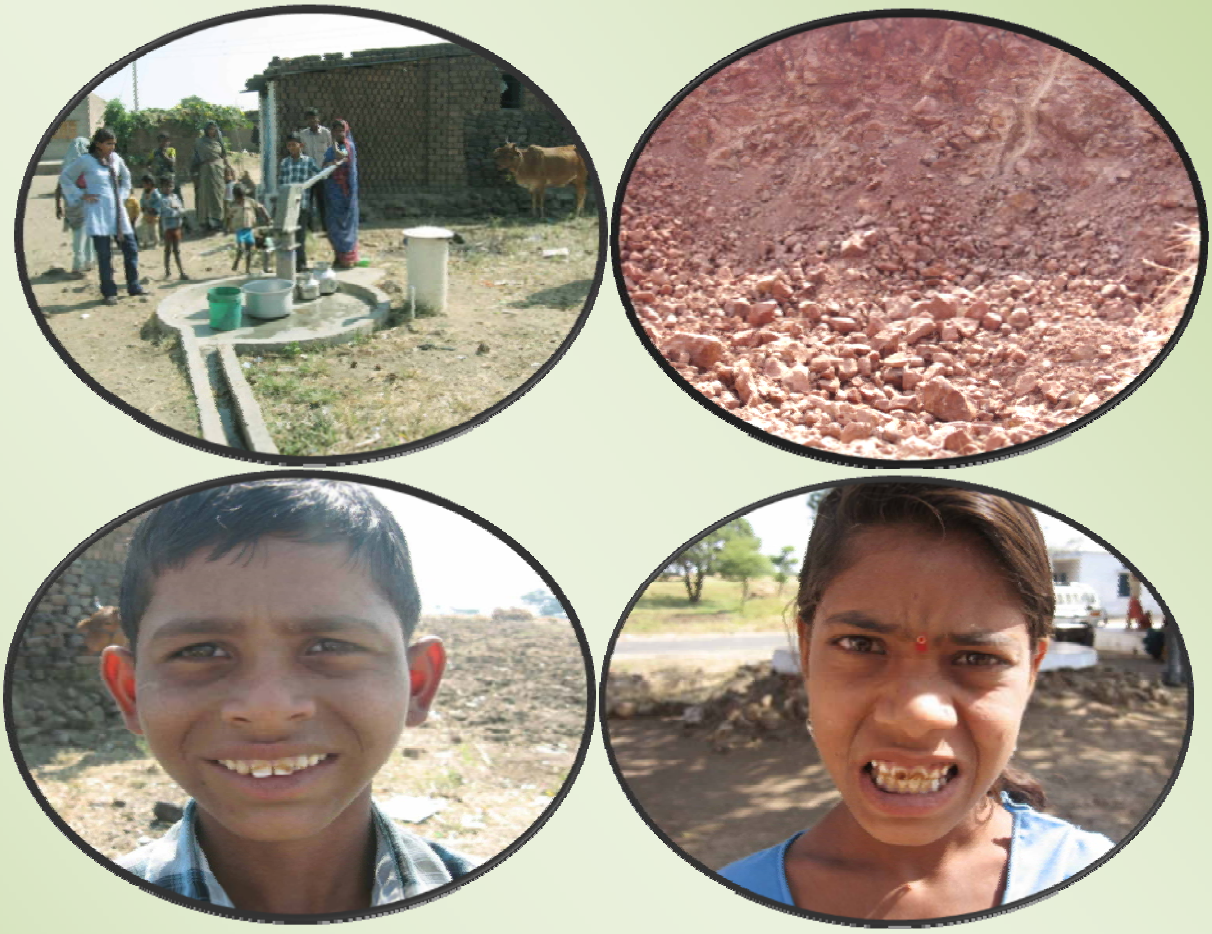
A Report on Fluorosis mitigation in Dhar District (M.P.)



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A Joint Study By-

People's Science Institute, Dehra Doon *Vasudha Vikas Sansthan (Dhar)* *Water Aid, India*

FLUORIDE TESTING AND FLUOROSIS MITIGATION IN DHAR DISTRICT (M.P.)

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. They are the Malwa in the north, the Vindhyachal 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 to a hill (Malwa Hill) area and the fluvial valley of River Narmada. The hilly region consists of fractured basaltic rocks, formed because of volcanic activities in the past and gets fractured because of tectonic movements of earth. As basaltic rocks contain fluoride in combined form with either Aluminium or with Calcium. Rather than basaltic rocks there are 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 downing of aquifer level and hence increase in fluoride concentration in ground water.

Vasudha Vikas Sansthan with the help of Peoples' Science Institute, Dehra Doon undertook fluoride testing and fluorosis mitigation in Tirala, Dharampuri and Umarban bloks of Dhar district. The program began in November 5th, 2008. A 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.

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) It shall thus help Vasudha Vikas Sansthan and local administration to prepare control and mitigation strategies for fluorosis.

(iii) The study may catch attention of the Govt. representatives and local administration on the seriousness of fluoride pollution and its effect in the area.

(iv) 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 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 informations, 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.

Dental Fluorosis survey at Kanya ashram Tarapur

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.

2.2, 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 to17th November, 08. Water quality for fluoride concentration of 109 water sources in the selected 31 habitations of 8 villages was monitored.

2.2.1, Sample Collection and Analysis:

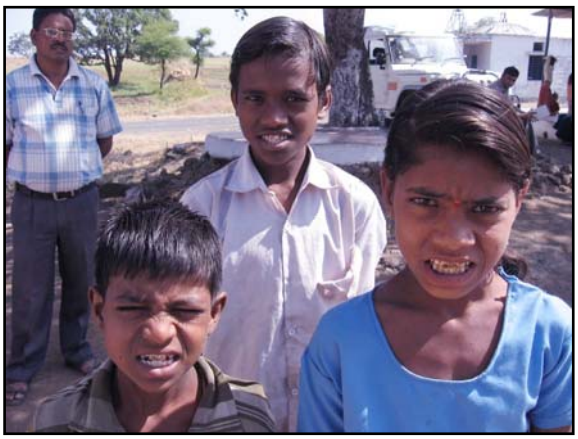
All the 31 habitations of 8 shortlisted villages are located in 3 distinct blocks, viz. Tirla, Dharampuri and Umarban. A temporary field laboratory was installed in VVS at Dhar. Samples were collected in polyethylene bottles, which were vigorously washed with detergents and rinsed with distilled water 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.

3.0 Results and discussions:

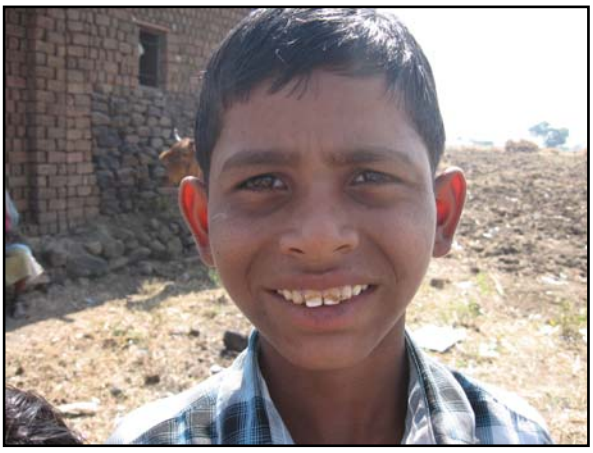
3.1 Dental fluorosis:

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, the details of which have been summarized in Table 4. It was observed that a out of a total of 1300 children, over 436 (33.5%) were effected 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.



Affected children of Pri. School Badpipli showing their teeth

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.



Affected boy vill. Sitapat showing his teeth

Table 1: Status of Dental Fluorosis in surveyed Schools

S. N.	Name of the School	Total No. of student surveyed	Status of Dental Fluorosis				% Dental Fluorosis
			Suspected	Preliminary	Medium	Severe	
1	Gov. Pri. School, Badpipali	73	25 (34.3)	23 (31.5)	6 (8.2)	2 (2.7)	42.4
2	Gov. Pri. School, Sitapat	33	8 (24.2)	5 (15.2)	7 (21.2)	1 (3.0)	39.4
3	Gov. Middle School, Paldiya	70	17 (24.3)	17 (24.3)	9 (12.9)	*	37.1
4	Satyam Vidhya Niketan, Paldiya (Pvt.)	42	16 (38.0)	8 (19.0)	2 (4.8)	*	23.8
5	Gov. Pri. School, Matlabpura	27	10 (37.0)	4 (14.8)	*	*	14.8
6	Gov. Middle School, Bahadra	63	17 (27.0)	17 (27.0)	8 (12.7)	2 (3.2)	42.9
7	Gov. Pri. School, Bahadra	35	5 (14.3)	24 (68.6)	1 (2.9)	*	71.4
8	Gov. Girls Adiwashi Ashram, Bahadra	46	15 (32.6)	16 (34.8)	*	*	34.8
9	Gov. Pri. School, Kalapani	20	2 (10)	11 (55)	6 (30)	*	85.0
10	Gov. High School, Tarapur	75	13 (17.3)	25 (33.3)	7 (9.3)	1 (1.3)	43.9
11	Gov. girls Ashram, Tarapur	46	15 (32.6)	12 (26.1)	3 (6.5)	*	32.6
12	Adiwashi Balak-Kanya Ashram, Tarapur	69	18 (26.1)	17 (24.6)	10 (14.5)	*	39.1
13	Gov. Pri. School Brahman puri	9	2 (22.2)	5 (55.5)	*	*	55.5
14	Gov. Pri. School Chitari (Choti)	16	5 (31.2)	4 (25)	2 (12.5)	*	37.5
15	Gov. Pri. School, Jamunwalapura (Bahadra)	11	2 (18.1)	4 (36.2)	2 (18.1)	*	54.3
16	Gov. Pri. School, Abdulpura	28	4 (14.3)	15 (53.5)	2 (7.7)	*	61.2
17	Gov. Middle School, Umaria	74	22 (29.7)	11 (14.8)	2 (2.7)	*	17.5
18	Middle School Bholiyapura	165	24 (14.5)	68 (41.2)	20 (12.2)	3 (1.8)	55.1
19	Primari School Surandi	19	4 (21.0)	6 (31.5)	3 (15.7)	*	47.2
20	Primari School, Nirgudiya Pura	37	8 (21.6)	9 (24.3)	*	*	24.3
21	Pvt. Middle Devi	42	6 (14.2)	16 (38.0)	*	*	38.0

	Nihalde						
22	Middle School Bagwania	27	1 (3.7)	26 (96.3)	*	*	96.3
23	Village children Lohgarpura	22	6 (27.2)	6 (27.2)	*	*	27.2
24	Village Children Kali Karai	24	3 (12.5)	16 (66.6)	2 (8.3)	*	75
25	Village Children Lalmatia	14	3 (21.4)	8 (57.1)	1 (7.1)	*	64.2
26	Middle School, Devi Nehalde (Chiktiyawad)	30	5 (16.6)	7 (23.3)	*	*	23.3
27	Gov. Pri. School, Bholiya Pura	36	10 (27.7)	10 (27.7)	1 (2.7)	*	30.4
28	Gov. Pri. School, Ahmadpura	24	5 (20.8)	8 (33.3)	1 (4.1)	*	37.4
29	Gov. Pri. School, Kacchuwania	16	6 (37.5)	1 (6.25)	1 (6.25)	*	12.5
30	Gov. Middle School, Kacchuwania	78	12 (15.4)	26 (33.3)	6 (7.7)	*	41.0
31	Gov. Pri. School, Karondiya	29	8 (27.5)	11 (37.9)	5 (17.2)	1 (3.4)	58.5
Total		**1300**	**297 (22.8)**	**436 (33.5)**	**105 (8.0)**	**10 (0.8)**	**42.3**

Table 2: Severity of dental fluorosis of the villages*

S. No.	Name of habitation	Children surveyed in habitation	Status of Dental Fluorosis					% Dental fluorosis in the habitations
			Not Affected	Suspected	Mild	Moderate	Severe	
1	Bahadra (Jamunwalapura)	100	24 (24)	19 (19)	47 (47)	9 (9)	1 (1.0)	57
2	Badpipli	83	16 (19.2)	28 (33.7)	30 (36.1)	7 (8.4)	2 (2.4)	47
3	Sitapat	70	24 (34.2)	21 (30)	13 (18.5)	11 (15.7)	1 (1.4)	35.7
4	Kakadda	50	30 (60)	11 (22)	8 (16)	1 (2)	*	18
5	Kacchuwania	43	22 (51.1)	10 (23.2)	10 (23.2)	1 (2.3)	*	25.6
6	Nirgudia Pura	46	25(54.3)	9 (19.5)	12 (26.1)	*	*	26.1
7	Dhapla	40	23 (57.5)	6 (15)	11 (27.5)	*	*	27.5
8	Bholiya Pura	41	17 (41.5)	8 (19.5)	14 (34.1)	2 (4.8)	*	39
9	Paldia	41	25 (60.9)	10 (24.4)	4 (9.7)	2 (4.8)	*	14.6
10	Matlabpura	36	16 (44.4)	10 (27.7)	9 (25)	1 (2.7)	*	27.8
11	Kali Karai	30	4 (13.3)	3 (10)	20 (66.6)	3 (10)	*	76.7
12	Kalapani	37	8 (18.7)	5 (35.1)	13 (35.1)	11 (29.7)	*	64.9
13	Surandi	22	6 (27.2)	6 (27.2)	7 (31.8)	3 (13.6)	*	45.5
14	Malpura	29	8 (27.6)	10 (34.48)	6 (20.7)	5 (17.24)	*	37.9
15	Ahmadpura	29	12 (41.3)	6 (20.7)	10 (34.5)	1 (3.4)	*	37.9
16	Brahmanpuri	24	8 (33.3)	5 (20.8)	11 (45.8)	*	*	45.8
17	Chitari (Choti)	26	8 (30.7)	9 (34.6)	7 (26.9)	2 (7.7)	*	34.6
18	Lohgarpura	22	10 (45.4)	6 (27.2)	6 (27.2)	*	*	27.3
19	Abdulpura	21	7 (33.3)	3 (14.2)	11 (52.4)	*	*	52.4
20	Tarapur	22	7 (31.8)	4 (18.2)	8 (36.3)	3 (13.6)	*	50
21	Chhiktiyawad	21	11 (52.3)	4 (19.1)	6 (28.6)	*	*	28.6
22	Anuppura	18	6 (33.3)	7 (38.9)	2 (11.1)	1 (5.5)	2 (11.1)	27.8
23	Ahmad Pura (Kacchuwania)	17	3 (17.6)	1 (5.9)	9 (52.9)	4 (23.5)	*	76.5
24	Genawa Pura (Kacchuwania)	16	5 (31.2)	3 (18.7)	7 (43.7)	1 (6.2)	*	50
25	Lalmatia	17	2 (11.7)	4 (23.5)	9 (52.9)	2 (11.7)	*	64.7
26	Umaria	16	8 (50)	5 (31.2)	2 (12.5)	1 (6.2)	*	18.8
27	Nelda	17	1 (100)	3 (35.3)	6 (35.3)	6 (35.3)	1 (5.8)	76.5
28	Panjaria	16	9 (56.2)	3 (18.7)	4 (25)	*	*	25
29	Chauhanpura, Kesharpura, Kalalpura	15	3 (20.0)	2 (13.3)	6 (40)	4 (26.6)	*	66.7

30	Tibediya	15	3 (20)	2 (13.3)	7 (46.7)	2 (13.3)	1 (6.6)	66.7
31	Bandhav	12	3 (25)	4 (33.3)	3 (25)	2 (16.7)	*	41.7
32	Telipura	12	*	*	9 (75)	3 (25)	*	100
33	Katar	11	7 (63.6)	1 (9.1)	2 (18.2)	1 (9.1)	*	27.3
34	Suradi Soliyapura	11	4 (36.3)	5 (45.4)	2 (18.1)	*	*	18.2
35	Nimat Baidi	11	*	1 (9.1)	9 (81.8)	1 (9.1)	*	90.9
36	Naya Pura (Karaundia)	8	*	3 (37.5)	*	4 (50)	1 (12.5)	62.5
37	Patel Pura (Suradi)	9	1 (11.1)	2 (22.2)	5 (55.5)	1 (11.1)	*	66.7
38	Bagwania	9	3 (33.3)	*	6 (66.6)	*	*	66.7
39	Talavpura	8	*	*	7 (87.5)	1 (12.5)	*	100
40	Kusumla	9	6 (66.6)	2 (22.2)	1 (11.1)	*	*	11.1
41	Dokaria	9	2 (22.2)	3 (33.3)	4 (44.4)	*	*	44.4
42	Kahir Pura (Kacchuwania)	7	4 (57.1)	1 (14.3)	2 (28.5)	*	*	28.6
43	Chilariapura	6	1 (16.6)	2 (33.3)	2 (33.3)	1 (16.6)	*	50
44	Ambapura	7	2 (28.5)	3 (42.8)	2 (28.6)	*	*	28.6
45	Lawani	6	6 (100)	*	*	*	*	*
46	Suradi Ungaunapura	6	1 (16.6)	2 (50)	3 (50)	*	*	50
47	Kund Pura	5	1 (20)	1 (20)	1 (20)	1 (20)	1 (20)	60
48	Patel Pura (Karaundia)	5	*	1 (20)	4 (80)	*	*	80
49	School Pura (Karaundia)	5	*	1 (20)	3 (60)	1 (20)	*	80
50	Karaundia	5	1 (20)	1 (20)	3 (60)	*	*	60
51	Suradi Telipura	4	*	2 (50)	2 (50)	*	*	50
52	Bhandaria pura	4	*	1 (25)	3 (75)	*	*	75
53	Hirapura	4	*	*	4 (100)	*	*	100
54	Jamla	4	*	1 (25)	3 (75)	*	*	75
55	Chandawad	4	1 (25)	1 (25)	2 (50)	*	*	50
56	Randa	4	3 (75)	*	1 (25)	*	*	25
57	Rampura	4	*	3 (75)	1 (25)	*	*	25
58	Jamania	4	*	4 (100)	*	*	*	*
59	Suraj Pura	5	2 (40)	*	2 (40)	1 (20)	*	60
60	Nayapura (Panjaria)	4	1 (25)	2 (50)	1 (25)	*	*	25
61	Bhutia	4	3 (75)	1 (25)	*	*	*	*
62	Dukan Pura (kacchuwania)	4	3 (75)	1 (25)	*	*	*	*
63	Patel pura (Kacchuwania)	4	2 (50)	*	*	2 (50)	*	50

64	Banjari	4	1 (25)	3 (75)	*	*	*	*
65	Khutamod	4	3 (75)	1 (25)	*	*	*	*
66	Jamnya	3	1 (33.3)	2 (66.6)	*	*	*	*
67	Kacchadad	3	*	1 (33.3)	2 (66.6)	*	*	66.7
68	Hasan pur	3	1 (33.3)	*	*	2 (66.6)	*	66.7
69	Dhegda	3	1 (33.3)	1 (33.3)	1 (33.3)	*	*	33.3
70	Bet Kuwna	3	1 (33.3)	*	2 (66.6)	*	*	66.7
71	Koyla Bahu	3	1 (33.3)	1 (33.3)	1 (33.3)	*	*	33.3
72	Banjari	3	*	1 (33.3)	2 (66.6)	*	*	66.7
73	Maliyabeda	3	*	*	3 (100)	*	*	100
74	Chedipura (Karaundia)	3	1 (33.3)	2 (66.6)	*	*	*	*
75	Sarpanch Pura (Karaundia)	3	2 (66.6)	*	1 (33.3)	*	*	33.3
76	DodwaPura (Karaundia)	2	1 (50)	*	1 (50)	*	*	50
77	Ahirwas	2	2 (100)	*	*	*	*	*
78	Jaman Jhiri	2	2 (100)	*	*	*	*	*
79	Hemantpura	2	1 (50)	*	1 (50)	*	*	50
80	Badwawar	2	1 (50)	*	1 (50)	*	*	50
81	Bandikhal	2	*	*	2 (100)	*	*	100
82	Pharas Pura	2	1 (50)	1 (50)	*	*	*	*
83	Dholi Bawdi	2	2 (100)	*	*	*	*	*
84	Gawadiya Badi	2	*	*	2 (100)	*	*	100
85	Dabia	2	1 (50)	*	1 (50)	*	*	50
86	Dhanora	2	1 (50)	*	1 (50)	*	*	50
87	Balipur	2	2 (100)	*	*	*	*	*
88	Bhowania	2	1 (50)	*	1 (50)	*	*	50
89	Lodhi Pura	2	1 (50)	1 (50)	*	*	*	*
90	Boharala	2	*	*	2 (100)	*	*	100
91	Amri	2	2 (100)	*	*	*	*	*
92	Pandar Pura (kacchuwania)	2	1 (50)	1 (50)	*	*	*	*
93	Kali Bawdi	1	1 (100)	*	*	*	*	*
94	Kotada	1	1 (100)	*	*	*	*	*
95	Rawapura	1	*	*	1 (100)	*	*	100
96	Sarasgaun	1	1 (100)	*	*	*	*	*
97	Aulipura	1	1 (100)	*	*	*	*	*
98	Bairagarh	1	*	1 (100)	*	*	*	*
99	Bheelpura	1	1 (100)	*	*	*	*	*

100	Sankota	1	1 (100)	*	*	*	*	*
101	Degonia	1	*	1 (100)	*	*	*	*
102	Ekalara	1	*	*	1 (100)	*	*	100
103	Dhanara	1	*	*	1 (100)	*	*	100
104	Kalanda	1	*	1 (100)	*	*	*	*
105	Khujanwa	1	1 (100)	*	*	*	*	*
106	Dhasoda	1	*	1 (100)	*	*	*	*
107	Kachadad	1	*	1 (100)	*	*	*	*
108	Indore	1	*	1 (100)	*	*	*	*
109	Bagadi	1	*	*	1 (100)	*	*	100
110	Ramadhama	1	*	1 (100)	*	*	*	*
111	Mundala	1	*	1 (100)	*	*	*	*
112	Beerampura	1	1 (100)	*	*	*	*	*
113	Ukhaida	1	*	1 (100)	*	*	*	*
114	Sadinathi	1	*	*	*	1 (100)	*	100
115	Dhamnod	1	*	*	1 (100)	*	*	100
116	Dhankhedi	1	1 (100)	*	*	*	*	*
117	Utavat	1	*	*	1 (100)	*	*	100
118	Badgaoun	1	*	*	1 (100)	*	*	100
119	Fatiapur	1	1 (100)	*	*	*	*	*
120	Auli Pura	1	*	*	1 (100)	*	*	100
121	Koyla Bahu	1	*	*	1 (100)	*	*	100
122	Phata Choti	1	1 (100)	*	*	*	*	*
123	Palash Hotel	1	*	*	1 (100)	*	*	100
124	Bedipura	1	1 (100)	*	*	*	*	*
125	Nariya Bada	1	1 (100)	*	*	*	*	*
126	School Pura (Kacchuwania)	1	*	1 (100)	*	*	*	*
Total		1300	452 (34.7)	297 (22.8)	436 (33.5)	105 (8.0)	10 (0.76)	42.3

* Data obtain by surveys of the dental fluorosis in 31schools

3.2 Water Quality:

A 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.

Among the 109 sources monitored, water quality analysis of the samples from 83 hand pumps, 17 wells, 3 tube wells and 6 ponds was done. The results showed that 67% of the hand pumps and 100% of the tube well sources were not safe; the fluoride concentration

was above the permissible limit prescribed by BIS, whereas the samples of wells and ponds were found safe and hence fit for drinking according to fluoride concentrations. Apart from these, over 28% of the hand pumps sources were found to have fluoride concentration above 5 mg/L. For details please see Table no. 3, 4 and Annexure 1.

Table 3: Fluoride concentration of different drinking water sources of the villages

SN.	Name of the village/identity of source	Type of source	Ownership	Longitude Latitude N/E	Fluoride concentration (mg/l)
	Anuppur				
1.	Ter Singh	Well	Private	$22^0$18’02.3” 75^o21’48”	0.36
2.	Near Augan badi	HP	Govt	$22^0$18’02.2” $75^0$21’51.1”	3.19
3.	Madi Singh	Well	Pri	$22^0$18’04.9” $75^0$21’52.3”	0.28
4.	Near Primary school	HP	Govt	$22^0$17’51.3” $75^0$21’45.8”	2.63
	Bahadara				
5.	Near Middle school	HP	Govt	$22^0$17’39.6” $75^0$21’35.8”	2.08
6.	Near Gokul House	HP	Govt	$22^0$17’34.4” $75^0$21’33.5”	4.23
7.	Near temple	HP	Govt	$22^0$18’34.2” $75^0$21’30.0”	2.76
8.	Rajan Sarpanch	Well	Pri	$22^0$17’35.0” $75^0$21’23.3”	0.45
9.	Near Banshi Lal house	HP	Govt	$22^0$17’41.7” $75^0$21’26.8”	5.98
10.	HP behind kanya ashram	HP	Govt	$22^0$17’33.3” $75^0$21’22.8”	3.56
11.	Near Bhairo/Dhoom Singh house	HP	Govt	$22^0$17’35.4” $75^0$21’14.0”	0.39
12.	Near Rai Singh House	HP	Govt	$22^0$17’43.2” $75^0$21’45.1”	6.59
13.	Near EGS, Jamunwala	HP	Govt	$22^0$17’45.5” $75^0$21’45.1”	0.85
	Rasalpur Bandhav				
14.	Near Kalu Ram house	HP	Govt	$22^0$18’23.2” $75^0$21’50.2”	1.54
	Matlabpura				
15.	Near Primary School	HP	Govt	$22^0$17’30.1” $75^0$21’45.6”	3.62
16.	Near Auganbadi kendra	HP	Govt	$22^0$17’33.0” $75^0$21’46.5”	0.20
17.	Matalabpura Pond	Pond			0.18
	Malpura				
18.	Santosh’s Tubewell	TW	Pri	$22^0$16’00.5”	4.29

				$75^0$21’58.0”	
19.	Santosh Well	Well	Pri	$22^0$16’00.9” $75^0$21’55.7”	0.39
20.	Near Chhotu house	HP	Govt	$22^0$16’00.2” $75^0$22’00.7”	0.67
21.	Near Narayan house	HP	Govt	$22^0$16’10.7” $75^0$22’05.4”	0.39
22.	Near Chagan house	HP	Govt	$22^0$16’07.0” $75^0$22’05.4”	0.34
	Abdulpura				
23.	Near School (very close to School)	HP	Govt	$22^0$17’24.8” $75^0$22’29.0”	2.49
24.	HP down side to School	HP	Govt	$22^0$17’28.1” $75^0$22’27.7”	0.42
25.	Budhiya’s well	Well	Pri	$22^0$17’32.9” $75^0$22’25.7”	0.22
26.	Near forest check post	HP	Govt	$22^0$17’08.5” $75^0$22’30.4”	0.64
	Kalapani				
27.	Near Galiya house	HP	Govt	$22^0$17’13.9” $75^0$21’05.7”	9.62
28.	Pond, kalapani	Pond			0.35
29.	Well, near pond kalapani	Well	Pri	$22^0$17’05.8” $75^0$20’58.7”	0.18
30.	HP, near pond	HP	Govt	$22^0$17’03.7” $75^0$20’56.7”	1.50
	Tarapur				
31.	Near Kanya Ashram	HP	Govt	$22^0$15’59.0” $75^0$22’40.8”	11.6
32.	Supply water	Surface +well	Panchayat		0.49
	Choti Chhitari				
33.	Near Primary School	HP	Govt	$22^0$16’11.1” $75^0$21’51.8”	0.66
34.	Near Temple	HP	Govt	$22^0$16’09.2” $75^0$21’47.6”	0.61
35.	Near Madhu Singh house	HP	Govt	$22^0$16’04.7” $75^0$21’45.8”	7.81
36.	Bharat’s well	Well	Pri	$22^0$16’00.2” $75^0$21’42.8”	0.50
	Kali Karai				
37.	Near School	HP	Govt	$22^0$15’19.3” $75^0$21’43.6”	6.86
38.	Parbat’s well	Well	Pri	$22^0$15’21.0” $75^0$21’43.1”	0.36
39.	Near Temple	HP	Govt	$22^0$15’20.1” $75^0$21’44.9”	6.51
40.	Near Gadpat house	HP	Govt	$22^0$15’20.8” $75^0$21’49.6”	6.86
41.	Near Hare Singh house	HP	Govt	$22^0$15’24.0”	11.5

				$75^0$21’51.1”	
42.	Village pond water	Pond			0.28
	Lalmatiya				
43.	Near Amar Singh house	HP	Govt	$22^0$16’15.4” $75^0$22’50.9”	0.46
44.	Near Bhagirathi house	HP	Govt	$22^0$16’15.6” $75^0$22’53.6”	0.47
45.	Near Santosh house	HP	Govt	$22^0$16’17.3” $75^0$22’54.3”	1.17
46.	Near Phool Singh house	HP	Govt	$22^0$16’19.8” $75^0$22’51.6”	1.19
	Kachhuwania				
47.	Near Middle School	HP	Govt	$22^0$18’03.8” $75^0$27’27.6”	2.66
	Ahmadpura				
48.	Near Primary School	HP	Govt	$22^0$18’11.0” $75^0$28’10.2”	3.25
49.	Near Chandar/Budhiya house	HP	Govt	$22^0$18’09.6” $75^0$28’04.8”	2.44
50.	Near Kailash Sarpanch house	HP	Govt	$22^0$18’09.5” $75^0$28’03.0”	3.56
51.	Near Ratan house	HP	Govt	$22^0$18’10.8” $75^0$28’08.5”	3.28
	Talabpura (Bagwania)				
52.	Near Primary School	HP	Govt	$22^0$16’10.2” $75^0$25’11.9”	1.59
53.	Near Mohan house	HP	Govt	$22^0$16’14.1” $75^0$25’14.3”	0.43
54.	Well of Govind/Champalal	Well	Pri		0.71
55.	Near Mangilal house	HP	Govt	$22^0$16’13.6” $75^0$25’10.3”	0.38
	Nirgudia				
56.	Near School	HP	Govt	$22^0$16’10.2” $75^0$24’33.4”	8.78
57.	Near Tannu house	HP	Govt	$22^0$16’05.2” $75^0$24’40.6”	4.02
	Suradi				
58.	Near Primary School	HP	Govt	$22^0$17’59.0” $75^0$19’51.7”	6.07
59.	Supply water				1.68
	Nelda				
60.	Near Galsingh/old Pri. school	HP	Govt	$22^0$18’35.6” $75^0$19’28.4”	1.61
61.	Near Kailash house	HP	Govt	$22^0$18’38.1” $75^0$19’25.2”	0.45
62.	Near Primary school	HP	Govt	$22^0$18’33.3” $75^0$19’29.1”	2.81
63.	Near Sakha Ram house	HP	Govt	$22^0$18’29.3” $75^0$19’26.5”	0.40

	Katar				
64.	Near School	HP	Govt	$22^0$17’08.8” $75^0$22’29.6”	6.54
65.	Near Madan house	HP	Govt	$22^0$14’57.2” $75^0$23’57.8”	0.45
66.	Bore well uses for animals			$22^0$15’02.8” $75^0$23’17.0”	8.58
	Lohagarpura				
67.	Near Maya Ram house	HP	Govt	$22^0$14’53.7” $75^0$23’57.8”	0.64
68.	Near Ratan house	HP	Govt	$22^0$14’44.7” $75^0$23’53.2”	11.5
	Karoundia-Schoolpura				
69.	In front of Auganbadi	HP	Govt	$22^0$15’50.1” $75^0$17’59.2”	6.81
70.	Behind primary school	HP	Govt	$22^0$15’50.4” $75^0$17’59.9”	9.31
71.	Near Kantilal shop	HP	Govt	$22^0$15’51.2” $75^0$18’02.0”	5.70
72.	Dariya’s well, near to pond, side to the road	Well	Pri	$22^0$15’47.2” $75^0$17’56.2”	0.30
73.	Pond water, karoundia	Pond			0.18
	Karoundia-Patelpura				
74.	Near Bhaku house	HP	Govt	$22^0$15’52.0” $75^0$17’56.3”	8.36
75.	HP behind temple	HP	Govt	$22^0$15’53.7” $75^0$17’54.7”	1.66
76.	Near Sardar house	HP	Govt	$22^0$15’56.3” $75^0$17’56.0”	1.02
	Karoundia-Nayapura				
77.	Near Ishwar house	HP	Govt	$22^0$15’41.6” $75^0$17’49.0”	2.46
78.	Near Temple	HP	Govt	$22^0$15’45.3” $75^0$17’50.2”	8.14
	Karoundia-Dodwapura				
79.	Near Galsingh house	HP	Govt	$22^0$15’18.8” $75^0$18’17.3”	3.41
80.	Near School	HP	Govt	$22^0$15’22.9” $75^0$18’20.8”	3.37
	Bholiyapura				
81.	Near Pyar Singh house	HP	Govt	$22^0$18’54.4” $75^0$19’56.8”	0.26
82.	Near Nand Ram house	HP	Govt	$22^0$17’54.6” $75^0$18’49.8”	6.32
83.	HP out side of boundary to middle school	HP	Govt	$22^0$17’59.6” $75^0$18’47.4”	0.32
84.	HP middle school	HP	Govt	$22^0$17’59.8” $75^0$18’43.4”	7.97

85.	Punja's well	Well	Pri	$22^0$17'50.3" $75^0$18'38.3"	0.32
	Patelpura				
86.	Well of Lal Singh	HP	Govt	$22^0$18'01.5" $75^0$17'55.5"	0.53
87.	Bore well Sumer Singh Teacher				4.33
	Kalalpura				
88.	Near Sohan Jaiswal house	HP	Govt	$22^0$17'39.4" $75^0$17'45.9"	2.93
89.	Near School	HP	Govt	$22^0$17'39.5" $75^0$17'47.5"	4.16
	Badpipli				
90.	HP near Khajoor tree	HP	Govt	$22^0$32'30.4" $75^0$18'14.5"	0.54
91.	Kaluram's well	Well	Pri	$22^0$32'32.3" $75^0$18'10.2"	0.51
92.	Near Shyamabai house	HP	Govt	$22^0$32'34.7" $75^0$18'08.4"	1.16
93.	Near Munna house	HP	Govt	$22^0$32'33.7" $75^0$18'05.9"	2.37
94.	Well of Chunni Lal	Well	Pri	$22^0$32'27.3" $75^0$18'07.6"	0.47
95.	Near Prakash house	HP	Govt	$22^0$32'35.6" $75^0$18'00.9"	3.84
96.	Near Vijay house	HP	Govt	$22^0$32'35.4" $75^0$18'10.8"	2.48
	Sitapat				
97.	Near Munna house, Kakad	HP	Govt	$22^0$32'46.8" $75^0$18'43.0"	6.37
98.	Near school	HP	Govt	$22^0$32'35.6" $75^0$18'30.0"	5.58
99.	Near old School	HP	Govt	$22^0$32'30.2" $75^0$18'28.5"	0.45
100	Near Banyan tree	HP	Govt	$22^0$32'24.9" $75^0$18'35.2"	2.21
101	Surajpura ka talab	Pond			0.27
102	Near Munna Lal house	HP	Govt	$22^0$32'14.2" $75^0$18'19.8"	1.64
103	Well of Kanha, Paldiya	Well	Pri	$22^0$32'43.7" $75^0$19'04.2"	0.40
	Surajpura				
104	Near Girdhari house	HP	Govt	$22^0$31'35.9" $75^0$18'31.2"	6.77
105	Near Nala (small bridge)	HP	Govt	$22^0$31'43.3" $75^0$18'25.7"	1.60
	Bhutia				
106	Govt. well Bhutia	Well	Govt		0.37
107	Well of Moolchand	Well	Pri		0.45
	Ganga Nagar				

108	Kanya Ashram, Ganganagar	HP			2.64
109	Kanya Ashram, Ganganagar	Well			0.21

Table 4: 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. The table given annexure 2 lists those drinking water sources which need to be stop immediately due to high levels of fluoride concentration.

4.0 Action plan for fluorosis mitigation

4.1 Village wise suggested measures

4.1.1 Annupur

Fluoride monitoring was done for 2 H.P and 2 well sources of Annupur village, of which the 2 H.P drinking water sources were found unsafe. These sources can be used for domestic purposes like washing, bathing, cleaning etc. other than drinking. The remaining two well sources were completely safe; these can be used for drinking purpose once their sanitary condition is improved. Awareness campaigns on ill- effects of high levels of fluoride should be encouraged. A community AA kit should be attached with the school hand pump. For long term benefits; dilution (fluoride contaminated water is diluted with surface water to lower its levels of fluoride) and supply from near by surface water should be promoted.

4.1.2 Bahadara

Nine drinking water sources of Bahadara village were monitored, of which 3 sources were found safe. Among the safe sources the sanitary condition of the well of Rayan Sarpanch should be improved. The hand pump installed near Bhairo house should be promoted to be used for drinking. The hand pump near school and one near the temple should be attached with an AA (Activated alumina) kit. For long term planning, arrangements for supply of surface water from Matlabpura pond to both Matlabpura and Bahadara village should be undertaken. The drinking water needs of 2-3 villages can be supplemented from Matlabpura

pond. Awareness should be created on the mitigation and harmful effects of fluoride in the village.

4.1.3 Matlabpura

The village school is at a distance of 25 – 30 meters from Anganbadi which is not very far; hence the hand pump near Anganbadi can be used for drinking by the school children. The hand pump near school should be put in use for domestic purposes eg. Washing, bathing, cleaning etc other than drinking. Awareness should be created among the school children of the health effects due to consumption of fluoride contaminated water, the children should be warned of not drinking the hand pump water near to their school. There is an urgent need to put a complete ban on use of hand pump water installed near the school. Arrangements to supply water to the village from Matlabpura pond should be considered seriously as a permanent solution.

4.1.4 Abdulpura

The hand pump near the school is unsafe and hence should not be used for drinking. The hand pump installed a little away and downward from the school can be used for drinking by the school children. There is only a need of creating awareness in the village on the effects and mitigation options for fluoride.

4.1.5 Kali Karai

All the hand pump sources of the village should be immediately stopped, since all of these sources have alarmingly high levels of fluoride. Immediate action should be taken to get the mountain well sanitary protected, a motor should be installed near to it, thereafter 2 – 3 high capacity tanks should be constructed in the village so that the well water can be pumped and stored in these tanks and thus can be used by the village folk for drinking purpose. As a long term option water should be supplied to the village from the sump well which should be created near the village pond.

4.1.6 Ahmadpura

As a temporary option, the hand pump near school should be attached with a AA kit, which then can be used by the school children as well as by the villagers for drinking since the water of all the four hand pumps installed in the village are not fit/safe for drinking. If the neighboring villages have a facility of supply of surface water in their village, then a pipeline from a nearby village should also be laid to this village, which then can be used for drinking purpose.

4.1.7 Nirgudia- Surandi

Both the hand pumps of the school should be stopped for further use. The pipeline of Surandi should be laid till Nirgudia so that pipeline water can be supplied to the village. If the

pipeline water is found to have a fluoride concentration of 1.68 mg/L, arrangements for other suitable treatment options for fluoride should be initiated.

4.1.8 Nelda

The school hand pump should be attached with a AA kit. For long term solution, dilution (fluoride contaminated water is diluted with surface water to lower its levels of fluoride) or rain roof harvesting (collection of roof water) in the school should be initiated.

4.1.9 Katar

The hand pump and tube well near school should be immediately stopped for further use. As an alternative the hand pump near Madan house can be used for drinking purpose. A well should be dug near the school or arrangements to supply surface water from the nearby pond should be undertaken.

4.1.10 Karoundhia

There is a need of safe supply water in Schoolpura, Nayapura and Dodwapura villages of Karoundhia GP, which can be fulfilled by constructing a sump well near the big pond situated midway of these three villages. For immediate relief, the Schoolpura village people should use the stream well water flowing near the pond for drinking purpose. People of Patelpura village should use the hand pump water situated near the temple and also the hand pump near Sardar house for drinking purpose. In Nayapura, the villagers should use the hand pump near Ishwar house and a AA kit should be attached with the school hand pump in Dodwapura.

4.1.11 Kalalpura

The school hand pump should be immediately attached with AA kit; thereafter a new well should be dug near the school.

4.1.12 Badpipli

Among the seven sources monitored, only four sources have been found safe for drinking, of which two are well water sources for which immediate action should be taken to get them sanitary protected. There is a need of awareness generation in the village.

4.1.13 Sitapat

The school hand pump should be stopped and the hand pump situated near the old school which is not very far should be put in use for drinking by the school children. In Paldiya, arrangements should be done to supply water from Kanha’s well or from the pond of Surajpura .

Above mentioned suggestions on various mitigation measures of fluoride and the implementation of the other alternative methods are a result of a well planned scientific study and survey done in these thirteeen villages. Interactive village meetings should be conducted before working on any plan of implementation in a particular village. After a close field study, awareness should be created among the villagers on the harmful health effects due to fluoride and also on the various treatment options available. Keeping in view of the economic conditions of a village, practical and suitable alternative/mitigation plan should be worked out.

4.2 Action Plan for 2009 – 2010

4.2.1 Awareness programme

(i) Preparation and development of awareness materials such as posters, pamphlets, slogans and scripts for street plays and puppet shows.

(ii) Execution of awareness programs for all the targeted villages.

- Poster pasting
- Wall writing
- Puppet shows
- Meeting in schools, gram sabha's, SHG's and general public meeting.
- Mobilization of PRI members including sarpanchs.

4.2.2 Immediate response

(a) Installation of H.P attached activated alumina kits

According to the village wise action plans mentioned above, activated alumina kits should be attached with the fluoride effected hand pumps of schools and villages.

(b) Establishment of the resource center with activated alumina recharge facility

A resource center should be established midway to the field areas so that it is easily accessible. The center should be equipped with resource persons having sound knowledge on implementation, awareness generation and monitoring related activities, apart from this it should also have a facility to recharge activated alumina which is required to be done at a regular interval. For establishment of a resource center, Tarapur Kanya Ashram has been found as the most suitable location. The primary responsibility of recharging of activated alumina kits and their maintenance should be borne by Vasudha Vikas Sansthan till the arrangements for a safe and sustainable alternative drinking water source for the village is not planned.

(c) Promotion for use of safe drinking water sources

Fluoride concentration in drinking water sources of 13 villages (source wise) have been listed in Table 3. The sources having fluoride concentration less than 1.5 mg/L should be promoted for use for drinking. All the monitored wells of this area have been found to be safe in view of the BIS limit prescribed for fluoride, therefore the village people should be encouraged to use these sources for drinking purpose.

(d) Renovation and sanitary protection of wells

Since the time the hand pumps took over as a private/public drinking water source, the wells have been completely wiped out from the village mainframe. Today the wells of this area as well as those of Indian villages are in miserable state; these are either used only for irrigation or as garbage dumps. But there are still some well water sources in this area that have been found to be fit/safe for drinking. It is clear from the monitoring results obtained that the wells of this region do not have fluoride concentration more than the BIS prescribed limit of 1.5 mg/L. The details of the wells that need to be sanitary protected and renovated have been given in the village wise action plan as discussed earlier. These wells should be protected and chlorinated at a regular interval and hence can be put to use for drinking. This will prove to be a safe and practical permanent solution.

Well need sanitary protection

4.2.3 Long term strategy

In the village wise action plan discussed, permanent solutions to the problem of fluoride and the use of alternative methods have been suggested. There is availability of surface water in the form of ponds in almost every village or in between 2 – 3 villages, proper planning should be devised to channel water from these sources or wells should be dug up near to these to supply water to the villages. For successful implementation of these plans, Vasudha Vikas Sansthan should initiate the PHED department officials and in turn the Gram Pradhans to take immediate course of action needed.

Big ponds as alternatives

4.2.4 Management and monitoring of the programme

Vasudha Vikas Sansthan should take the overall responsibility to successfully implement, manage and monitor the program in the region for a period of three years. Awareness should be created among the community on the health effects due to high levels of fluoride in water and work on human resource development activities should be focused so that within a period of 2 years the community is trained to manage the programmes at their own level.

Defunct Defluoridation kit attached by PHED, at Sitapat village

Close view of Defluoridation kit

Government interventions/initiatives in such programmes are limited only to devising of baseline structure for implementation but nothing is done for their sustainability. As per our experience, 55 Hand pump attached fluoride removal plants installed way back by the PHED department are no more in working position, the photograph of two can be seen in pictures. The Government had also initiated projects for supply of surface water to the villages but due to lack of proper management, these too are in poor state, a photograph of one such poorly managed Brahmanpuri drinking water project has been shown in picture. Keeping all these factors in mind, the programme should be run by Vasudha Vikas Sansthan for complete two years, within which the community should be trained so that by the third year the programme is managed by the community itself but during this period the responsibility of carrying out programme monitoring should be undertaken by Vasudha Vikas Sansthan.

Poorly managed water supply scheme Brahmanpuri

4.3 Action Plan for 2010 – 2011

- The projects on supply of safe water which had been planned last year in liaison with the Government departments should be executed.

- A follow up monitoring exercise should be conducted for the existing programmes in phase initiated last year.
- Entire Dhar district is fluoride affected, this has been proved from the data obtained from PHED department, and hence a dental survey should be conducted in 100 village schools of Dhar. Thereafter 50 most fluoride effected villages should be selected and hence a fluoride monitoring (source wise) exercise should be initiated so that village wise action plan can be worked out.
- The devised fluorosis mitigation plans should be implemented on the strategy adopted in 2009 – 2010 and also on the experiences obtained while executing these plans last year.

5.0 Estimated budget for implementation of proposed action plan

Estimated budget for 2009-10

S.No.	Particulars	Sub-total	Total
1	**Implementations Materials:**		
	i) Renovations and sanitary protections of the wells, Rs 40000/ well X 8 wells	3,20,000.00	
	ii) 3 water storage tanks, pump with pipes at village Kali kirai,	1,00,000.00	
	iii) Rainwater harvesting structures for HP water dilution, Rs 60000/structure X 3 nos.(School of Nelda, Ahamadpura and Bahadara)	1,80,000.00	
	iv) HP attached AA kits, Rs 60000/Nos X 8 nos	4,80,000.00	10,80,000.00
2	**Resource centre:**		
	i) Formation of Activated Alumina recharge facility with platform and disposal facility	75,000.00	
	ii) Fluoride ion analyzer with accessories	1,50,000.00	
	iii) Stock of bleaching powder/hypo chlorite	15,000.00	
	iv) Infrastructures and resource materials	50,000.00	
	v) Rent of resource centre	24,000.00	3,14,000.00
3	**Awareness:**		
	i) Printing of posters and pamphlets	1,00,000.00	
	ii) Materials for street plays, Poppet shows and wall writing	50,000.00	1,50,000.00
4	**Travel:**		
	i) Travels for awareness programs, Rs 1500/d X 60d		
	ii) Travel for implementation, monitoring and management of the program, Rs 6000/m X 12m	90,000.00	
	iii) Travel for resource persons, Rs 30,000/trip X 3 trips (including to and fro, and field visit)	72,000.00	
		90,000.00	2,52,000.00
5	**Lodging & boarding:**		
	i) for resource persons, Rs 25000/trip X 3 trips	75,000.00	

	ii) for implementations of the program including awareness team, Rs 8000/m X 12m	96,000.00	1,71,000.00
6	**Honorarium:** i) 1 Project coordinator, Rs 15000/m X 12m ii) 4 project staffs,Rs 8000/p/m X 12m X 4p iii) Resource persons for campaigning iv) Resource persons for planning, technology, implementations, program review etc	 1,80,000.00 3,84,000.00 50,000.00 1,00,000.00	 7,14,000.00
7	Admin., contingencies and overheads (10% of the items 1 to 6)	2,36,700.00	2,36,700.00
8	**Total**	**26,03,700.00**	**26,03,700.00**

Estimated budget for 20010-11

S.No.	Particulars	Sub-total	Total
1	**Resource centre:** i) Chemicals and other requirements for AA recharging ii) Chemicals and standard for fluoride monitoring iii) Stock of bleaching powder/hypo chlorite iv) Infrastructures and resource up gradations v) Rent of resource centre	 50,000.00 70,000.00 20,000.00 40,000.00 30,000.00	 2,10,000.00
2	**Awareness materials:** i) Posters, pamphlets, street plays, Poppet shows and wall writing etc	 1,25,000.00	 1,25,000.00
3	**Implementations Materials:** As per requirements, but according to 2009-10 budget can be estimated about Rs. 15 lakhs for the demonstration and existing infrastructures management cost	 15,00,000.00	 15,00,000.00
4	**Travel:** i) Travels for programs follow-up, managements and monitoring, Rs 8000/m X 12 ii) Travel for dental surveys in schools, water quality monitoring and preparation of mitigation plans, Rs 25000/m X 4m iii) Travel for resource persons, Rs 20,000/trip X 3 trips. iv) Travel for awareness campaign and mitigation plans executions, Rs 15000/m X 4m	 96,000.00 1,00,000.00 60,000.00 60,000.00	 3,16,000.00
5	**Lodging & boarding:** i) for resource persons, Rs 30,000/trip X 3 trips ii) for implementations of the program including awareness team, Rs 12000/m X 12m	 90,000.00 1,44,000.00	 2,34,000.00
6	**Honorarium:** i) 1 Project coordinator, Rs 18000/m X 12m	 2,16,000.00	

	ii) 4 project staff, Rs 10000/p/m X 12m X 4p iii) Resource persons for campaigning iv) Resource persons for dental surveys, WQ monitoring, planning, technology, implementations, program review etc	4,80,000.00 60,000.00 2,00,000.00	9,56,000.00
7	Admin., contingencies and overheads (10% of the items 1 to 6)	3,34,100.00	3,34,100.00
8	**Total**	**36,75,100.00**	**36,75,100.00**

6.0 Conclusions

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.

Keeping these points in mind, there is a need for a detailed scientific study on Fluorosis since there are other regions, which too share the same fluoride concentration viz. Sonebhadra

(UP), Naupada (Orissa), Warangal (A.P), Mandla (MP) and Unnao (UP) and have many people suffering from skeletal Fluorosis. 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 near by 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. Thereafter planning to supply near by 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.

This report contains an action plan for Fluorosis mitigation for each monitored village which enlists the short term (interim measure) as well as the long term strategy. These can be incorporated in the village model and thereafter implemented.

Annexure 1: Fluoride Concentrations in Different Sources of Water

S.No.	Range of fluoride (mg/L)	Number of drinking water sources				Total	
		HP	Well	Tube well	Pond	Number	%
1	***Anuppur***						
	<1.0		2			2	
	1.1-2.5						
	2.6-5.0	2				2	
	>5.0						
2	***Bahadara***						
	<1.0	2	1			3	
	1.1-2.5	1				1	
	2.6-5.0	3				3	
	>5.0	2				2	
3	***Rasalpur Bandhav***						
	<1.0						
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0						
4	***Matalabpura***						
	<1.0	1			1	2	
	1.1-2.5						
	2.6-5.0	1				1	
	>5.0						
5	***Malpura***						
	<1.0	3	1			4	
	1.1-2.5						
	2.6-5.0						
	>5.0			1		1	
6	***Abdulpura***						
	<1.0	2	1			3	
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0						
7	***Kalapani***						
	<1.0		1		1	2	
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0	1				1	
8	**Tarapur**						
	<1.0				1	1	
	1.1-2.5						
	2.6-5.0						
	>5.0	1				1	
9	**Chhitari**						
	<1.0	2	1			3	
	1.1-2.5						
	2.6-5.0						

	>5.0	1				1	
10	**Kali Kirai**						
	<1.0		1		1	2	
	1.1-2.5						
	2.6-5.0						
	>5.0	4				4	
11	**Lalmatiya**						
	<1.0	2				2	
	1.1-2.5	2				2	
	2.6-5.0						
	>5.0						
12	**Kachhuwania**						
	<1.0						
	1.1-2.5						
	2.6-5.0	1				1	
	>5.0						
13	**Ahamadpura**						
	<1.0						
	1.1-2.5	1				1	
	2.6-5.0	3				3	
	>5.0						
14	**Talabpura**						
	<1.0	2	1			3	
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0						
15	**Nirgudia**						
	<1.0						
	1.1-2.5						
	2.6-5.0	1				1	
	>5.0	1				1	
16	**Surandi**						
	<1.0						
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0	1				1	
17	**Nelda**						
	<1.0	2				2	
	1.1-2.5	2					
	2.6-5.0					2	
	>5.0						
18	**Katar**						
	<1.0	1				1	
	1.1-2.5						
	2.6-5.0						
	>5.0	1		1		2	
19	**Lohgarpura**						
	<1.0	1				1	
	1.1-2.5						

	2.6-5.0						
	>5.0	1				1	
20	**Karoundia-Schoolpura**						
	<1.0		1		1	2	
	1.1-2.5						
	2.6-5.0						
	>5.0	3				3	
21	**Karoundia-Patelpura**						
	<1.0	1				1	
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0	1				1	
22	**Karoundia-Nayapura**						
	<1.0						
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0	1				1	
23	**Karoundia-Dodwapura**						
	<1.0						
	1.1-2.5						
	2.6-5.0	2				2	
	>5.0						
24	**Bholiapura**						
	<1.0	2	1			3	
	1.1-2.5						
	2.6-5.0						
	>5.0	2				2	
25	**Patelpura**						
	<1.0	1				1	
	1.1-2.5						
	2.6-5.0			1		1	
	>5.0						
26	**Kalalpura**						
	<1.0						
	1.1-2.5						
	2.6-5.0	2				2	
	>5.0						
27	**Badpipli**						
	<1.0	1	2			3	
	1.1-2.5	3				3	
	2.6-5.0	1				1	
	>5.0						
28	**Sitapat**						
	<1.0	1	1		1	3	
	1.1-2.5	2				2	

	2.6-5.0						
	>5.0	2				2	
29	**Surajpura**						
	<1.0						
	1.1-2.5	1				1	
	2.6-5.0						
	>5.0	1				1	
30	**Bhutia**						
	<1.0		2			2	
	1.1-2.5						
	2.6-5.0						
	>5.0						
31	**Ganga Nagar-Ashram**						
	<1.0		1			1	
	1.1-2.5						
	2.6-5.0	1				1	
	>5.0						
	Total						
	<1.0	**24**	**17**	**-**	**6**		
	1.1-2.5	**19**	**-**	**-**	**-**		
	2.6-5.0	**17**	**-**	**1**	**-**		
	>5.0	**23**	**-**	**2**	**-**		

HP – *Hand pump*

Annexure 2: List of higher fluoride concentration sources

S.N	Village	Type of source	Fluoride concentration (mg/L)
1.	Bahadara	H.P(Banshi Lal)	5.98
		H.P (Rai Singh)	6.59
2.	Kalapani	H.P (Near Galia House)	9.62
3.	Tarapur	H.P (Kanya Ashram)	11.6
4.	Choti Chittari	H.P (Madhu Singh House)	7.81
5.	Kali Kirai	H.P (Near Temple)	6.51
		H.P (Gadapat House)	6.86
		H.P (Hare Singh House)	11.5
6.	Katar	Borewell	8.58
7.	Lohgarpura	H.P (Near Ratan House)	11.5
8.	Karoundhia - schoolpura	H.P (In front of Anganbadi)	6.81
		H.P (Near Kanti Lal shop)	5.70
9.	Karoundhia - patelpura	H.P (Near Bhaku House)	8.36
10.	Karoundhia - Nayapura	H.P (Near Temple)	8.14
11.	Bholiapura	H.P (Near Nandram House)	6.32
12.	Sita pat	H.P (Near Munna House Kakad)	6.37
13.	Surajpura	H.P (Near Girdhari House)	6.77

Annexure 3: Action needed for fluorosis mitigation of the villages

SN.	Village	Muhalla/Phaliya	Action
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