	Govt			0.42
8	Near Gokul House	HP	Govt	22°17'34.4" 75°21'33.5"	4.23	0.54
9	Near temple	HP	Govt	22°18'34.2" 75°21'30.0"	2.76	0.76
10	Rajan Sarpanch	Well	Pri	22°17'35.0" 75°21'23.3"	0.45	0.40
11	Near Banshi Lal house	HP	Govt	22°17'41.7" 75°21'26.8"	5.98	0.85
12	HP behind kanya ashram	HP	Govt	22°17'33.3" 75°21'22.8"	3.56	1.47
13	Near Bhairo/Dhoom Singh house	HP	Govt	22°17'35.4" 75°21'14.0"	0.39	0.35
14	Near Rai Singh House	HP	Govt	22°17'43.2" 75°21'45.1"	6.59	3.59
15	Near EGS, Jamunwala	HP	Govt	22°17'45.5" 75°21'45.1"	0.85	2.20
16	Well Supply	well	Govt			0.51
Rasalpur Bandhav						
17	Near Kalu Ram house	HP	Govt	22°18'23.2" 75°21'50.2"	1.54	
18	Matlabpura					
19	Near Primary School	HP	Govt	22°17'30.1" 75°21'45.6"	3.62	4.5
20	Near Auganbadi kendra	HP	Govt	22°17'33.0" 75°21'46.5"	0.20	0.17
21	Matalabpura Pond	Pond			0.18	

22	Govt. Well for Supply					0.33
Malpura						
23	Santosh's Tubewell	TW	Pri	22°16'00.5" 75°21'58.0"	4.29	
24	Santosh Well	Well	Pri	22°16'00.9" 75°21'55.7"	0.39	
25	Near Chhotu house	HP	Govt	22°16'00.2" 75°22'00.7"	0.67	
26	Near Narayan house	HP	Govt	22°16'10.7" 75°22'05.4"	0.39	
27	Near Chagan house	HP	Govt	22°16'07.0" 75°22'05.4"	0.34	
Abdulpura						
28	Near School (very close to School)	HP	Govt	22°17'24.8" 75°22'29.0"	2.49	1.57
29	HP down side to School	HP	Govt	22°17'28.1" 75°22'27.7"	0.42	0.28
30	Supply well	Well	Pri	22°17'32.9" 75°22'25.7"	0.22	0.43
31	Near forest check post	HP	Govt	22°17'08.5" 75°22'30.4"	0.64	
Kalapani						
32	Near Galiya house	HP	Govt	22°17'13.9" 75°21'05.7"	9.62	
33	Pond, kalapani	Pond			0.35	
34	Well, near pond kalapani	Well	Pri	22°17'05.8" 75°20'58.7"	0.18	
35	HP, near pond	HP	Govt	22°17'03.7" 75°20'56.7"	1.50	
Tarapur						
36	Near Kanya Ashram	HP	Govt	22°15'59.0" 75°22'40.8"	11.6	
37	Supply water	Surface +well	Panchayat		0.49	0.39
38	HP middle of Village in main road	HP	Govt			0.28
39	HP near High school	HP	Govt			1.75
40	Well near High school	well	Govt			0.29
41	near new High school	HP	Govt			1.38
Choti Chhitari						
42	Near Primary School	HP	Govt	22°16'11.1" 75°21'51.8"	0.66	
43	Near Temple	HP	Govt	22°16'09.2" 75°21'47.6"	0.61	
44	Near Madhu Singh	HP	Govt	22°16'04.7"	7.81	

	house			75°21'45.8"		
45	Bharat's well	Well	Pri	22°16'00.2" 75°21'42.8"	0.50	
Kali Karai						
46	Near School	HP	Govt	22°15'19.3" 75°21'43.6"	6.86	5.28
47	Parbat's well	Well	Pri	22°15'21.0" 75°21'43.1"	0.36	0.30
48	Near Temple	HP	Govt	22°15'20.1" 75°21'44.9"	6.51	5.36
49	Near Gadpat house	HP	Govt	22°15'20.8" 75°21'49.6"	6.86	5.01
50	Near Hare Singh house	HP	Govt	22°15'24.0" 75°21'51.1"	11.5	9.41
51	Village pond water	Pond			0.28	
Lalmatiya						
52	Near Amar Singh house	HP	Govt	22°16'15.4" 75°22'50.9"	0.46	
53	Near Bhagirathi house	HP	Govt	22°16'15.6" 75°22'53.6"	0.47	
54	Near Santosh house	HP	Govt	22°16'17.3" 75°22'54.3"	1.17	
55	Near Phool Singh house	HP	Govt	22°16'19.8" 75°22'51.6"	1.19	
Kachhuwania						
56	Near Middle School	HP	Govt	22°18'03.8" 75°27'27.6"	2.66	
Ahmadpura						
57	Near Primary School	HP	Govt	22°18'11.0" 75°28'10.2"	3.25	
58	Near Chandar/Budhiya house	HP	Govt	22°18'09.6" 75°28'04.8"	2.44	
59	Near Kailash Sarpanch house	HP	Govt	22°18'09.5" 75°28'03.0"	3.56	2.71
60	Near Ratan house	HP	Govt	22°18'10.8" 75°28'08.5"	3.28	
61	Supply well	Well	Govt			0.73
Talabpura (Bagwania)						
62	Near Primary School	HP	Govt	22°16'10.2" 75°25'11.9"	1.59	
63	Near Mohan house	HP	Govt	22°16'14.1" 75°25'14.3"	0.43	
64	Well of Govind/Champalal	Well	Pri		0.71	
65	Near Mangilal house	HP	Govt	22°16'13.6" 75°25'10.3"	0.38	

Nirgudia						
66	Near School	HP	Govt	22°16'10.2" 75°24'33.4"	8.78	
67	Near Tannu house	HP	Govt	22°16'05.2" 75°24'40.6"	4.02	
Suradi						
68	Near Primary School	HP	Govt	22°17'59.0" 75°19'51.7"	6.07	
69	Supply water				1.68	
Nelda						
70	Near Galsingh/old Pri. school	HP	Govt	22°18'35.6" 75°19'28.4"	1.61	
71	Near Kailash house	HP	Govt	22°18'38.1" 75°19'25.2"	0.45	0.99
72	Near Primary school	HP	Govt	22°18'33.3" 75°19'29.1"	2.81	4.42
73	Near Sakha Ram house	HP	Govt	22°18'29.3" 75°19'26.5"	0.40	0.46
74	Supply well	Well	Govt			0.41
Katar						
75	Near School	HP	Govt	22°17'08.8" 75°22'29.6"	6.54	
76	Near Madan house	HP	Govt	22°14'57.2" 75°23'57.8"	0.45	0.79
77	Bore well uses for animals			22°15'02.8" 75°23'17.0"	8.58	2.28
78	Proposed supply well	Well	Govt			0.56
Lohagarpura						
79	Near Maya Ram house	HP	Govt	22°14'53.7" 75°23'57.8"	0.64	0.69
80	Near Ratan house	HP	Govt	22°14'44.7" 75°23'53.2"	11.5	
Karoundia-Schoolpura						
81	In front of Auganbadi	HP	Govt	22°15'50.1" 75°17'59.2"	6.81	
82	Behind primary school	HP	Govt	22°15'50.4" 75°17'59.9"	9.31	
83	Near Kantilal shop	HP	Govt	22°15'51.2" 75°18'02.0"	5.70	
84	Dariya's well, near to pond, side to the road	Well	Pri	22°15'47.2" 75°17'56.2"	0.30	
85	Pond water, karoundia	Pond			0.18	
Karoundia-Patelpura						
86	Near Bhaku house	HP	Govt	22°15'52.0" 75°17'56.3"	8.36	

87	HP behind temple	HP	Govt	22 ⁰ 15'53.7" 75 ⁰ 17'54.7"	1.66	
88	Near Sardar house	HP	Govt	22 ⁰ 15'56.3" 75 ⁰ 17'56.0"	1.02	
Karoundia-Nayapura						
89	Near Ishwar house	HP	Govt	22 ⁰ 15'41.6" 75 ⁰ 17'49.0"	2.46	
90	Near Temple	HP	Govt	22 ⁰ 15'45.3" 75 ⁰ 17'50.2"	8.14	
Karoundia-Dodwapura						
91	Near Galsingh house	HP	Govt	22 ⁰ 15'18.8" 75 ⁰ 18'17.3"	3.41	
92	Near School	HP	Govt	22 ⁰ 15'22.9" 75 ⁰ 18'20.8"	3.37	
Bholiyapura						
93	Near Pyar Singh house	HP	Govt	22 ⁰ 18'54.4" 75 ⁰ 19'56.8"	0.26	
94	Near Nand Ram house	HP	Govt	22 ⁰ 17'54.6" 75 ⁰ 18'49.8"	6.32	
95	HP outside of boundary to middle school	HP	Govt	22 ⁰ 17'59.6" 75 ⁰ 18'47.4"	0.32	
96	HP middle school	HP	Govt	22 ⁰ 17'59.8" 75 ⁰ 18'43.4"	7.97	
97	Punja's well	Well	Pri	22 ⁰ 17'50.3" 75 ⁰ 18'38.3"	0.32	
Patelpura						
98	Well of Lal Singh	HP	Govt	22 ⁰ 18'01.5" 75 ⁰ 17'55.5"	0.53	
99	Bore well Sumer Singh Teacher				4.33	
Kalalpura						
100	Near Sohan Jaiswal house	HP	Govt	22 ⁰ 17'39.4" 75 ⁰ 17'45.9"	2.93	
101	Near School	HP	Govt	22 ⁰ 17'39.5" 75 ⁰ 17'47.5"	4.16	
Badpipli						
102	HP near Khajoor tree	HP	Govt	22 ⁰ 32'30.4" 75 ⁰ 18'14.5"	0.54	0.45
103	Kaluram's well	Well	Pri	22 ⁰ 32'32.3" 75 ⁰ 18'10.2"	0.51	0.43
104	Near Shyamabai house	HP	Govt	22 ⁰ 32'34.7" 75 ⁰ 18'08.4"	1.16	
105	Near Munna house	HP	Govt	22 ⁰ 32'33.7" 75 ⁰ 18'05.9"	2.37	
106	Well of Chunni Lal	Well	Pri	22 ⁰ 32'27.3" 75 ⁰ 18'07.6"	0.47	0.44

107	Near Prakash house	HP	Govt	22 ⁰ 32'35.6" 75 ⁰ 18'00.9"	3.84	
108	Near Vijay house	HP	Govt	22 ⁰ 32'35.4" 75 ⁰ 18'10.8"	2.48	
109	Supply well	Well	Govt			0.52
Sitapat						
110	Near Munna house, Kakad	HP	Govt	22 ⁰ 32'46.8" 75 ⁰ 18'43.0"	6.37	
111	Near school	HP	Govt	22 ⁰ 32'35.6" 75 ⁰ 18'30.0"	5.58	
112	Near old School	HP	Govt	22 ⁰ 32'30.2" 75 ⁰ 18'28.5"	0.45	
113	Near Banyan tree	HP	Govt	22 ⁰ 32'24.9" 75 ⁰ 18'35.2"	2.21	
114	Surajpura ka talab	Pond			0.27	
115	Near Munna Lal house	HP	Govt	22 ⁰ 32'14.2" 75 ⁰ 18'19.8"	1.64	
116	Well of Kanha, Paldiya	Well	Pri	22 ⁰ 32'43.7" 75 ⁰ 19'04.2"	0.40	
Surajpura						
117	Near Girdhari house	HP	Govt	22 ⁰ 31'35.9" 75 ⁰ 18'31.2"	6.77	
118	Near Nala (small bridge)	HP	Govt	22 ⁰ 31'43.3" 75 ⁰ 18'25.7"	1.60	
Bhutia						
119	Govt. well Bhutia	Well	Govt		0.37	0.39
120	Well of Moolchand	Well	Pri		0.45	0.49
Ganga Nagar						
121	Kanya Ashram, Ganganagar	HP			2.64	
122	Kanya Ashram, Ganganagar	Well			0.21	
Surani						
123	HP near Kalu House	HP	Govt			1.23