

## The Problem of Fluorosis in Nuapada District

*(Summary of the Survey Report of Sahabhagi Vikash Abhiyan, 2006-07)*

During the year 1997-98 one Mr. Prafulla Behela, a school teacher by profession from the village Karlakote of Boden block in Nuapada district developed severe pain in his joints and muscles for which he consulted several doctors in Nuapada district as well as specialists in the adjoining districts. However, when he failed to get any cure even after one year of medication he had to go to Seven Hills Hospital in Visakhapatnam (Andhra Pradesh) for the treatment. After a thorough check up the Doctors in Seven Hills Hospital could make the correct diagnosis as Mr. Behera was already severely affected by a dreadful disease called **fluorosis**. Until then, in Nuapada district nobody had heard about prevalence of such a disease in this region. After the return of Prafulla Behera many other people from this village could relate to some of their problems as fluorosis and the news of fluorosis was covered by many local and state level newspapers. Following this, the Rural Water And Sanitation Department (RWSS) also made a test of few drinking water sources and advised the villagers not to use them since water from those sources were having excess quantities of fluoride. In Karlakote and some other places RWSS also attempted to provide drinking water by tankers but the supply was found to be erratic and inadequate.

Later on while visiting the villages in Nuapada district SVA workers came across symptoms of fluorosis in many more villages and in the year 2003-04 SVA conducted a survey in Boden and Sinapali blocks to identify people having symptoms of dental and skeletal fluorosis. During this period, SVA also trained some of its workers in water testing and with the support of Peoples' Science Institute, Dehradun and a survey was conducted in 23 villages of Boden and Sinapali blocks. During this survey, SVA felt that the problem of fluorosis in Nuapada district is much wide spread and more serious than the public in general is aware of it. Hence, during the year 2006 SVA conducted a detail

survey of almost all the drinking water sources of Nuapada district to ascertain presence of higher level of fluoride.

**From this survey, it has been found that out of the 4920 drinking water tube wells from which water quality was tested 907 sources have presence of fluoride above the 1 PPM which is dangerous for human health. Those 907 tube wells and wells have been spreaded over 214 villages in all the five blocks of Nuapada district. As per a calculation it is estimated that 22557 persons from those 214 villages had been consuming the water from those sources for a long period and they are all in danger of getting the fluorosis in the coming years. During the survey many of those people have also expressed clear symptoms of fluosis.**

#### **Heading for a Crisis:**

The survey finding clearly indicates that thousands of people in Nuapada have been already confronting with fluorosis and unless urgent measures are taken up it will become a crisis for Government and others to handle the situation.

#### **Reports from the Health Checkup Camps:**

As a test check up camps SVA conducted 12 health check up camps in all the five blocks and in some of the camps also Government doctors had joined. In those health check up camps 81 persons having skeletal problems were referred for X-ray and later on the X-ray plates were sent for check up by specialists in Bhubaneswar. Dr. Umesh Chandra Mohapatra a famous consultant Radiologist examined those X-ray plates and confirmed that 33 of them were affected by fluorosis.

Since fluorosis is not a curable disease the only option for development workers and Government is to take steps to prevent it. In case of Nuapada district the

causes of fluorosis is primarily due to unsafe drinking water and hence efforts need to be initiated to provide safer drinking water to the villagers. In the villages where the tube well water is found to be having excess fluoride SVA also has tested the water from open well, ponds and nearby streams to find out alternative sources where the level of fluoride is less. Simultaneously, SVA has informed the villagers about the problem and has suggested them to use alternative sources for drinking water.

**Request to Government:**

SVA would like to make the following request to Government so as to prevent fluorosis in Nuapada district.

- 1) Government should initiate further testing of all the water sources on emergency basis using experts to reconfirm the presence of high level of fluoride.
- 2) All the tube wells having excess fluoride must be sealed immediately.
- 3) Government need to take steps to provide alternative sources of drinking water which is free from excess fluoride.
- 4) Government may organize health check up camps and provide rehabilitation support to all the people who have been partially or fully crippled or disabled because of fluorosis.

## **A Brief Report of the Survey conducted by Sahabhagi Vikash Abhiyan to ascertain Fluoride Contamination of Drinking water sources in Nuapada district**

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### **Background:**

Nuapada district has a population of 530690 (2001 census) of which percentage of S.T. and S.C. are 34.65 and 13.56 respectively. The district has five blocks and 663 revenue villages though the number of inhabited villages is 648. The economy of the district is primarily agricultural though Non Timber Forest produces also is an important source of livelihood for many people. Even though the annual average rainfall of the district is above 1000 mm, since the rainfall is erratic and the agriculture is mostly rainfed Agricultural drought is a regular feature in Nuapada district. Because of failure of crops, deforestation and several other factors a large number of people in Nuapada district have been living below the poverty line.

In spite of periodic drought and low level of productivity the total production of cereals, pulses, oilseeds etc. are enough to meet the local requirement. But unfortunately because of poverty the poor farmers cannot retain their own produces in adequate amount for their own consumption. Thus malnutrition and under nutrition have been part of their life for a large section of the population.

### **Problem of drinking water:**

Traditionally the people in Nuapada district had been using the water from open wells, tanks, riverbeds and hilly streams. Water borne diseases were very common in all the villages till very recent time. With the spread of deep tube wells, in many villages water related diseases have been very much under control. However, to the misfortune of the people in many villages even the tube well waters have been found to be contaminated with several minerals which are harmful to human health. Among such minerals iron contamination is very

common. But presence of high quantities of fluoride in some tube well water has posed a very serious problem in this district.

During the year 1997-98 the first case of fluorosis in the district was identified in village Karlakot. Later on in many adjoining villages symptoms of fluorosis were detected by the field staff of SVA. Hence during 2003 SVA conducted a rapid survey in 23 villages of Boden and Sinapali block to understand the gravity of the situation. This survey led SVA to go for the testing of all the drinking water tube wells in Nuapada district and to raise public awareness on fluorosis so as to prevent the dreadful disease – fluorosis.

With the above objective SVA could mobilize a one time grant from Action Aid India to set up a water testing laboratory at Bilenjore and to meet the cost of the technical workers and volunteers to carry out the survey.

### **The Process of the Survey:**

First of all the senior technical trainers of People's Science Institute (PSI), Dehradun, trained the field investigators and the laboratory technician of SVA. The training was held during 20<sup>th</sup> to 25<sup>th</sup> January 2006 and the field staffs acquired adequate technical knowledge and skill to carry out the water testing activities.



Practical Training imparted to SVA field workers by the Trainers from People's Science Institute (P.S.I)

The field investigators revisited all the villages earlier covered under the 2003 survey and the villages where the chemical testing was done. Simultaneously new villages were added to the programme and eventually all the 648 villages of 5 Blocks of Nuapada district were covered. The investigators took water samples from all the drinking water sources and tested the samples at the Bilenjore central laboratory.

The water quality was classified into 6 categories depending upon its fluoride concentration. The categories are as follows:

Table 1

<i>Category</i>	<i>Quantity (mg/litre)</i>	<i>Remarks</i>
1	< 1	Acceptable
2	1-1.5	Minor risk
3	1.5-3	Risky
4	3-5	Risky
5	5-6.5	Highly risky
6	> 6.5	Very dangerous

A total number of 4702 tube wells and 218 open wells were covered under the survey in all the 5 blocks of Nuapada district. The following table gives the block-wise distribution of wells.

Table 2

Sr. No	Name of the Block	No. of tubewells / wells covered	Volume of fluoride found					Block Total
			535					
			1-1.5	1.5-3	3-5	5-6.5	>6.5	
1	Nuapada	1700	25	33	9	1	-	68
2	Komna	1241	200	190	47	5	3	445
3	Boden	794	102	128	40	5	-	275
4	Khariar	525	27	17	7	2	2	55
5	Sinapali	660	18	31	11	4	0	64
<b>District Total</b>		<b>4920</b>	<b>372</b>	<b>399</b>	<b>114</b>	<b>17</b>	<b>5</b>	<b>907</b>

The above table shows that out of the 4920 wells and tube wells that were tested for the amount of fluoride contamination, 907 wells (both tube wells / open wells) were found to be having more than the permissible limit. The wells that contained higher quantity of fluoride were declared as very dangerous and it was resolved that the people will not drink water from these wells.

### **Community Education & Mobilisation:**

As soon as the survey findings started coming in, SVA started organizing meetings at village as well as at G.P level to explain the public about the acuteness of the problem relating to fluoride and the possibility for alternative source of drinking water. Meanwhile SVA prepared a booklet and several leaflets & posters (IEC materials) regarding fluorosis and its prevention.

SVA is also working closely with local youth clubs and Panchayati Raj institutions so that awareness generation on fluorosis could be more effective

### **Discussions in the Pallisabha and Gramsabha:**

The issue of fluorosis was discussed in the meetings of the Pallisabha and Gramsabhas and resolutions were passed in several Gram Panchayats to undertake construction of drinking water ponds to harvest rain water. In this regard SVA has helped preparation of plan and estimates in around 34 villages of Nuapada district.



(A Palli Sabha meeting)

SVA volunteers have also taken up the issue with the representatives of PRIs and also with the Nuapada Collector. The collector has shown keen interest to arrange funds for fluorosis mitigation and prevention activities in all the villages of Nuapada district based on the recommendations of SVA's survey report.

### **Formation of Village Water Monitoring Committees:**

Water monitoring committees were formed in the affected villages. These committees were formed on the basis of population dependent upon each water source thereby meaning that in a village there can be multiple water monitoring committees. Each committee consists of at least 5 members, 3 women and 2 men. The responsibility of the committee was to motivate people not to use water from the contaminated wells and also to find out alternative sources. The following table shows the number of villages where such committees have been formed.

Table 3

<b>Name of the Blocks</b>	<b>No. of GPs</b>	<b>No. of affected Villages</b>	<b>No. of Villages where water committees have been formed</b>
Nuapada	29	24	8
Komna	27	93	10
Boden	14	53	21
Khariar	18	24	1
Sinapali	21	20	4
<b>Total</b>	<b>109</b>	<b>214</b>	<b>44</b>

The reason for not being able to form committees in all the affected villages was shortage of staff members and the engagement of existing staff in the survey.

### **Workshop and Campaign:**

After completing the water testing using the Orion Ion Meter in all the villages SVA initiated a concerted campaign at the block and district level. In the beginning workshops were conducted at the block headquarters. The Block Development Officer, the Block Chairman, the Sarpanches, other PRI members, NGOs, CBOs, water monitoring committee members, and several political leaders

participated in the workshops. SVA staff representatives presented their findings to the participants and explained the existing crisis and the vulnerability of the people to fluorosis. Possibility of alternative water sources, government's financial support, construction of WHS through NREGA were also discussed. A district level workshop was held in Bilenjore. The RWS&S officials, the social welfare department officials, NGO, elected representatives, villagers etc participated in the workshop. Apart from other discussions it was resolved to access funds from existing Government projects like NREG and IWDP etc.



(Project coordinator sharing the findings with the people in a block level meeting)

### **Exposure Visit:**

7 staff members of SVA went for an exposure visit to Nalgonda in Andhra Pradesh. Nalgonda has been highly affected by fluorosis and has been drawing maximum media attention. Many new methods to counter fluorosis are experimented in Nalgonda as well. The purpose of the visit was to see the intensity of the problem, the different techniques adopted by the communities and the coping mechanisms adopted by the victims.

The staff members interacted with members of an NGO named 'Fluorosis Vimukti Porata Samithi', at Marriguda which is working exclusively on fluorosis. They showed how they have made all the villagers aware about the problems of fluorosis. They have also developed a small water testing chemical kit and have supplied to each of the household to regularly monitor the level of fluorosis. They have also developed various techniques to isolate fluoride from drinking water. The SVA team's visit was facilitated by Action Aid.

### Health Camps:

A total of 12 health camps were organized in all the 5 blocks at cluster levels. Health problems related to fluorosis was discussed in the health camps. The villagers attended the camps and got themselves examined. Unfortunately, only in one health camp, a government doctor participated and examined the patients. In rest 11 camps the government doctors did not join citing one excuse or the other. SVA had to hire private doctors to get the people examined. The following table shows the number of patients who attended the health camps, the persons who were suspected of fluorosis and sent for X-ray, and the number of persons having confirmed fluorosis.

Table -4

Name of the block	Camps held	Total persons who attended	Person suspected of fluorosis on whom X-ray was carried out	Persons identified as fluorosis affected		
				Male	Female	Total
Nuapada	1	8	1	0	0	0
Komna	4	87	31	6	6	12
Boden	3	103	25	4	2	6
Khariar	2	11	3	0	0	0
Sinapali	2	47	21	9	6	15
<b>Total</b>	<b>12</b>	<b>256</b>	<b>81</b>	<b>19</b>	<b>14</b>	<b>33</b>

It can be seen from the above table that out of the total 81 suspected cases 33 were confirmed to be having fluorosis. This is a very high percentage (41%) giving jitters to development activists and workers and warrants urgent remedy.

### Survey:

A survey was undertaken in all the blocks to ascertain the spread and intensity of fluorosis. It also intended to find out the socio-economic condition of the affected people, their loss of income and assets and their current coping mechanisms. For this purpose all the villages in the 5 blocks of Nuapada district were covered. The distribution of population in those villages is as follows:

Table-5

Name of the Blocks	Total G.P.	Total Villages	Population		
			Male	Female	Total
Nuapada	29	173	76571	77432	154003
Komna	27	159	53076	53866	106942
Boden	14	89	53379	53286	106665
Khariar	18	115	34457	34776	69233
Sinapali	21	125	46913	46934	93847
<b>Total</b>	<b>109</b>	<b>661</b>	<b>264396</b>	<b>266294</b>	<b>530690</b>

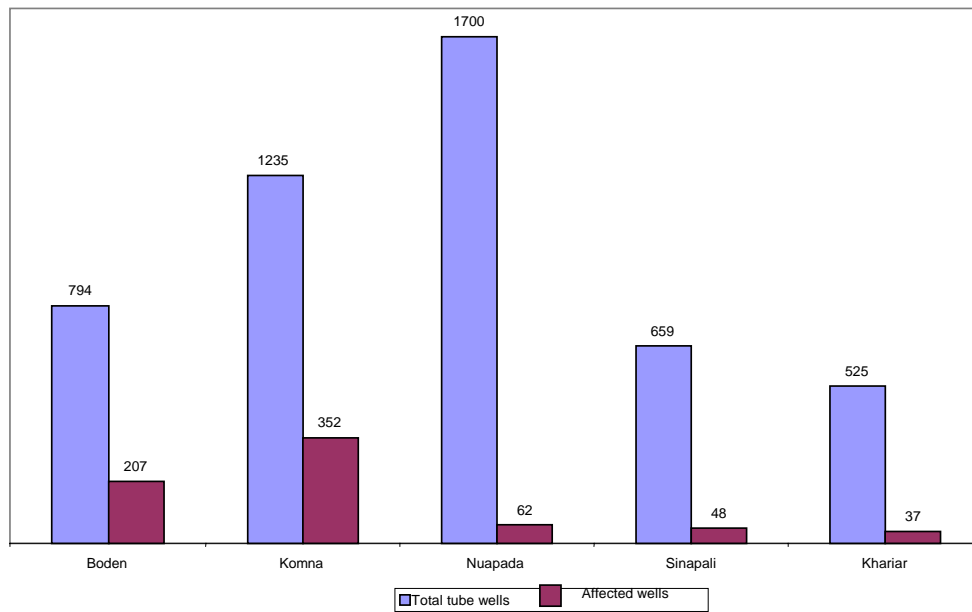
Though the above table shows the total G.Ps, Villages and Population the data appropriate for the study is the drinking water sources that were covered and water samples were tested. As can be seen from table - 6 out of the total 4913 water sources 711 were found to have excess fluoride in them. However to get a comprehensive picture we provide the following table.

Table-6

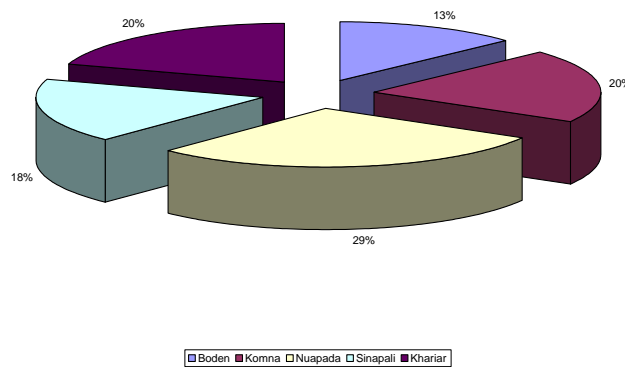
Name of the blocks	Total no. of tube wells surveyed	Affected wells	Affected GP	Affected Villages	Population having high risk	Population already affected		
						Male	Female	Total
Nuapada	1700	68	15	24	20819	642	633	1275
Komna	1241	445	24	93	84870	6562	5303	11865
Boden	794	275	14	53	49921	3473	2728	6201
Khariar	525	55	10	24	22566	668	477	1145
Sinapali	660	64	10	20	13150	1158	913	2071
<b>Total</b>	<b>4920</b>	<b>907</b>	<b>73</b>	<b>214</b>	<b>191326</b>	<b>12503</b>	<b>10054</b>	<b>22557</b>

In the above table the population having high risk means the village where any of the water source contains excess fluoride. Thus out of the 661 villages 214 villages have drinking water sources that contains excessive fluoride. The affected village population means the number person living in the villages, which has at least one fluoride, contaminated well. The affected male, female and total means the number of people dependent upon the fluoride contaminated water source and have symptoms of fluorosis. Some of the findings are presented below:

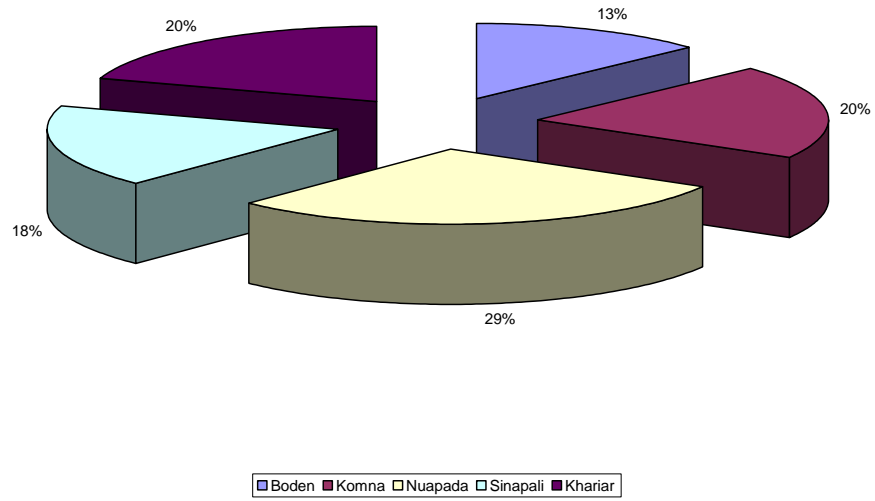
**No. of fluoride affected wells to total no. of wells**



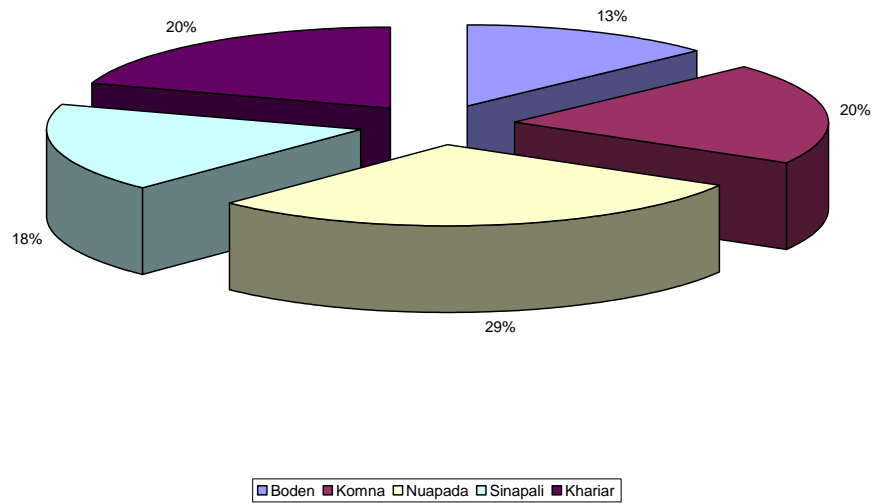
**% of affected Population to total population**



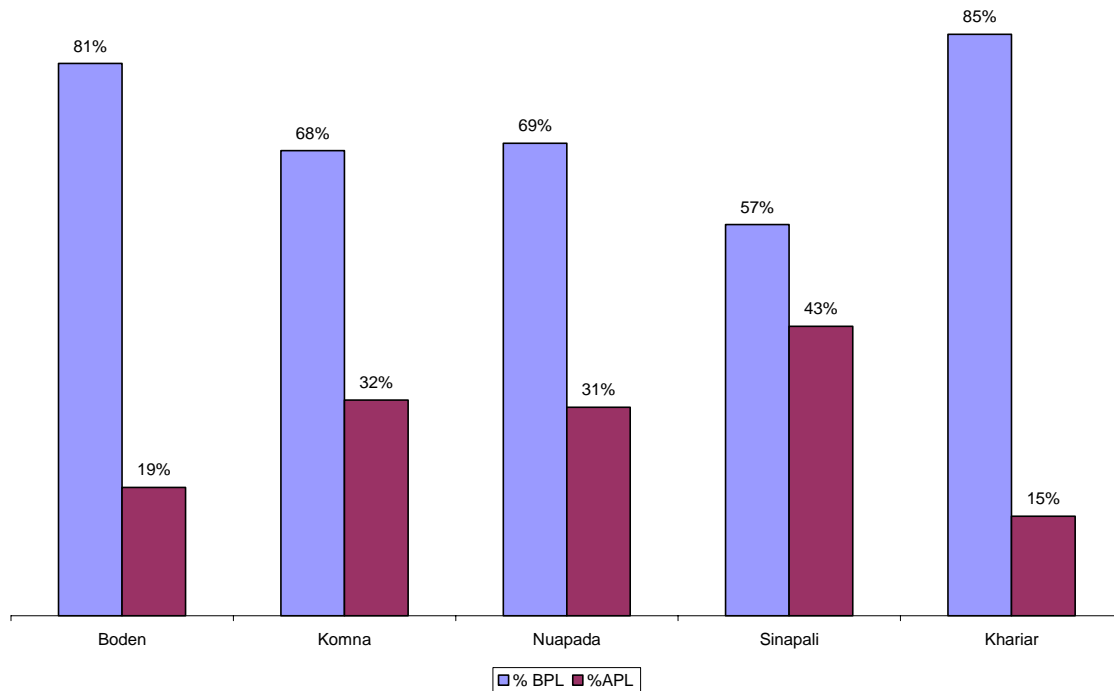
**% of affected Villages to total villages**



**% of affected population to affected village population**



Income status of affected families



### Conclusion:

The intervention of SVA over the past few years has been throwing upon new lights to the problem of fluorosis, both in terms of the spread and intensity. Earlier it was believed that fluorosis was confined to only a few pockets but now as the reports suggest it might be present in the contiguous areas such as Bargarh, Bolangir, Kalahandi and other districts. The issue that also needs to be looked at is contamination by other toxic materials which may be affecting the people's health. Therefore a holistic analysis of water, i.e. extent of bacterial contamination, existence of different toxic elements, dissolved solids etc needs to be carried out. Simultaneously low cost, replicable technologies should be developed and experimented to make sure every one gets access to safe drinking water. It should also be our priority to demonstrate that fluorosis can be prevented if not cured and impress upon the government to make it a national policy to ensure safe drinking water as a fundamental right for every one.

## A Few Case Studies

The Plight of the people in the village Nuamalpada in Sinapali block of Nuapada District.

### **The Plight of Shri Giridhari Naik:**

Girdhari Naik in his youth was thrilled when the government dug the first tube well in his village Nuamalpada. He was elated that unlike his forefathers he and his posterity would not suffer from small ailments like diarrhoea and other waterborne diseases as rural supply and health officials told him tube well water is the safest.

Girdhari Naik represents one of such innocuous villagers who migrated and settled in Nuamalpada in lure of greater prosperity. He left his job at Arkabahali Government horticultural farm at Bhawanipatna and got married in the year 1972 to Belmati, the 3<sup>rd</sup> daughter of Nabin Barik-one of the founder of Nuamalpada village.



(The one in the middle is Giridhari Naik)

Nuamalpada is a small village of Nangalbod Panchayat located inside a dense forest, 22 Kms away from its block headquarter Sinapali that adjoins the neighbouring state of Chhatisgarh. The villagers have more cultural and transactional affinity with Chhatisgarh than with Orissa. The village came in to existence in the year 1947 when Bharat Prasad Panda of Karangamal village, Uddhab Pati of Mahulpada village and Nabin Prasad Barik of Chalanpada (Goimundi) village started settling in the village. In the subsequent period people from others places started coming in and at present 330 households live in the village. Among the inhabitants of Nuamalpada, Gond, Kondh, Paik, Luhura, Mali,

Goud, Kumbhar, Meher, Teli, Brahmin and Bairagi are the major caste groups. However the tribals constitute the majority.

Nuamalpada is a revenue village having three wards. Within the geographical boundary of the village there are 10 hamlets. The economy of the people mostly depends on agriculture and collection of Non-Timber Forest Produce (NTFP). The villagers have a lot of agricultural and forest activities in different seasons of a year. Other than Bholanath Bag all families in the village possess more or less some amount of land for cultivation. Agriculture is mostly rain fed and crop failure has been a phenomenon due to erratic rain fall and frequent dry spells. The amount of land under the possession of the families do not matter much to the households as they all depend a lot of NTFP collection.

Nuamalpada is one of the most backward villages and has been deprived of many socio-economic facilities of development. The village is neither connected with an all weather road nor electricity. The village has no PHC or any other medical facility. There is one Auxiliary Nurse and Midwife but she stays in Nagalbod, about 12 far from Nuamalpada. Due to lack of interest in her work and the difficult terrain she occasionally comes to the village. One Primary school for the village was sanctioned during 1996-97 which unlike other remote villages is functional.

Availability of safe drinking water has been a perennial problem for the people of Nuamalpada. In the first two decades the villagers used water from the 3 streams (nalas), namely, Bagdhara nala, Ghodamundi nala, Ratakhand nala, that flows near the village. In 1962, two families dug open wells in the village. These wells than became the drinking water source for the entire village.



(An open well dug in 1962)

This process continued till 1985 when the first tube well was installed by the government. Presently, there are 8 tube wells in the village and all are maintained by the Rural Water Supply and Sanitation (RWSS) department.



(A tube well installed by the government)

Girdhari was blessed with one son in 1973. His second son was born in 1975. With his two sons and a hard working wife he led a very happy life. But 20 years down the line to his utter dismay he discovered his wife to be suffering from an alien disease. Without having any support in the family he was forced to get his 17-year-old son married so that the daughter-in-law can do the cooking and other household work.

**When his wife first complained about joint pains he took her to the village healer. Upon seeing no improvement to Belmati's pain, he later took her on a bi-cycle to Sinapali, which is 22 Kms away from his village, and from there took a bus to Dharamgarh which is another 40 Kms. The Government Hospital located in Dharamagarh had a very good reputation in the undivided Kalahandi district. The consulting doctor in Dharamagarh hospital told Girdhari that his wife is suffering from rheumatic arthritis and prescribed some medicines and injections. Even after taking the medicines Belmati did not recover from her pain. Afterwards Girdhari and his wife lost faith on allopathic medicines and took to Ayurvedic medicines but all their efforts were in vain. On Belmati's insistence Girdhari solemnized their younger son's marriage with Pramila at an early age. Belmati suffered for 15 years and was bed ridden and lived the life of a disabled person for nearly 6 years. Finally, she passed away in Dec.2006. Girdhari spent around 25,000 on the treatment of his wife which he borrowed from 3 local money lenders at 120% rate of interest per annum. He has not been able to pay back the**

loan and has no clues as to how he is going to get rid of his indebtedness.

**Now Giridhari's elder son Jayram and younger son's wife Pramila complain of the same symptoms. Giridhari relates this to the symptoms of his wife and gets terribly frightened of losing them too.**

Today many people in the village, irrespective of their caste, creed and age are now complaining of joint pain, browning teeth, graying hair, stiff neck etc. Villagers say that these problems have become acute since last 5-6 years. Even though many families of the village belong to BPL category and are reeling under economic stress, some of them have managed to go for medical treatment. The result, however, has been futile.

The survey has shown that in the village Nuamalpada already more than 100 persons have shown symptoms of fluorosis and already 27 persons have become disable to walk properly.

### **The story of Gopinath**

Gopinath Rautray, hailing from Nuamalpada, is one of the several victims of the harrowing disease-fluorosis. At the age of 37 he is a confirmed patient of fluorosis as detected from the X-ray test conducted by Sahabhazi Vikash Abhiyan (SVA) during November 2006 and confirmed by a Bhubaneswar based radiologist Dr. Umesh Chandra Mahapatra.



(Gopinath with his wife)

Gopinath is married to Mathura and has 4 sons, aged 12, 11,9 and 7. The family belongs to the Paika community (OBC), the comparatively better off community of Nuamalpada. He has one brother aged 32 but unmarried as he too suffers from fluorosis which has partially crippled him and has affected his nerve system leading to a semi-lunatic stage.



**(Brother of Gopinath)**

Gopinath and his brother jointly own 9 acres of land. In addition Gopinath owns a bi-cycle repairing cum spare parts shop in the village. There are about 300 bi-cycles in the village and 2 shops. He repairs about 3 cycles a day and ekes out about Rs 3000 a month. In addition he makes a profit of about Rs 500 a month from cycle parts selling. He learnt cycle repairing on his own some 15 years ago. He had invested Rs 10,000 in his shop from his own income. In addition he received Rs 2000 in December 2005 from the Western Orissa Rural Livelihood Project (WORLP) under the livelihood promotion-watershed plus fund which he has invested in the shop. He is not interested in agriculture as agriculture is entirely rainfed in Nuamalpada. Secondly, due to his illness he cannot work in the field. Thirdly, as an artisan he was never interested in agriculture. But unlike others he does not want to give his land on a share cropping basis as he feels he will financially lose out in that. He therefore hires labourers and gets his land cultivated. Out of his 9 acres of land, 4 acres are being banded under the WORL projects. The rest 5 acres were banded by his father.



(Gopinath in front of his cycle shop)

Around 10 years back Gopinath developed pain in his waist. He went to Dharamgarh in Orissa some 50 Kms far from his village to get himself diagnosed. He was treated of arthritis. He took the prescribed medicines but the pain instead of subsiding started affecting his chest, shoulders and knee. Desperation took him to many doctors in Sinapali and Khariar but no one could diagnose his disease properly. Many a times the distance, the doctor's fee, the cost of medicines prevented him to go to the doctors and he kept suffering. This is even happening now and when the pain becomes unbearable he takes loans from the money lenders and visits the doctors. Unfortunately all along he has been taking the wrong medicines for wrong reasons. The last time he visited the doctor at Sinapali he was prescribed a tonic named ANAFER, that contains Haematinic syrup with Folic acid, Vitamin B-12 & Zinc.



In the last 2 years Gopinath has spent about Rs 25,000 on his treatment. He has mobilized this amount by taking loans from two local money lenders namely Mr Sudar Kanda and Mr Debram Bag at 120% rate of interest. His income was much higher before he developed such pains and has come down to Rs 3000 from a peak of Rs 5000. His wife Mathura who was a member of a SHG promoted by a NGO named Lokadrusti. She was saving Rs 20 month but because of the financial disress she had to quit her membership. Here it may be noted that a monthly income of Rs 3000 may appear to be reasonable in a rural setting but in case of Gopinath he has to spend a lot of money on his treatment, his brother's treatment and maintaining a family of 7 members.

### **Maina – A severe painful life with fluorosis:**

Temri is a small village in Boden block of Nuapada district. Maina Jagat aged 55 is an old fragile lady. Her husband Banbasi Jagat who is around 65 years old developed vision problem and became blind five years back. Both Maina and Banabasi are disabled and are depending on their only son Laxman Jagat aged 30. Maina has severe joint pain and difficulty in movement for the last six years. She could not even carry out household works. The symptoms indicate that she has been suffering from fluorosis. Laxman got married to Dulavi from Dota village at the age of 18. He has four sons. The eldest one Balram Jagat who is 14 years old is studying in Class 9, the second one Chandra Jagat 10 years old is studying in class 4, the third one Raidhar Jagat is 9 years old and is also studying in class 4. The youngest one is Mahendra Jagat 7 years old is studying in class 3. The entire family of 8 members lives in a small house constructed on a Govt. land for the last 35 years. They don't have any homestead land in their name.



Maina's husband was a marginal farmer having less than one acre of land. Earlier both Maina and Banabasi were working as wage labourers to support their family, as the small patch of agricultural land was not enough. Laxman, their son, could not study after class seven due to his father's illness. Maina also fell sick. Within a period of two years the entire burden of the family is shifted to Laxman and Dulavi. Both Laxman and Dulavi also worked as wage labourer. Last year Dullavi met with an accident for which she is not in a position to do heavy work. To meet the medical expenses Laxman has taken Rs.2000 as loan from a relative giving his 99 decimal land as mortgage and Rs 3000 from Timri Sahukar for doing bricks work in future. Dulavi is a member of Ma Binapani SHG. To meet the consumption need of the family she took a loan of Rs. 5000 from the SHG six months back at the interest rate of Rs. 1 per Rs. 100 in each month. She has neither given interet nor installment to repay the loan. For 3 months in a year they get agricultural work in the village. Last year they worked as wage labour in Binapur, Boden, Moharajore for one and fifteen days and in the month of June Laxman worked for 14 days under NREGS.

Laxman and his family live in abject poverty. Under such a condition Maina is neglected and she is not getting any medical facility. She is just waiting for death.

**Photos of a few other victims:**



## Fluorosis- its Cause and effects

The name fluorine originated from the Latin word 'fluere' (Meaning 'to flow'). Fluorine is the 13<sup>th</sup> most ubiquitous pollutant, abundant on earth. In its elemental form it is a pale yellow, highly toxic and corrosive gas (Glasser, 1979). French scientists Henri Moissan discovered it in 1886. He has been awarded Nobel Prize in chemistry for this discovery in 1906 (Glasser, 1979). It combines with all elements except Oxygen and noble gases to form fluorides. Fluorides are ubiquitous in nature and are present in rocks, soil, water, plants, foods and even air.

Feil first mentioned fluorosis in humans as an occupational disease in 1930. This was substantiated when the occurrence of skeletal fluorosis in cryolite miners in Denmark was reported (Moller and Gudjonsson 1932). In India Fluorosis was first reported in the then Madras Presidency in 1937.

### Historical Facts about Fluorosis

- In 1866 Fluoride was discovered by French Scientist Henri Moissan
- In early part of 20<sup>th</sup> century residents of certain areas of USA developed brown stains on teeth.
- In 1925 the term Fluorosis was coined and used by Cristian and Guatier.
- In 1930 relationship between mottled enamel and fluoride in water was established.
- In 1930 Feil mentioned fluorosis in human as an occupational disease.
- In 1932 skeletal fluorosis was reported in humans as an occupational disease.
- In 1937 skeletal fluorosis was 1<sup>st</sup> reported in India.

Endemic fluorosis is usually restricted to tropical and subtropical areas, and is frequently complicated by factors such as calcium deficiency or malnutrition. Endemic fluorosis is widely prevalent in China, India, Middle East, North Africa, Ethiopian rift valley and other parts of Africa. Sixty odd industries use fluorides and hence pollution can occur in them if proper precautions are not taken. Besides, there are several natural pockets in earth's crust that has heavy deposits of different compounds of fluoride which significantly adds to fluoridation.

The incidence of fluorosis has been reported in 17 countries of the world including India. The worst sufferer countries are USA, Italy, Holland, Spain, France, Germany, Switzerland, China, Japan, Thailand and South America due to the presence of excessive fluorides (beyond permissible limits) in drinking water. In India over 66 million people including 7 million children in 17 states out of 32 states and union territories are affected with endemic fluorosis. (Rao & Perera, 2003)<sup>1</sup>.

### **Metabolism of fluoride:**

Biological effects of fluoride intoxication are related to the total amount of fluoride ingested irrespective of the source, be it, food, water or air.

### **Sources of fluoride:**

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##### **Food:**

Fluoride content is high in vegetables and food in endemic areas of India. Staple diets rich in Sorghum, Ragi & Bajra contain high fluoride content.

##### **Water:**

Fluoride content depends on source of water, geographical formation, amount of

##### **Rainfall.**

Ground water contains more fluoride than surface water.

Tea has exceptionally high fluoride content. –(122-260 PPM or more)

Each cup of tea supplies 0.3-0.5 mg of fluoride.

##### **Air:**

Atmospheric fluoride levels rise due to volcanic and industrial activity.

Low grade coal has high levels of fluoride.

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<sup>1</sup> Rao S.M. & Perera J.A.J. (2003)- Establishment of a community wealth knowledge network(CKN) on environment issue of fluoride contaminated ground water. Spl. Review pp 27.

### **Total daily fluoride intake:**

The fluoride contents from all the sources determine the human intake of fluoride. In majority of endemic areas around the world, the main contribution is from water. The estimated range of safe and adequate intake of fluorides for adults is 1.5 to 4.0 mg per day and it is less for children and those with renal disease. The daily intake of fluoride in endemic regions varies from 10 to 35 mg and can be even higher in summer months.

### **Distribution of fluorides:**

About 96-99% of the fluoride retained in the body combines with mineralized bones, since fluoride is the most exclusive bone seeking element on account of its affinity for calcium phosphate.

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When the ingestion is >5 mg 50% is retained by skeleton and the rest is excreted through urine.

Normal Plasma fluoride levels are 0.14-0.19 PPM in non-endemic areas.

Fluoride levels in soft tissues are < 1PPM, in brain 0.4-0.68 PPM, in CSF it is 0.1 PPM.

Fluoride up takes is faster in young bones.

Fluoride content in skeletal bones varies, it is highest in bones of pelvis and vertebral.

### **Excretion of fluorides:**

#### **Feces:**

Fluoride present in feces results from two sources: the ingested fluoride that is not absorbed and the absorbed fluoride that is excreted into the gastrointestinal tract. About 10-25% of daily intake of fluoride is excreted in the feces.

**Urinary:**

The elimination of absorbed fluoride occurs almost exclusively via the kidneys. Urinary fluoride in normal individuals fluctuates widely between 0 and 1.2 PPM with an average of about 0.4 PPM when fluoride content of drinking water is 0.3PPM. Urinary levels of fluoride are higher in individuals exposed to higher intake of fluoride. The renal clearance of fluoride is directly related to urinary PH, and under some conditions, to urinary flow rate. In alkaline urine the fluoride is present in ionic form and hence its renal clearance is rapid. In the acidic urine on the other hand, fluoride is present in nonionic form (HF) and hence it is rapidly reabsorbed in renal tubules. The excretion of fluoride is much less if person concerned is suffering from chronic kidney disease resulting in renal failure, which inevitably leads to high concentrations of fluoride in serum as well as

**Sweat:**

Some fluoride is also lost from the body through sweat and so appreciable amounts may be lost in situations marked by excessive sweating. Sweat fluoride concentrations are similar to plasma.

**Other routes:**

The amount of fluoride in breast milk is low and same is true of saliva.

**Types of Fluorosis:**

Fluorosis is classified into 3 types. They are dental fluorosis, skeletal fluorosis, and non-skeletal fluorosis. The features of these 3 types are:

## **Dental fluorosis:**

**Mainly involves enamel**

**Mottling is one of the earliest in most recognizable feature**

**Both sexes are equally affected**

**Permanent teeth are affected**

**Teeth become rough, Opaque and chalky white**

**Pitting and chipping are also soon**

**In endemic areas dental fluorosis has linear relationship to fluoride content of water**

## **Skeletal fluorosis:**

**Vague discomfort and paraesthesia in limbs and trunk are early symptoms**

**Pain & stiffness in back appear later**

**Stiffness increases steadily and restriction of movement occurs**

**"Poker back" spine is late manifestation**

**Soon stiffness spreads to various joints**

**Fluorosis deformity at hips, knee and other joints are seen**

**Bony exostosis seen in limb bones**

**Men suffer more than women**

**Skeletal fluorosis becomes crippling between 30-50 years of age in endemic areas**

**New comers to endemic area develop symptoms within 4 years of arrival**

## **Non-Skeletal Fluorosis**

Fluoride exposure disrupts the synthesis of collagen and leads to the breakdown of collagen in bone, tendon, muscle, skin, cartilage, lungs, kidney and trachea.

Fluoride stimulates granule formation and oxygen consumption in white blood cells, but inhibits these processes when the white blood cell is challenged by a foreign agent in the blood.

Fluoride depletes the energy reserves and the ability of white blood cells to properly destroy foreign agents by the process of phagocytosis. As little as 0.2 ppm fluoride stimulates superoxide production in resting white blood cells, virtually abolishing phagocytosis. Even micro-molar amounts of fluoride, below 1 ppm, may seriously depress the ability of white blood cells to destroy pathogenic agents.

Fluoride confuses the immune system and causes it to attack the body's own tissues, and increases the tumor growth rate in cancer prone individuals.

Fluoride inhibits antibody formation in the blood.

Fluoride depresses thyroid activity.

Fluorides have a disruptive effect on various tissues in the body.

Fluoride promotes development of bone cancer.

Fluorides cause premature aging of the human body.

Fluoride ingestion from mouth rinses and dentifrices in children is extremely hazardous to biological development, life span and general health.

