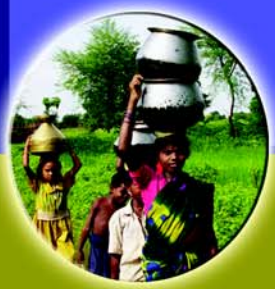
Fluoride Menace in Orissa



Dr. Manoj K. Mahapatra

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by

Dr. Manoj K. Mahapatra

RCDC Centre for Water for Life
Bhubaneswar

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Author	:	Dr. Manoj K. Mahapatra
Editors	:	Tapan K. Padhi Sandeep Sahu
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About the book...

Centre for Water for Life (CWL) is a thematic unit of Regional Centre for Development Cooperation (RCDC), an organisation working on natural resources management, dealing exclusively with issues related to water. Since its inception a little over three years ago, CWL has been identifying and drawing attention to water related problems in the state through a series of publications both in Oriya and English, advocacy exercises, seminars and workshops.

We at CWL firmly believe that the fluoride problem in Orissa calls for greater attention than it has been given so far by the government and the society at large. Hence, study, research and action on the growing menace of fluoride have been an important part of CWL's activities from the beginning. Our work in the field reveals that 27 out of the 30 districts in the state are battling with fluoride contamination of drinking water. In areas like Angul-Talcher industrial belt, Balasingh-Singhpur in Khurda district, Gohiriapadar in Kalahandi district and Krushakpalli in Bargah district, the fluoride problem has assumed alarming proportions. In many of these areas, the fluoride content in drinking water is as high as 10 mg/l or more when the permissible limit is just 1 mg/l. In Deokananpur in Sundargarh district, it stands at a staggering 45 mg/l. Worse still, none of these areas have been provided with alternative sources of safe drinking water - forcing the people to continue drinking the highly hazardous fluoride contaminated water and jeopardising their health and even life in the process. What makes the task of arresting the spread of fluorosis, the dreaded disease caused by excessive intake of fluoride through drinking water, is the fact that there is no cure available anywhere in the world for it. Prevention thus is the only way to control it. But an effective prevention strategy can hardly be drawn up without first assessing the extent of the problem and understanding it in its entirety.

This national workshop is part of the exercise to focus attention on a problem that is getting increasingly intractable. Of course, the fact that organisation of such an event was provided for in our project proposal certainly helped. But the primary motivation for it remains our concern that flurosis could emerge as a major killer like malaria and gastroenteritis in the state in the none-too-distant future if remedial measures are not initiated urgently.

This book is a humble attempt to familarise all stakeholders – the government, health planners, academicians, health professionals, civil society organisations, the media and society at large – with the various ways fluoride gets into the body, impact of excess fluoride on the body and ways to prevent and fight the dreaded disease of flurosis. While the first chapter of the book presents an overview of the problem of fluoride, the second deals with the impact of fluroride on health. The third chapter presents an overview of the extent of fluoride contamination in Orissa and the fourth talks about the health, social and livelihood impact of fluorosis. The fifth chapter assesses the extent of coverage of the issue in the local media; the sixth lists measures taken by the government to fight the problem. The seventh chapter identifies the challenges ahead while the eighth and last chapter contains a set of recommendations that we think would constitute an adequate response to the growing fluoride menace.

The author of the book, **Dr. Manoj Kumar Mahapatra** is an acknowledged expert on the issue of fluoride and has done extensive work in the field. He has been an International Fellow in Ecological Communication and Aquatic Toxicology (The Netherlands), Fellow of Science and Environmental Science Society of India. He has several publications in different books and journals of repute to his credit.

We take this opportunity to thank **Mr. Ramakrishna Maharana** of CWL, who has taken great pains to do the lay-out and design of this volume. We also thank Perfect Print & Graphics Pvt. Ltd., for having printed the book at a very short notice.

We are under no illusion that this book is the last word on the fluoride problem in Orissa. It is just a humble beginning, which, we expect, will encourage experts in the field to build on it and conduct further studies and research on the issue. We shall feel vindicated if this volume provokes debate and discussion on the issue of fluoride among the various stakeholders. But nothing will give us more pleasure to us than if the government, the key player, takes note of it and formulates an appropriate response strategy to fight the scourge of fluoride and flurosis in the state.

Tapan K Padhi

Sandeep Sahu

Authorspeak

"Nala kuara pani, piiba niti chhani" ("Filter the water of tube well and drink") - many of us read in school and grew up believing that tube well water is safe for drinking. But this old couplet no longer holds good. Tube well water today comes with an assortment of contaminants, the deadliest of which is fluoride. No amount of filtration can prevent the entry of these hazardous substances into human and animal body.

While the government goes on digging more and more tube wells, it has been utterly callous in ensuring the quality of drinking water extracted from them. It has no apparent qualms about admitting that it has so far been able to test the quality of barely 25% of the tube wells. Even the fact that quality-related problems have been detected in as many as 16% of the tube wells tested and excess fluoride in 2.58% of them has failed to expedite the testing of drinking water quality in the whole state. Amazingly, the government continues to deny the existence of the fluoride problem even though, by its own admission, it has not tested the quality of all drinking water sources.

The zeal with which the government has been guarding the 'secret' makes a mockery of the Right to Information Act. In this connection, I would like to recount a personal experience that speaks volumes about the length to which bureaucracy goes to hide information on drinking water quality from the public. Recently, when I asked the Executive Engineer of RWS&S, Balasore for water quality data of the district, he told me that the data could not be given since it was 'top secret' – on par with defence secrets. But unbelievably, the same officer had absolutely no hesitation in sharing the same 'top secret' data with an industry that has been squarely responsible for the spread of fluorosis in Remuna area of the district.

This document on the fluoride menace in Orissa is part of the project funded by SIMAVI. We had to depend on secondary information from government sources, besides reports from the field ferreted out by our field informants. I must say the field informants – Ananda Sethi, Hemanta Nayak and Manas Ranjan Biswal – have done a tremendous job in collecting the often elusive data from the ground

level. I must also thank the Executive Engineers and Assistant Engineers of the state, who have shared information on water quality at their disposal with us (unlike the Executive Engineer, Balasore).

I express my deep gratitude to Dr. Ramakar Jha, Prof. A Susheela and Prof. Maya Shedpure, all of whom have lent their constant support and given their valuable suggestions during the writing of the book. I take this opportunity to place on record my indebtedness to the Director, CWL **Mr. Tapan K Padhi,** who has not only encouraged me all along, but has also gone out of way to help me at every stage of the compilation and preparation of this volume. I shall be failing in my duty if I don't thank Mr. Sandeep Sahu, a journalist of international repute, for editing the volume despite his busy schedule. I also thank all my colleagues for their cooperation during preparation of the book. Lastly, I am also thankful to my parents, Pushpa and Pranati Mahapatra for their constant support and encouragement during this busy period.

I hope that the report will be of help to policy-makers, administrators, health professionals, water engineers, academicians and civil society organisations active in the field of water and environment. Their feedback on the volume, I am sure, will go a long way towards improving subsequent reports on fluorosis in both form and content.

Dr. Manoj K Mahapatra
1st October, 2007

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CHAPTER 1

INTRODUCTION

Fluoride is the compound form of fluorine. Fluorine is a highly toxic and corrosive gas, light yellow–green in colour and with a pungent smell. Fluoride accounts for about 0.3g/kg (0.06 to 0.09%) of the earth crust.

Fluoride bearing rocks are abundant in India. As of result, fluoride leaches out and contaminates the adjacent water and soil resources.

> French scientists **Henri Moissan** discovered **Fluoride** in **1886** and was awarded the Nobel Prize for this discovery in 1906

Depending upon the source of fluoride contamination, there are two types of water pollution: artificial and natural. When fluoride contamination is caused by anthropological activities and/or industrial effluents, it is referred to as **artificial fluoride pollution** while significant presence of the chemical in water, soil and air is referred to as **natural fluoride pollution.**

Distribution of fluoride

Fluoride in water

The concentration of fluoride in drinking water depends mainly on the basic chemical composition of soil, the time of contact between the source of minerals and the water source, leaching of fluoride from rocks, calcium-poor aquifers, volcanic rocks, granite rocks and the amount of water withdrawn from the source over a period of time.

Generally, surface water has low fluoride content while ground water possesses a huge concentration of fluoride. River water near industries/mines like bauxite, graphite, aluminum, phosphate and fertilizer does contain some fluoride. But ground water is the single biggest contributing factor for the spread of fluoride and fluorosis.

Fluoride in Air

Air borne fluoride arises from both natural and anthropogenic sources. However, air is responsible for only a small fraction of the total fluoride exposure (USNRC, 1993). The air in regions of volcanic activities has long been known to contain fluoride. Fluoride is released into the atmosphere on a large scale due to dust, industrial production of phosphate fertilizers, coal ash from the burning of coal and volcanic activities.

Fluoride in Soil

Fluoride occurs in the form of minerals such as biotite, muscovite and hornblende etc. which usually originate from micas, apatite and tourmaline. The fluoride content of soil is largely dependent on the mineralogical composition of the soil, inorganic fraction and the extent of clay and pH.

Fluoride in Food

Nearly all food contain small quantities of fluoride and the total daily intake through any average human diet is small except in endemic regions. The contribution of food to the total daily intake of fluoride varies from region to region.

Fluoride in soil and water used for irrigation ultimately finds its way into food items. Fluoride exerts residual toxicity due to its non-biodegradable nature and passes on to each phase of the trophic level through the food chain. The food items carrying high levels of fluorides are rice, wheat, cereal, maize, pulses, cabbage, cucumber, tomato, brinjal, lady's finger, beetroot, potato, onion and sweet potato, banana, grapes, mango, apple, coconut, ground nut, mustard, mutton, beef, pork, fish, egg etc.

Food	Fluoride concentration in %
Banana	2.9 - 4.58
Grapes	0.84 - 1.74
Mango	3.7 - 8.18
Apple	5.7 - 5.22
Vegetables	9.0 - 45.0
Cereals	16.0 - 52.0
Pulses	6.0 - 22.0
Mutton	3.0 - 3.5
Fish	1.0 - 6.5
Wheat	5.9
Rice	1.7 - 2.23
Maize	5.6
Cabbage	3.3
Tomato	3.4
Brinjal	1.2
Lady's finger	4.0
Potato	2.8
Onion	3.7

Fluoride in Beverages

Tea, coffee, coconut water, beer and wine etc. contain higher levels of fluoride. Among beverages tea has an exceptionally high fluoride content. Each cup of tea may supply 0.3 - 0.5 mg of fluoride. Bottled beverages, which are increasingly being consumed around the world, have a variable and some have high content of fluoride and should be considered as an additional source of fluoride.

Beverages	Fluoride concentration
Tea (Dry leaves)	39.8-68.5
Tea infusion (1 gm boiled for 5 min. in 125 ml. water)	18.13-56.19
Tea infusion (1 gm in 125 ml of hot water)	11.13-37.34
Aerated drinks	0.77-1.44
Coconut Water	0.43-0.60

Fluoride in Spices

Almond, Garlic, Ginger, Coriander, Cumin Seeds, Garlic, Turmeric, Black Salt etc contain high degrees of fluoride.

Spices	Fluoride concentration in %
Coriander	2.3
Cumin Seeds	1.8
Ginger	2.0
Garlic	5.0
Turmeric	3.3

Fluoride in Nuts & Oilseeds

Nuts and oilseeds such as almond, coconut, mustard oil and groundnut also have higher concentration of fluoride

Nuts & Oilseeds	Fluoride concentration
Almond	4.0
Coconut	4.4
Mustard Seeds	5.7
Groundnut	5.1

Fluoride in Cosmetics viz. Toothpaste, Mouth rinses and Pan Masala

Cigarettes may be another significant route of fluoride intake by humans. Significant associations have been found between estimated fluoride ingestion from toothpaste and fluorosis. The fluoride content in raw material used for the manufacture of toothpaste, viz. calcium carbonate, talc and chalk, can be as high as 800-1000 ppm. In the fluoridated brands, there is a deliberate addition of fluoride, which may range from 1, 000 to 4, 000 ppm.

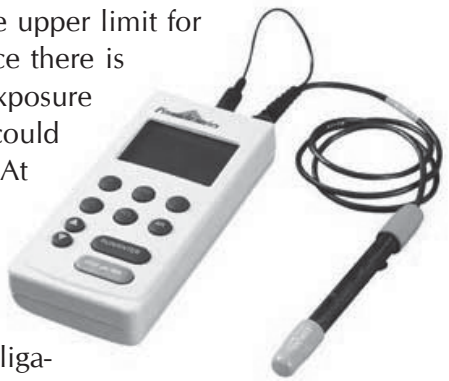
Fluoride in Drugs

Prolonged use of certain drugs has been known to lead to chronic adverse effects of fluoride e.g. sodium fluoride for treatment of osteoporosis, Niflumic acid for the treatment of rheumatoid arthritis, fluoride mouth rinse (Proflo) for making the tooth stronger etc.

Safe Limit of Fluoride

Water is the major source of fluoride. The 1984 guidelines published by the World Health Organization (WHO) suggested that in areas with a warm climate, the optical concentration of fluoride in drinking water should remain below 1mg/litre (1ppm or part per million), while in cooler climate, it could go up to 1.2 mg/litre. The difference is due to the fact that we perspire more in hot weather and consequently drink more water. The guideline value (permissible upper limit) for fluoride in drinking water was set at 1.5 mg/l, considered that a threshold where the benefit of resistance to tooth decay did not yet shade in to a significant task of dental fluorosis. The WHO guideline value for water is not universal. In India, for instance, the permissible upper limit was lowered from 1.5 ppm to 1.0 ppm in 1998.

Scientists working on issues related to fluoride in India have made a strong case for the lowering of the upper limit for fluoride to at least 1 ppm, if not less, since there is enough evidence to prove that constant exposure to fluoride even at the level of 0.7 mg/l could lead to fluorosis and other allied diseases. At concentrations of above 1 mg/l, fluoride in drinking water can be positively dangerous to human health and lead to dental and skeletal fluorosis, a disease that can cause mottling of the teeth, calcification of ligaments, crippling bone deformities and many other physiological disorders that might ultimately result in death.



ION METRE
usedto assess fluroride

Exposure to fluoride is a gigantic problem. According to UNICEF, fluorosis is endemic in at least 25 countries around the world with India, China and Africa being the countries with the highest prevalence rates. It is not known how many people are currently afflicted with the disease, but conservative estimates put the figure in tens of millions of people.

The most disquieting fact about fluorosis is that it has no cure so far. That leaves prevention as the only means of controlling the disease. Developing effective and inexpensive techniques for the remediation of fluoride in groundwater is a major challenge worldwide. No wonder it is the primary objective of Kerry's research.

Adequate levels of fluoride for different age groups

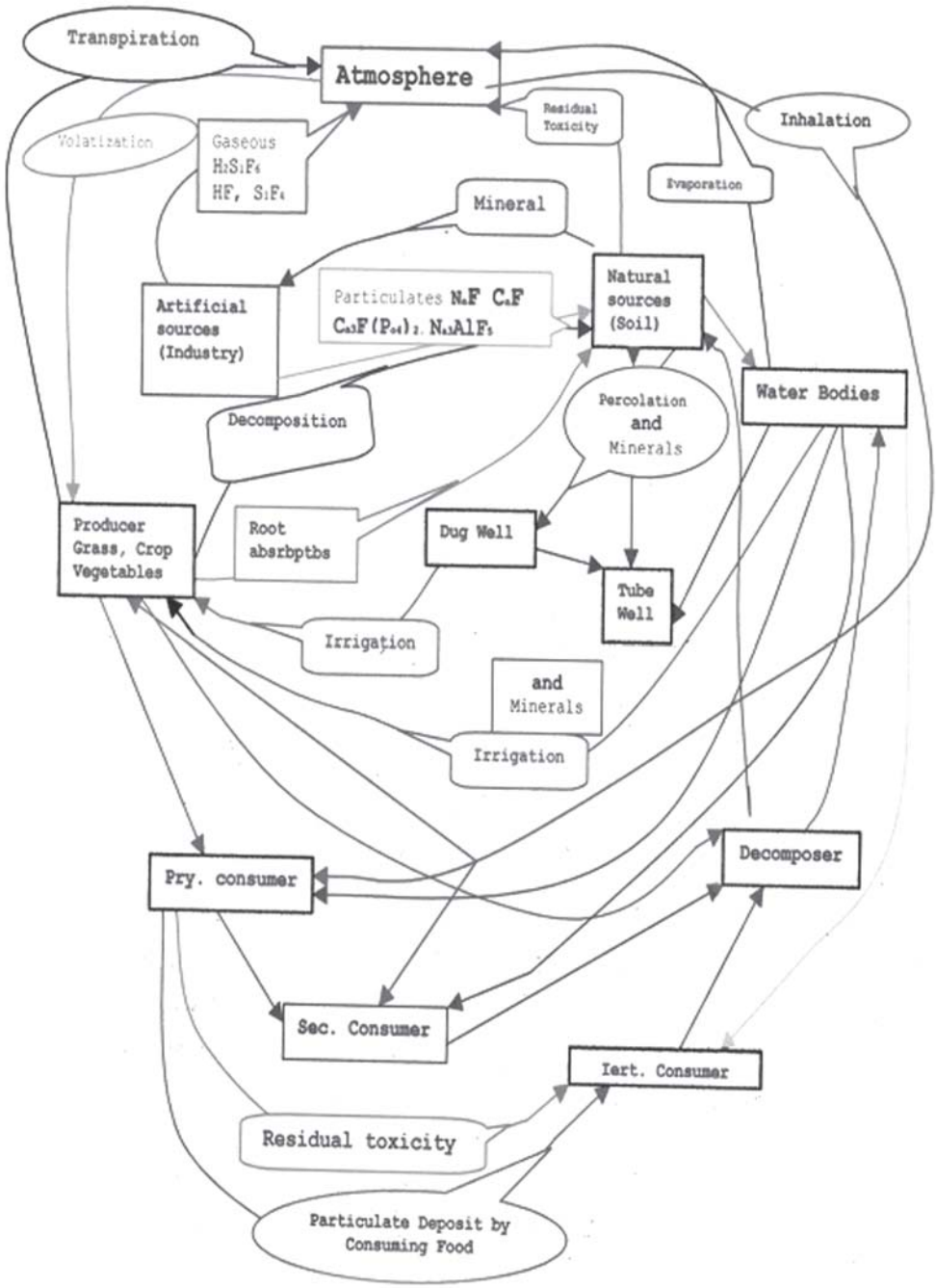
Infants	
0 - 6 months	0.01 mg/day
7 - 12 months	0.5 mg/day
Children	
1 - 3 years	0.7 mg/day
4 - 8 years	1 mg/day
Boys/Girls	
9 - 13 years	2 mg/day
14 - 18 years	3 mg/day
Males	
19 and above	4 mg/day
Females	
19 and above	3 mg/day

Pathway of fluoride

Fluoride is drawn from soil, water and nutrients by plants. Both man and animal are exposed to fluoride since they consume fluoride contaminated water and food. About 75% of the daily fluoride uptake by humans and animals returns to the atmosphere in the form of urine (approximately 50%) and dung (approximately 25%) while the rest is deposited in the bone. Even after the death and decay of animals and plants, the residual fluoride never really disappears; it only changes from one form to another. The decomposer releases this accumulated fluoride into the atmosphere again in the form of cast. The F-content in cast is transformed into nutrient form by the fermentation of transformers and then up-taked by the producer and passed on to the consumers directly or indirectly through the food web and ultimately fluoride gets deposited again and again as an abiotic component even after death and decay.

The figure depicted below illustrates the pathway of fluoride through different components of the ecosystem.

FLUORIDE CYCLE



Source: Mahapatra M. K. (2005):
Residual Fluoride Toxicity in Community Ecosystem, Ph.D. Thesis of Pt. Ravishankar Shukla University, Raipur

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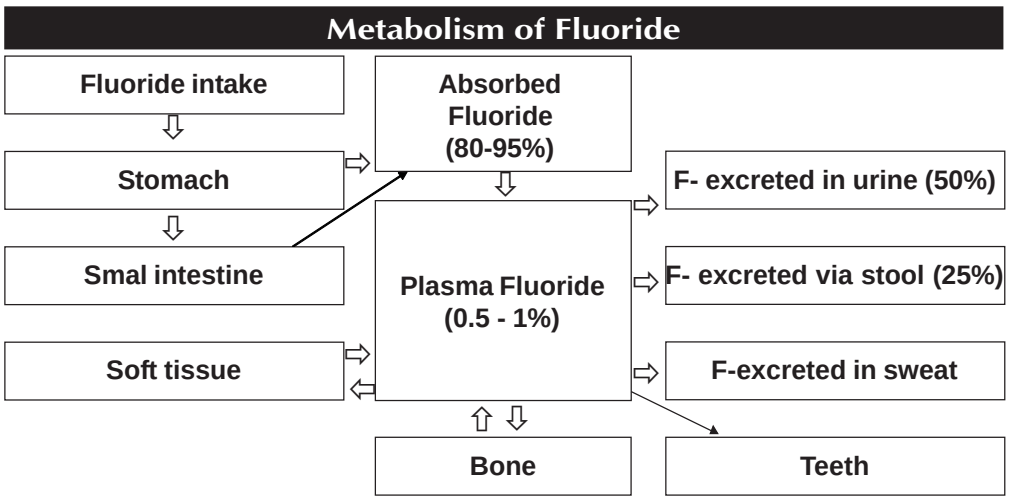
CHAPTER 2

HEALTH IMPACT OF FLUORIDE

When excessive amount of fluoride is ingested for a long period, it leads to a dreaded, crippling disease known as Fluorosis, which is **not curable.** It has been described as slow poison for community organisms.

Fluorosis is a result of abnormal deposition of fluoride in hard tissues. Fluoride has a marked affinity for teeth and bones. The 1st clinical indication of fluorosis in an area may be mottled teeth in children (Mahapatra et al., 2005).

Fluoride enters the human body mainly through drinking water; 96-99% of it combines with the bones as fluoride has an affinity for the calcium phosphate in the bones. Approximately 75–90 per cent of ingested fluoride is absorbed in the blood. About three-fourths of the fluoride in blood is contained in the plasma; the remainder is in the erythrocytes, which make up 40 to 50% of the blood volume. Once absorbed in blood, fluoride readily distributes throughout the body, with approximately 99 per cent of the body burden of fluoride retained in calcium rich areas such as bone and teeth (dentine and enamel) where it is incorporated into the crystal lattice. Levels of fluoride that are found in the bone vary with the part of the bone examined and with the age and sex of the individual. Bone fluoride is considered to be a reflection of long-term exposure to fluoride (IPCS, 2002).



Types of fluorosis

Depending upon the clinical presentation, there are basically three types of fluorosis. They are:

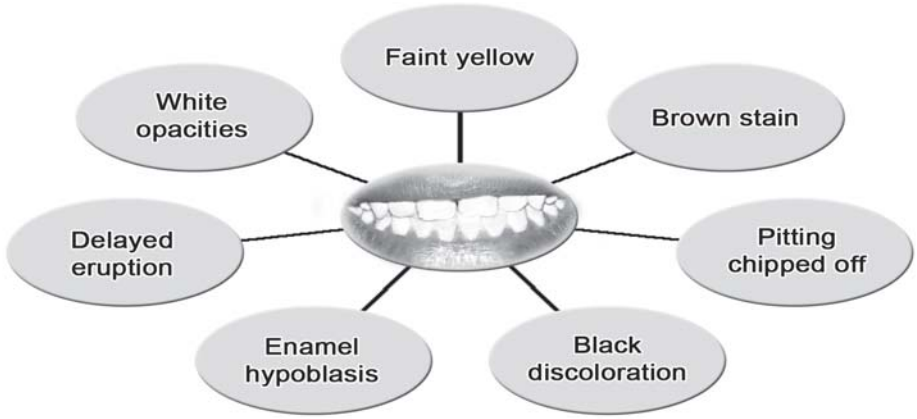
- Dental Fluorosis
- Skeletal fluorosis
- Non-skeletal fluorosis.

Dental Fluorosis

Dental Fluorosis (mottling of teeth) is not just a "cosmetic" problem. Amongst fluoride researchers, it has been recognized for many years as the first visible sign of chronic fluoride poisoning. When a person drinks or eats fluoride contaminated water or food, it gets deposited in the bone and accumulates for 2-3 years. The person suffers non-skeletal fluorosis during this period. Yellow, parallel lines that emerge on the teeth thereafter indicate accumulation of fluoride in the bone and replacement of calcium from the teeth. Dental fluorosis increases in proportion with the increase in fluoride concentration. A major reason for this increase is the substantial increase in fluoride, which is now ingested from numerous sources by many populations.

The following are the symptoms of dental fluorosis:

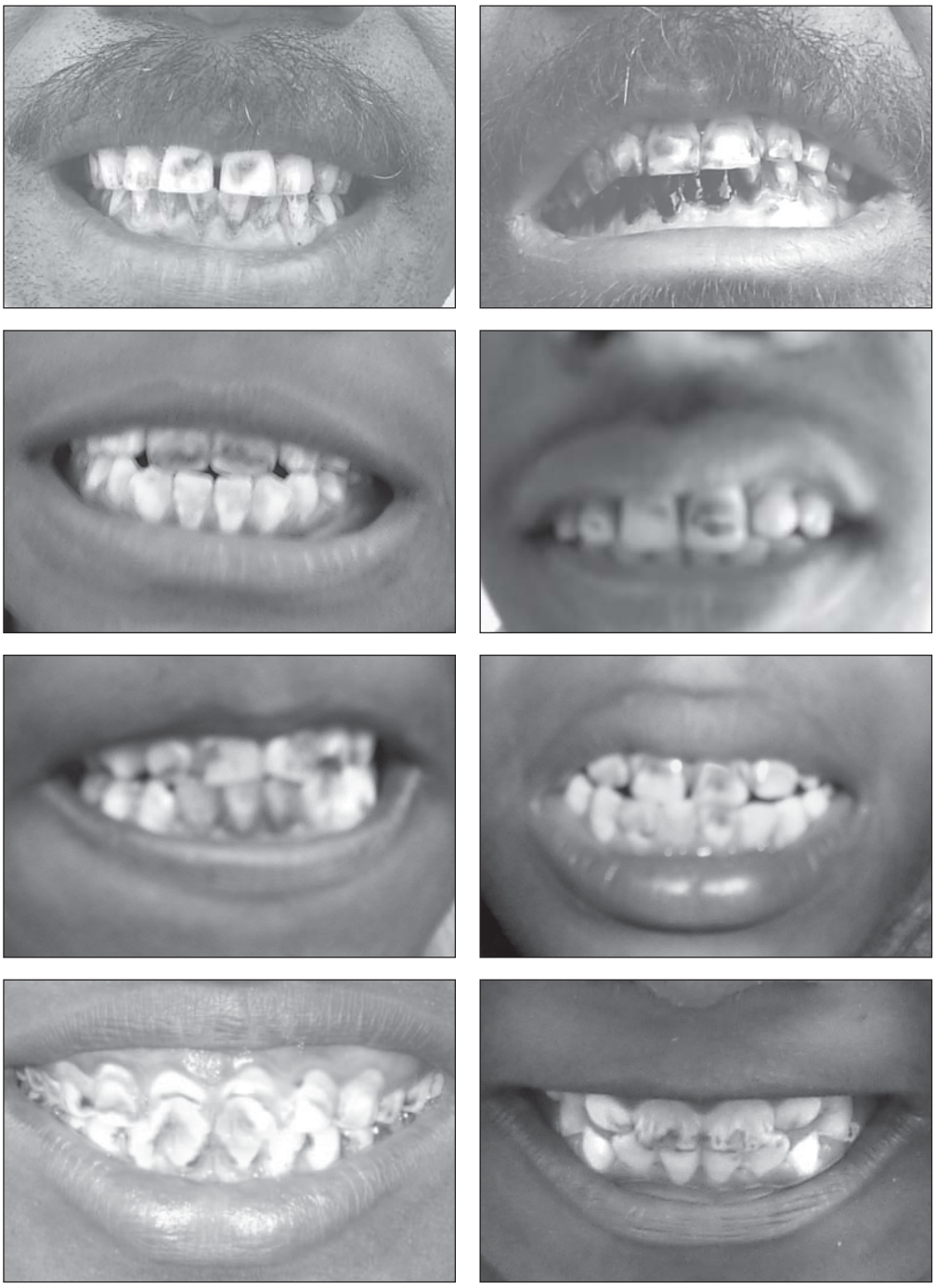
- Yellowish white-glistening tooth - become dull, lose their shine and develop yellow white spots.
- Yellow white spots turn brown and present themselves in horizontal streaks.
- The brown streak is at the tip of the teeth, in the middle of the teeth or in the upper part of teeth, indicates that a child has been exposed to high fluoride in food or water or both up to the age of 2 years, from the age of 2 years up to 4 years and from the age of 4 years up to 6 years and after respectively.
- In later stages, the teeth may become black. They could be pitted or perforated and may even get chipped off.
- Loss of teeth at an early age.
- Delayed eruption of teeth.



DENTAL FLUOROSIS

Type	Weight	Description
Normal enamel	0	The enamel presents the usual translucent semivitriform type of structure. The surface is smooth, glossy and usually of a pale, creamy-white colour.
Questionable fluorosis	0.5	Slight aberration from the translucency of normal enamel seen, ranging from a few white flecks to occasional white spots.
Very mild fluorosis	1	Small opaque, paper white areas, scattered irregularly over the tooth, but not covering more than approximately 25% of the tooth surface.
Mild fluorosis	2	The white opaque areas in the enamel of the teeth are more extensive, but do not cover more than 50% of the tooth.
Moderate fluorosis	3	All enamel surface of the teeth are affected. Brown stain is frequently observed.
Severe fluorosis	4	All enamel surface are affected and hypoplasia is so marked that the general form of tooth may be affected. Brown stains are widespread and teeth often present a corroded appearance.

DENTAL FLUOROSIS IN DIFFERENT AGE GROUPS



Skeletal Fluorosis

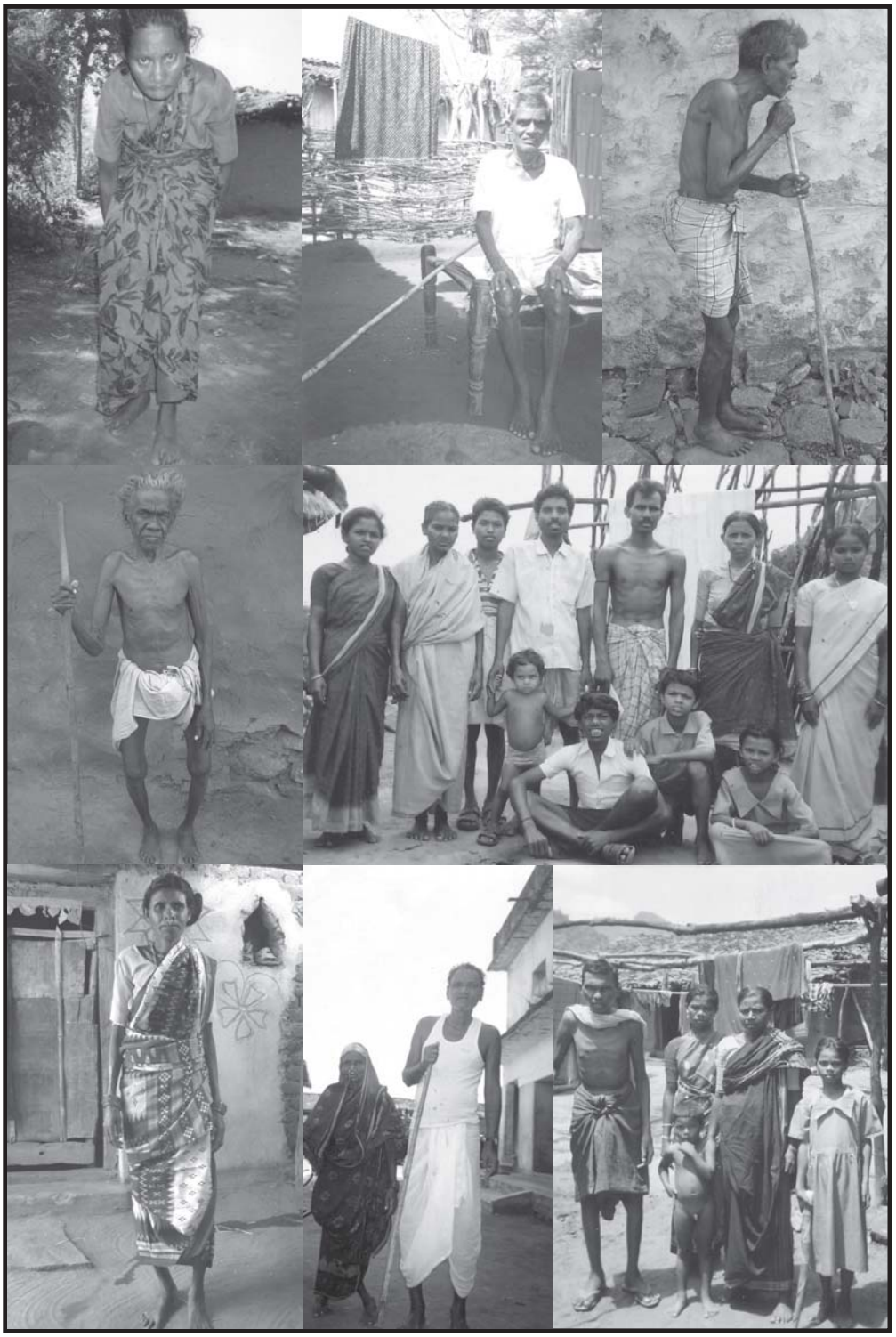
With the increase in bioaccumulation of fluoride in bone with the advancement of age, there are chances of appearance of skeletal fluorosis. Skeletal fluorosis leads to severe and permanent bone and joint deformities. It causes pain and stiffness in the joints and cripples a person. It is primarily associated with the consumption of drinking-water containing high levels of fluoride; but exposure to additional sources of fluoride such as high-fluoride coal can also be a potential reason for it. The problem is compounded by a number of other factors including climate, water consumption, nutritional status and diet, additional sources of fluoride and exposure to other substances that modify the absorption of fluoride into the body. Crippling skeletal fluorosis, which is associated with higher levels of exposure to fluoride, can result in osteosclerosis, ligamentous and tendinous calcification and extreme bone deformity. Evidence from occupational exposure also indicates that exposure to higher concentrations of fluoride in the air may also be a cause of skeletal fluorosis.

Clinical Symptoms

- Severe pain and stiffness in the backbone
- Severe pain and stiffness in joints
- Severe pain and rigidity in the hip region
- X-ray:- Increased girth/thickening and density of bone, besides calcification of ligaments.
- Constriction of vertebral canal and inter-vertebral foramen pressure on nerves
- Deformities in limbs
- Hunch back
- Paralysis
- Muscular wasting
- Premature aging

A person from Ichhapalli village of Baragarh district suffering stiffness and pain in backbone due to fluoride

Victims of skeletal fluorosis



Non-skeletal Fluorosis

This kind of fluorosis is often overlooked because of the wrong prevailing notion that fluoride affects only bone and teeth. Non-skeletal fluorosis can lead to gastro-intestinal problems and neurological disorders. The pre-skeletal stage of fluoride intoxication poses problems for diagnosis. Moreover, the symptoms that are manifested are so varied that they may be identified with those of various other diseases. The complaints of the victims in such cases are so commonplace that they may be easily mistaken for those resulting from other ailments; for example, muscle/neurological involvement in children may be mistaken for Poliomyelitis.

- Neurological Manifestations.
- Muscular Manifestations
- Allergic Manifestations
- Gastro-intestinal Problems
- Urinary Tract Manifestations.
- Headache

Neurological manifestations

- Nervousness and Depression
- Tingling sensation in fingers and toes
- Excessive thirst and tendency to urinate frequently
- Control by brain appears to be adversely affected

Muscular manifestations

- Muscle Weakness and stiffness
- Pain in the muscles and loss of muscle power

Allergic manifestations

- Very painful skin rashes, which are perivascular inflammation. Prevalent in women and children.
- Pinkish red or bluish red spots, round or oval in shape, appear on the skin that fade and clear up within 7-10 days.

Gastro - intestinal problems

- Acute abdominal pain
- Diarrohea
- Constipation
- Blood in Stool

- Bloated feeling (Gas)
- Tenderness in Stomach
- Feeling of nausea
- Mouth sores

Urinary tract manifestations

- Urine may be much less in volume
- Yellow/ red in colour
- Itching in the region of axilla.

The health impact of fluorosis is different for different age groups. Depending upon its general symptoms for different age groups, it may be further classified into:

1) Primary fluorosis
2) Secondary fluorosis and
3) Tertiary fluorosis

Primary fluorosis

When a person ingests excess amount of F- water supported by F- vegetation for a period of 10-15 years, primary fluorosis takes place. The symptoms of the disease are graying of hair, decreasing visual power, bended vertebral column, horizontal lines on teeth, curved foot, abdominal pain etc. Primary fluorosis generally occurs in the age group of 40-70 and advances the process of gerontology. Comparatively speaking, women are afflicted with the disease in greater numbers than men.

Secondary Fluorosis

Secondary fluorosis is seen in a person when he/she has ingested higher F- contaminated water and food since his/her birth. The symptoms are more severe in the age group of 20-40. They not only report muscular pain but also pain in the bone. The total body experiences severe pain and the victim cannot stand erect, touch their chick with chest or touch his/her cheek with his/her fingers in the standing posture. There is loss of epidermal hair from most of the body surface. The most important problem though is sociological in nature since most of the victims give birth to handicapped (physically or mentally) children. The people of other areas don't want to marry their sons or

daughters in villages affected by fluorosis. The disease also severely affects the sex life of the victims.

Tertiary fluorosis

The victims of tertiary fluorosis are generally youth in the 1-20 age group, who ingest high doses of fluoride from surrounding water, F-food, F-vegetables, breast milk and flesh of animal – all of which contain fluoride in varying degrees. Most children afflicted with the malaise do not go to school, while 8% of school-going children bear a hump on their back. They have a bent physique and their HRD index is low. Dental fluorosis is common, but the percentage of lethality is maximum.

Fluorosis is also associated with several other impacts on health. They are as follows:

Fluoride and Red Blood Corpuscles (RBCs)

It is now known that when fluoride is ingested, it accumulates on the erythrocyte membrane which, in turn, loses its calcium content. This change causes formation of echinocytes. The life span of echinocytes is less than the normal life span of RBC and hence early destruction of the RBCs causes anemia. A unique feature of the disease is that soft tissues like ligaments and blood vessels tend to harden and calcify and blood vessels are blocked.

Fluoride stimulates granule formation and oxygen consumption in white blood cells. It depletes the ability of white blood cells to properly destroy foreign agents

by the process of phagocytosis. It also inhibits antibody formation in the blood.

Fluoride and Cancer

Fluorides are known to cause chromosome damage and mutations and are therefore considered possible carcinogens. A majority of studies on the correlations between fluoride exposure and deaths from various causes, including cancer, have focused on fluoride exposure via drinking water. Fluoride promotes development of bone cancer.

Fluoride and Mutagenicity

Chromosome damage has been observed in a variety of mammalian cell types. It is believed that these effects are due to interference with protein synthesis rather than a result of any direct interaction between fluoride and DNA.

Fluoride and thyroid

Fluoride depresses thyroid activity. It has an inhibitory effect on iodine uptake. It has been observed that in high iodine and high fluorine areas, the prevalence rate of thyroid enlargement among inhabitants of all ages was 3.8%, while that among children was 29.8%.

Fluoride and diabetes

Reports obtained from several studies observed that chronic fluoride toxicity in humans could result in significant abnormalities in glucose tolerance, which is reversible on removal of the excess fluoride.

Fluorosis and lactation

Fluoride inhibits lactation in mammals. During chronic fluorosis, serum prolactin level decreases. Mother's milk in fluoride infested areas is also contaminated by fluoride.

Fluoride and reproductive behaviour

Fluoride exerts adverse impacts on the morphology of sex organs and reproductive physiology in both males and females, if the doses are greater than 4 to 5 mg/kg body weight per day for varying periods, either orally or by injection. There is a

decrease in plasma F- concentration in the mother's blood during human pregnancy;

Fluoride and mental efficiency

Excessive fluoride intake since early childhood reduces mental work capacity (MWC) and hair zinc content. The effect on zinc metabolism due to excessive intake of fluoride influences MWC. Excessive fluoride intake decreases 5-hydroxy-indole acetic acid and increases norepinephrine in brain.

Fluoride and kidney

Healthy kidneys excrete 50 to 60% of the ingested fluoride. The fluoride content of urine has been suggested as an index of animal exposure and as a diagnostic test for humans in cases of chronic exposure to fluoride.

Fluoride and Bone

Fluoride accumulation in bone might occur less rapidly as the fluoride content of bone increases.

The development of fluoride toxicity depends upon

1) The availability and level of the ingested fluoride
2) The period of time involved
3) Skeletal retentions
4) The age of the animal
5) Physiological stress
6) The effectiveness of the immune system

Lethal dose

The lethal dose of fluoride for man is probably about 5 g as NaF. Fluorosis is a preventable crippling disease. No effective therapeutic agent, which can cure fluorosis, is available right now.

□□

FLUORIDE CONTAMINATION IN ORISSA

The incidence of fluorosis has been reported in 28 countries of the world, including India. The countries affected by it are India, China, USA, Italy, Holland, Spain, France, Germany, Switzerland, Japan, Thailand , Pakistan, Bangladesh, Argentina, Morocco, Middle East countries, Japan, South African Countries, New Zealand, Sri Lanka, West Indies, Spain, Holland, Italy, Mexico, and North and South American countries.

The states with a high prevalence rate of fluoride in India are Assam, Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, West Bengal, Uttar Pradesh and New Delhi.

Around 70 million people in the world suffer from incapacitating skeletal fluorosis. This excludes the 20 million dental fluorosis patients. It has been estimated that nearly 25 million people in India are already affected by fluoride while over 66 million more, including 7 million children, in 20 states of the country are susceptible to it.

Out of the total of 569 districts of India, 205 (36%) have fluoride contamination in their drinking water. Fluoride contamination in the drinking water of these districts is mostly geogenic in nature though there are a few pockets where alumina, phosphate and fertilizers industries are the culprit.

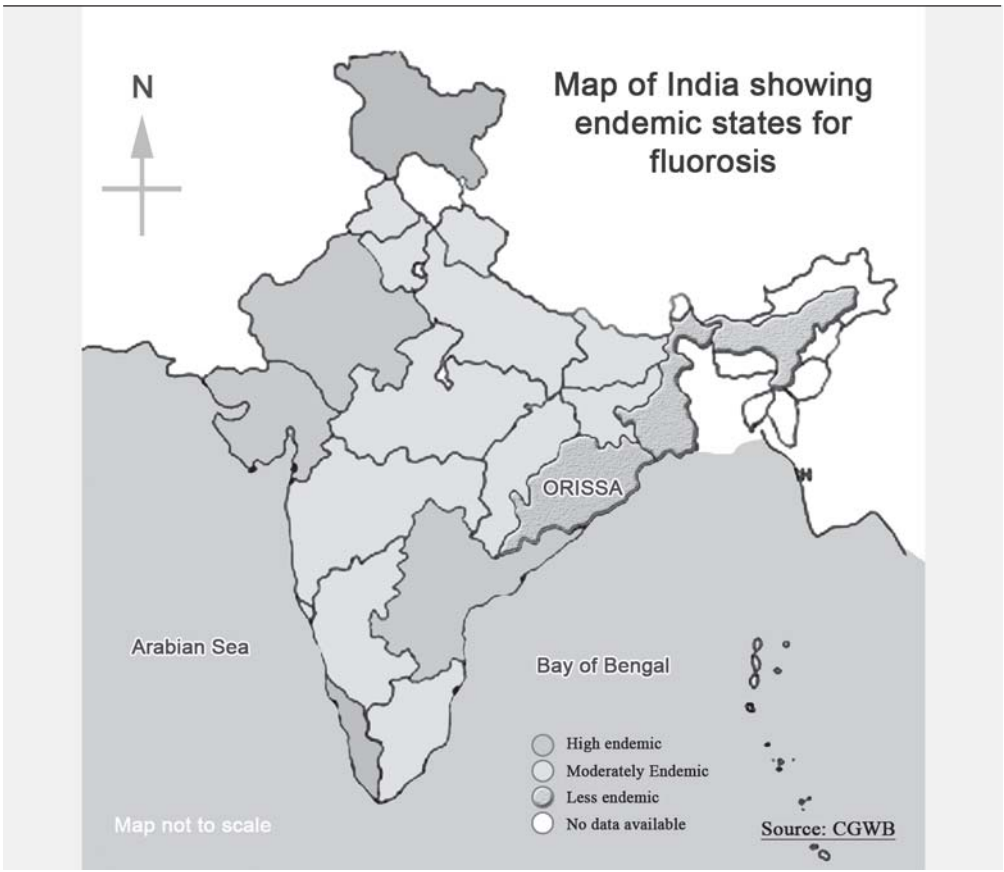
As per the records of the Central Ground Water Board (CGWB), Government Of India, all districts of Rajasthan, 15 districts of Andhra Pradesh, 27 districts each of Orissa and Gujarat, 18 districts of Uttar Pradesh, 13 districts of Punjab, 12 districts each of Karnataka and Haryana and 10 districts each of Madhya Pradesh and Maharashtra have high fluoride concentration (above the permissible limits) in their hydrograph stations.

Fluoride endemicity wrongly represented?

The map of India given below shows us the distribution of fluoride pockets in India under three categories; high endemic, moderate endemic and less endemic. As is clear from the map, Gujarat, Rajasthan and Andhra Pradesh come under the high endemic category while Orissa is less endemic.

But the situation on the ground is quite different. The classification in the map is based on the percentage of districts affected by fluoride. If less than 30 % of the districts are affected by fluoride contamination, a state comes under less endemic category. As per latest available data, 27 out of the 30 districts in Orissa have high concentrations of fluoride, which should put the state in the high endemic category. Clearly, the CGWB map needs to be updated.

The actual picture of fluoride endemicity and the percentage of district affected are as follows:



Fluorosis endemic States in India

Sl. No	Name of the State	% of Dists. affected
1	Rajasthan	100
2	Sikkim	100
3	Gujarat	96
4	Orissa	90
5	Punjab	76.47
6	Andhra Pradesh	68.18
7	Haryana	63.15
8	Karnataka	42.85
9	Maharashtra	34.48
10	New Delhi	33.33
11	Tamil Nadu	27.58
12	Uttar Pradesh	25.71
13	West Bengal	23.52
14	Kerala	21.42
15	Madhya Pradesh	20.83
16	Jharkhand	13.63
17	Jammu & Kashmir	12.5
18	Chhattisgarh	12.5
19	Bihar	10.52
20	Assam	8.69

Fluoride is the second major contaminant in India

As per information made available by the Department of Drinking Water Supply, Ministry of Rural Development, Government of India, there are a total of 15, 99, 430 habitations in the country, out of which 29, 065 habitations have fluoride contamination in their drinking water sources. The six contaminants affecting

drinking water quality and their percentages as per the habitation survey carried out by the department in 2003 are as follows:

Contaminant	No. of Habitations	% of Contamination
Iron	42, 788	41.66
Arsenic	3, 863	3.76
Fluoride	**29, 065**	**28.30**
Nitrates	7, 296	7.10
Salinity	19, 576	19.06
Sulphates	108	0.10
Total	**1, 02, 696**	**100.00**

As is clear from the box above, fluoride, at 28.30%, is the second major contaminant in drinking water – next only to iron (41.66%) - in India. Though both iron and fluoride have an adverse impact on human body, fluoride is considerably more hazardous since it leads to fluorosis, a dreaded, incurable disease.

The Central Ground Water Board, India has divided the states of the country into 6 hydrographical zones: east, west, north, south, central and north-east. Orissa is included under the east zone, along with West Bengal, Bihar, Jharkhand and Sikkim, The western zone, which includes Rajasthan, Gujarat and Maharashtra, is the worst affected, followed by north zone. The eastern zone has a share of about 19.51 % of fluoride contaminated hydrograph stations.

Name of the Districts with Fluoride contaminated Ground Water

State	Districts
Andhra Pradesh	Adilabad, Anantapur, Chitoor, Kadapa, East Godavari, Guntur, Karimnagar, Khammam, Krishna, Kurnol, Medak, Mahaboobnagar, Nalgonda, Nellore, Nizamabad, Prakasam, Rangareddy, Srikakulum, Vijaynagaram, Visakhapatnam, Warrangal and West Godavari.
Assam	Karbi Anglog, Nagaon
Bihar	Daltonganj, Gaya, Rohtas, Gopalganj
Chhattisgarh	Raipur, Rajnandgaon

Gujurat	Ahemadabad, Amveli, Anand, Banaskantha, Bharuch, Bhavnagar, The Dangs, Dohad, Gandhinagar, Jamnagar, Junagarh, Panchamahals, Patun. Porbunder, Rajkot, Sabarkantha, Surat, Surendra Nagar, Vadodara and Valsad
Haryana	Rewari, Faridabad, Karnal, Sonepat, Bhind, Gurgaon, Mohindergarh, Rohtak, Kurukshetra, Kaithal, Bhiwani, Sirsa
Jammu & Kashmir	Doda
Jharkhand	Palamu, Giridh, Paschim Singhbhum
Karnatak	Dharwad, Gadag, Bellary, Raichur, Bijapur, Gulbarga, Chinadurga, Tumkur, Chikmagalur, Mandya, Bangalore rural, Mysore.
Kerala	Palaghat, Allepey, Ernakulum
Madhya Pradesh	Shivpuri, Jhabua, Mandla, Dindari, Chhindwada, Dhar, Vidisha, Sconi, Schore, Raisen
Maharastra	Chandrapur, Bhandara, Nagpur, Jalgaon, Bulunda, Amravati, Akola, Yavatmal, Nanded, Sholapur
Orissa	Puri, Khurda, Nuapada, Bargarh, Kalahandi, Jajpur, Bolangir, Dhenkanal, Deogarh, Jharsuguda, Phulbani, Kendrapara, Angul, Nayagarh, Boudh, Balasore, Bhadrak, Cuttack, Sundaragh, Ganjam, Gajapati, Jagatsinghpur, Keonjhar, Nabarangpur, Mayurbhanj
Punjab	Mansa, Faridkot, Bhatinda, Muktasar, Moga, Sangrur, Ferozepur, Ludhiana, Amritsar, Patiala, Ropar, Jalandhar, Fategarhabib
Rajasthan	Ajmer, Alwar, Banswara, Baran, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Chura, Dausa, Dholpur, Dungarpur, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalore, Jhalawar, Jhunjhunu, Jodhpur, Karauli, Kota, Nagpur, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirohi, Tonk, Udaipur.

Tamil Nadu	Salem, Erode, Dharampuri, Coimbatore, Tiruchirapalli, Vellore, Madurai, Virudunagar
Uttar Pradesh	Urimano, Agra, Meerut, Mathura, Aligarh, Raibareilly, Allahabad
West Bengal	Birbhum, Vardhaman, Purulia, Bankura.
Delhi	Kanjhawala, Najafgarh, Alipur

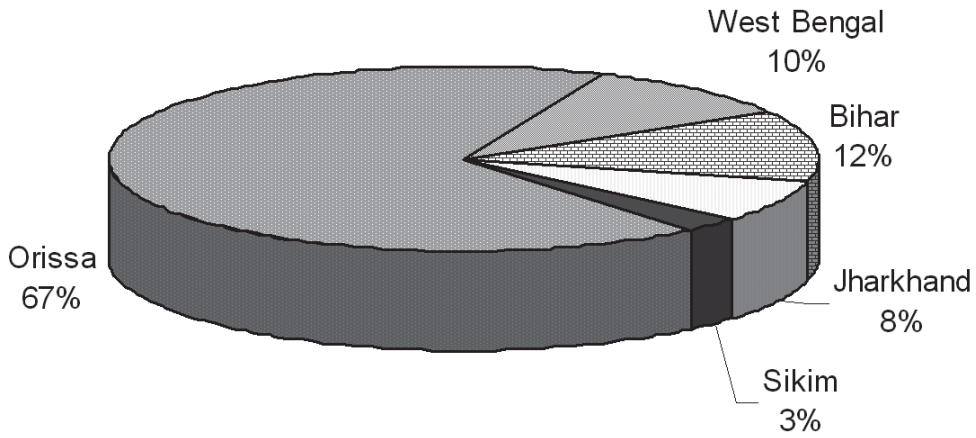
Zonal Distributation of Fluoride

Sl.No.	Zone	Name of the states	Fluoride contaminated hydrograph stations (in %)
1	East	Orissa, West Bengal, Bihar, Jharkhand, Sikkim	19.51
2	South	Andhra Pradesh, Kerala, Tamil Nadu, Karnataka & Goa	18.53
3	West	Rajasthan, Gujarat & Maharashtra	32.19
4	Central	Madhya Pradesh & Chhattisgarh	5.85
5	North	Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Uttar Pradesh & Uttaranchal	22.92
6	North East	Arunacha Pradesh, Assam, Nagaland, Manipur, Mizoram, Meghalaya & Tripura	0.97

When we observe the total number of hydrograph stations affected by fluoride in the eastern zone, we see that fluoride contaminated hydrograph stations of Orissa contribute a lion's share i.e. 67.5% of the entire zone, followed by Bihar and West Bengal respectively. Since hydrograph stations represent the total water quality status of a state and other hydro-geological parameters of ground water, including ground water development and soil profile of the region, the above table clearly establishes that the state of Orissa is the worst sufferer of fluoride

contamination in the eastern region of the country. The distribution of fluoride among the states in the eastern zone are as follows.

Fluoride distribution in Eastern Zone



The state of Orissa is again divided into 5 physiographical sites: coastal plains, northern uplands, erosional plains of Mahanadi and other valleys, south eastern hilly region and subdued plateau. The name of the districts under different physiographical sites are as follows:

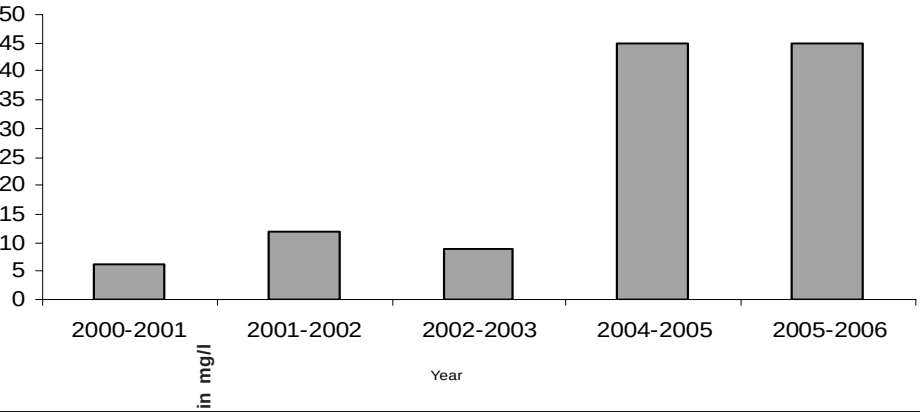
Sl. No	Physiographical site	Name of the Districts Covered
1	Coastal Plains	Ganjam, Puri, Cuttack & Balasore
2	Northern Uplands	Mayurbhanj, Keonjhar, Sundargarh, Angul
3	The erosional plains of Mahanadi & other Valleys	Sambalpur, Bargarh, Deogarh, Jharsuguda, Bolangir, Sonepur, Boudh, Phulbani & Dhenkanal,
4	South Western hilly	Phulbani, Ganjam, Koraput (Part)
5	Subdued Plateau	Kalahandi, Nuapada, Koraput, Malkanigiri, Raygada & Nowrangpur

All hydrograph stations are not monitored

There are a total of 1, 068 hydrograph stations in the state for monitoring of ground water quality by the Central Ground Water Boar (CGWB). If we analyse the year books of CGWB for the following years, it is evident that it has not been able to monitor all the hydrograph stations of the state in any year. Thus, the clear picture of ground water quality is not properly reflected in the year book.

Year	Total no. of Hydrograph stations monitored	No. of F-contaminated hydrograph stations	F-contaminated hydrograph stations (in %)
2000-2001	886	95	10.72
2001-2002	889	85	9.56
2002-2003	735	80	10.88
2004-2005	710	70	9.85
2005-2006	723	71	9.82
Total	**1068**	**207**	**19.56**

Highest Fluoride concentration as reported by CGWB



ntration of fluoride
h station of Boudh
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Badlasasan of Khurda district had highest fluoride concentration the following year. In 2004-2005 and 20005-2006, the hydrograph station in Deokananpur in Sundargarh district recorded the highest contamination of fluoride. Fluoride concentration in this hydrograph station in both these years was unbelievably high i.e 45 mg/l. This hydrograph station is located in the High school premises of the Deokananpur village.

The CGWB had tested the water quality of the same hydrograph station in 2001-2002 and found the fluoride level was just 0.17mg/l. In other words, fluoride concentration increased by more than 250 times in just 2 year!

In Badlasasan, it was 8.98 in 2002-2003. The CGWB did not test the water quality of the hydrograph station in the following years. The same is the case in Pratapramchandrapur of Puri district. It reported an all time high level of fluoride concentration, i.e. 12 mg/l, in 2001-2001. But the water quality of this hydrograph station has not been tested in the subsequent years.

There are a lot of examples of hydrograph stations contaminated with fluoride in a particular year not being tested the next year. Hence, it can be safely said that CGWB data give a completely misleading picture of not just the fluoride situation in the state, but also about the general quality of the ground water.

Hydrograph station	2000-01	2001-02	2002-03	2004-05	2005-06
Chhatarang	6.26	3.2	NT	NT	NT*
Pratapramchandrapur	NT	12	NT	NT	NT
Badlasasan	NT	3.24	8.98	NT	NT
Deokananpur	NT	0.17	NT	45.00	45.00

** NT : Not tested*

In Orissa, drinking water in 27 districts is heavily contaminated with fluoride. The districts are; Puri, Khurda, Nuapada, Bargarh, Kalahandi, Jajpur, Bolangir, Dhenkanal, Deogarh, Jharsuguda, Phulbani, Kendrapara, Angul, Nayagarh, Boudh, Balasore, Bhadrak, Cuttack, Sundaragh, Ganjam, Gajapati, Jagatsinghpur, Keonjhar and Nabarangpur.

Habitation Survey of India

The Habitation Survey of India samples and analyzes the water quality of different habitations in the state periodically. The last year for which the findings are available was 2003. But interestingly, the 2003 survey report gives three sets of figures updated for three years – 2000, 2003 and 2005! As per the report, 206 habitations in the state were fluoride contaminated in 2000. In 2003, fluoride was identified in 101 habitations and in 2005, the number of fluoride contaminated habitations went up to 204. The findings beg the question: how come data for the year 2005 were known two years beforehand in 2003?

There is another problem with the data contained in the 2003 survey. A perusal of the findings of the survey reveals that some new habitations were taken up for testing afresh while a few of the previously tested habitations were tested again during the three years – 2000, 2003 and 2005 – when the survey was presumably carried out. Since it is difficult to get a correct picture of the situation from the data available for the three said years, we decided to compile and analyze the water quality data for all these three years and concluded that 347 habitations in the state were fluoride contaminated as per the habitation survey.

Total no. of Habitation in the state	139338
No. of Fluoride Identified habitation in 2000	206
No. of Fluoride Identified habitation in 2003	101
No. of Fluoride Identified habitation in 2005	204
Total no. of Fluoride Identified habitations in the state (Up to 1st Apr. 2005)	**347**
Percentage of total no. of Fluoride Identified habitations in Orissa (As per Habitation Survey)	**0.24 %**

Another problem with the habitation survey report is the fact that it contains data for just 18 of the 30 districts in the state. Data for the rest 12 were not available, according to the survey report. Among the districts for which data was available, the worst affected was Nuapada with 158 of its habitations contaminated with fluoride. It was followed by Khurda, where 64 habitations were found contaminated and then Nayagarh with 53. Only one habitation each was found contaminated with fluoride in Dhenkanal, Jajpur, Kandhamal, Malkangiri and Sundargarh districts.

Rural Water Supply & Sanitation (RWS&S)

The Rural Water Supply and Sanitation (RWS&S) department is the nodal agency of the Government of Orissa for supply of drinking water to both rural and urban households. It supplies water through tube wells, sanitary wells, bore wells, deep bore wells and piped water from nearby river and rivulet.

As drinking water has been accorded top priority in water policies over the years due to its direct impact on the health of both human beings and animals, this department has been entrusted with the task of constantly monitoring the water quality to ensure that the supplied water is potable.

This department has its own laboratories at district headquarters to ensure quality in drinking water on a regular basis. But unfortunately, 60 years after independence and 17 years after its new incarnation as Rural Water Supply and Sanitation (this was with effect from 1st July 1990), it has yet to establish laboratories in all district headquarters. The few that are in existence are not equipped with essential equipment like Orion ion meter or atomic absorption Spectrophotometer to quantify toxic elements.

With the hand over of drinking water sources in rural areas to the panchayats, the department is washing its hand off its responsibility to ensure water quality on the specious plea that after the hand-over, it is now the responsibility of the Panchayati Raj Institutions (PRIs). But it conveniently hides the fact that it had failed to hand over the water quality report of tube wells at the time of handing them over to the PRIs as decided by the government. The hand over process was completed by 20th October 2006.

Government guidelines clearly laid down that while digging a new tube well, its water quality has to be tested and the public informed about it before handing it over to the community. But there is not a single instance in the state where RWS&S engineers are testing the water quality while commissioning a new tube well. Periodic monitoring of water quality, as required under the guidelines, is conspicuous by its absence. The department is extremely wary of disseminating information on water quality and is forced to admit quality related problems only after the situation gets out of hands. When its hands are forced, it rushes to the affected site with a billboard with the warning; "This water is not suitable for drinking" and plants it there without bothering to provide any alternative safe drinking water source. Of course, there are stray pockets where the department does intervene periodically, but mostly due to political compulsions. There are other compul-

sions as well. In a few instances, the department is forced to act because that particular cluster has been hailed as a 'success story' in departmental or government literature - forgetting that the same institution has the task of ensuring potable water supply throughout the state and not just in a few pockets.

The staff of Center for Water for Life (CWL) have taken great pains and battled departmental stonewalling to collect information about drinking water quality in the state. The information collected, compiled and updated up to 30th Sept 2007 by CWL is as follows:

State at a glance *

Total No. of Districts in the state	30
Total No. of block in the state	314
Total No. of Gram panchayats in the state	6270
Total No. of Villages in the state	47126
Total No. of habitations in the state	139748
Totasl no. of fluoride affected districts	27
Percentage of the districts affected	90
Total no. of fluoride affected blocks	150
Percentage of blocks affected	47.77
Total no. of fluoride affected gram panchayats	566
Percentage of gram panchayats affected	9.03
Total no.of fluoride affected villages	1216
Percentage of villages affected	2.58
Total no. of fluoride affected habitations	2097
Percentage of habitations affected	1.50

RWS&S departments *

Total no. of tube wells	211037
Total no. of existing tube wells	217561
No. of missing tube wells	6524
Total no. tube wells where water quality has been tested	40598
Percentage of tube wells where water quality has been tested	18.66

No. of tube wells tested for fluoride	18318
No. of tube wells identified as fluoride contaminated	2784
Total percentage of tube wells tested for fluoride	8.41
Percentage of tube wells tested for fluoride out of the total number of water sources tested	53.36
Percentage of fluoride identified sources out of sources tested for fluoride	15.19

* *Source: RCDC Centre for Water for Life, Bhubaneswar*

Name of Blocks with Fluoride contaminated Ground Water

District	Affected Blocks
Angul	Angul, Athmallick, Banarpal, Chendipada, Kaniha, Talcher, Pallahara
Balasore	Balasore, Remuna, Basta, Bhogarai
Bargarh	Barpali, Bijepur, Attabira, Bheden, Gaisilet, Paikmal, Bargarh, Jharbandh, Sohella, Padmapur
Bhadrak	Bant, Chandabali
Bolangir	Agalpur, Bolangir, Belpara, Bongamunda, Gudvella, Khaprakhol, Patnagarh, Saintala, Loisingha, Muribahal, Deogaon, Puintala, Titlagarh
Boudh	Boudh, Harbhanga, Kantamal
Cuttack	Athgarh, Baramba, Narsinghpur, Tangi-Chowdar, Kantapara, Mahanga, Niali , Banki
Deogarh	Barkote, Riamal
Dhenkanal	Dhenkanal, Parjang, Kamakhyanagar
Gajapati	Kashinagar, Mohana, Paralakhemundi
Ganjam	Buguda, Sorada, Kukudahandi, Jagannathprasad, Khallikote, Seragarh, Belaguntha, Brahmapur, Hinjilikatu and Rangeilunda

Jagatsinghpur	Raghunathpur, Tirtol, Balikuda, Borikina, Earsama
Jajpur	Bari, Badachana, Dharmasala, Sukinda, Binjharpur, Dasrathpur, Rasulpur, Jajpur
Jharsuguda	Jharsuguda, Laikera
Kalahandi	Bhawanipatna, Golamunda, Junagarh, Koksara, Lanjigarh, Kalampur, Jaipatna, Dharamgarh, Narla, Thuamul Rampur, Kesinga
Kandhamal	Daringibadi, Firingia
Kendrapara	Kendrapara, Rajnagar, Aul, Derabis
Keonjhar	Ghasipura, Patna
Khurda	Balianta, Jatni, Balipatna, Banpur, Begunia, Bhubaneswar, Bolgarh, Chilika,and Khurda
Malkangiri	Kalimela, Korukonda
Mayurbhanj	Udala, Saraskana, Kaptipada, Khunta
Nuapada	Nuapara, Komna, Boden, Khariar,Sinapali
Nayagarh	Dasapalla, Bhapur, Nayagarh, Nuagaon, Odagaon, Gania, Khandapara, Ranapur
Puri	Brahmagiri, Gop, Kanas, Krushnaprasad, Puri, Nimapara, Pipili, Satyabadi
Sambalpur	Dhanakauda, Maneswar
Subarnapur	Sonepur, Tarbha
Sundargarh	Sabdega, Balisankara, Bisra, Kuanrmunda, Kinjirikela, Badgaon

District-wise distribution of fluoride contaminated habitations

Sl No	District	Affected Blocks	Affected G Ps	Affected Villages	Affected Habitations
1	Angul	7	12	22	22
2	Baleswar	4	5	5	5
3	Bolangir	13	55	116	348
4	Bargarh	10	72	153	47
5	Boudh	3	8	20	55
6	Bhadrak	2	2	2	2
7	Cuttack	8	17	17	17
8	Dhenkanal	4	6	6	6
9	Deogarh	2	2	2	2
10	Ganjam	10	15	15	15
11	Gajapati	3	4	4	4
12	Jagatsinghpur	5	11	11	11
13	Jajpur	8	28	100	166
14	Jharsuguda	2	4	4	4
15	Kalahandi	11	24	25	25
16	Khurda	9	64	163	313
17	Koraput	0	0	0	0
18	Keonjhar	2	11	14	15
19	Kendrapara	4	5	5	5
20	Kandhamal	2			4
21	Mayurbhanj	4	11	16	17
22	Malkangiri	2	2	2	2
23	Nabarangpur	0	0	0	0
24	Nuapada	5	73	247	398
25	Nayagarh	8	93	222	549
26	Puri	8	18	18	24
27	Rayagada	0	0	0	0
28	Sambalpur	5	17	22	36
29	Sonepur	4	9	10	11
30	Sundargarh	5	6	6	6
Total		**150**	**574**	**1227**	**2109**

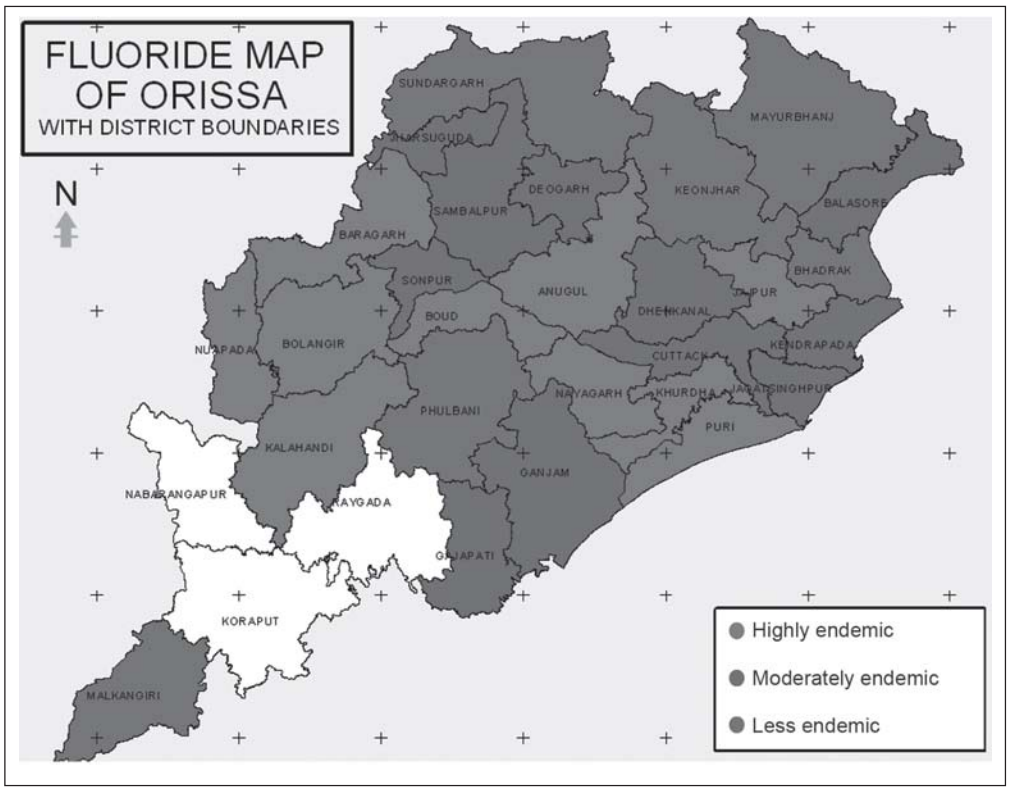
District-wise distribution of fluoride concentration

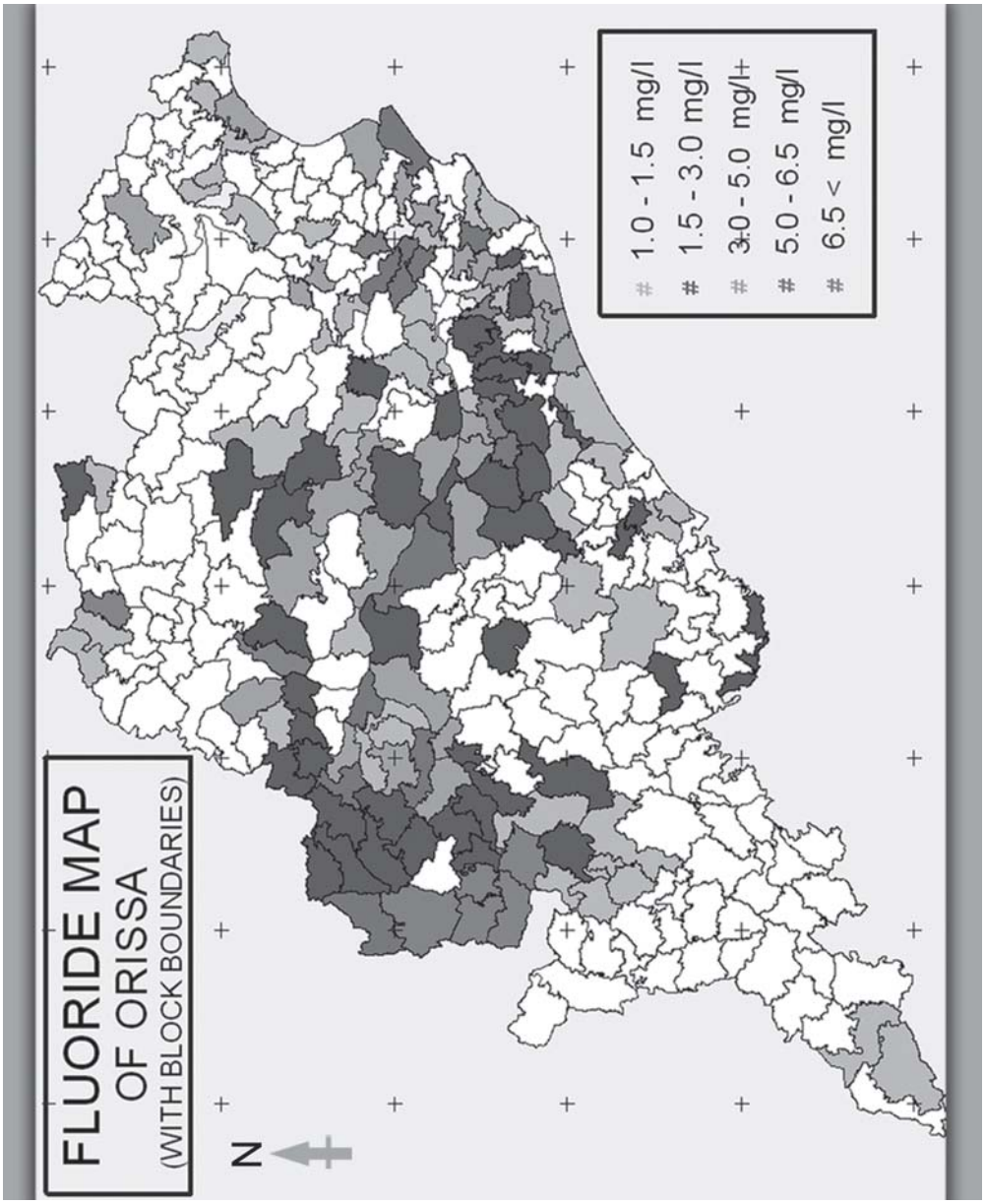
Sl. No	District	1-1.5	1.5-3.0	3.0 -5.0	5.0-6.5	6.5 <	Total
1	Angul	5	12	5	0	0	22
2	Baleswar	3	0	2	0	0	5
3	Bolangir	96	97	17	1	0	211
4	Bargarh	327	76	1	2	0	406
5	Boudh	16	33	4	2		55
6	Bhadrak	1	0	1	0	0	2
7	Cuttack	8	2	2	1	0	13
8	Dhenkanal	4	1	0	0	0	5
9	Deogarh	0	2	0	0	0	2
10	Ganjam	9	4	0	0	0	13
11	Gajapati	1	2	0	0	0	3
12	Jagatsinghpur	4	0	3	1	0	8
13	Jajpur	61	98	3	2	2	166
14	Jharsuguda	4	0	0	0	0	4
15	Kalahandi	14	10	0	0	1	25
16	Khurda	200	107	3	1	2	313
18	Keonjhar	3	1	11	0	0	15
19	Kendrapara	2	0	2	1	0	5
20	Kandhamal	0	0	0	0	0	0
21	Mayurbhanj	15	3	1	0	0	19
22	Malkangiri	2	0	0	0	0	2
24	Nuapada	261	470	130	25	6	892
25	Nayagarh	400	139	8	2	0	549
26	Puri	5	6	4	0	0	15
28	Sambalpur	2	32	1	0	1	36
29	Sonepur	2	0	1	1	0	4
30	Sundargarh	5	0	0	0	1	6
Total		**1450**	**1095**	**199**	**39**	**13**	**2796**

- Based on the number of blocks affected in the district, the state can be divided into 3 endemic zones.
- Highly endemic: More than 70% blocks are affected
- Moderately endemic: 30-70% blocks are affected
- Less endemic: Less than 30% of the blocks affected.

The distribution of districts under the three categories is as follows:

Highly endemic	Moderately endemic	Less endemic
Angul, Bolangir, Bargarh, Boudh, Jajpur, Kalahandi, Khurda, Nayagarh, Nuapada and Puri	Balasore, Cuttack, Dhenkanal, Ganjam, Gajapati, Jagatsinghpur, Jharsuguda, Kendrapara Sambalpur and Sonepur	Bhadrak, Keojhar Kandhamal, Mayurbhanj and Sundergarh




FLUORIDE MAP
OF ORISSA
(WITH BLOCK BOUNDARIES)
N
1.0 - 1.5 mg/l
1.5 - 3.0 mg/l
3.0 - 5.0 mg/l
5.0 - 6.5 mg/l
6.5 < mg/l

□□

IMPACT OF FLUOROSIS IN ORISSA

Lack of reliable data makes it extremely difficult to assess the magnitude and the impact of the crippling and incurable disease called fluorosis in India. What is, however, known is that fluoride contamination affects 15 States of the country. Fluoride levels are high in Andhra Pradesh, Gujarat, Haryana, Karnataka, Rajasthan and Orissa. An estimated 66 million people in India consume ground water with unsafe levels of fluoride. Due to the earth's crust being extremely rich in fluoride bearing minerals, ground water at many places is naturally fluoridated. The maximum fluoride content recorded in drinking water is 38.5 ppm (mg/liter).

Though India has been grappling with fluorosis for over 50 years, precious little has been done so far to find a solution to the problem. The Govt. of India did launch the "National Drinking Water Mission" and the Sub-Mission for eradication of the fluoride problem with great fanfare in 1986. But not much appears to have been achieved by the Mission as evidenced by the rapid spread of fluoride contamination throughout the country.

The fluoride problem has assumed serious proportions in several areas of Orissa. Drinking water in many villages of Angul, Khurda, Puri, Nayagarh, Boudh, Kandhamal, Bolangir, Bargarh and Nuapada districts is contaminated with excessive quantities of fluoride. The situation is particularly alarming in Balsingh-Singhpur in Khurda district, Karlakote in Nuapada district, Gohiriapadar in Kalahandi district and Krushakpalli in Bargarh district.

Anthropogenic Fluoride in Angul

Surface and ground water in Angul district in Orissa have been found to be contaminated by fluoride. In the absence of organized water supply, people depend on ponds, tube wells and dug wells to meet their water needs. The untreated waste water contaminated with fluoride discharged from industrial units are either allowed to accumulate in the lagoon or discharged to the river without adequate treatment. As a result, ground water gets contaminated by percolation through the soil. According to a study done by CPCB, Kolkata, 57% of tube wells and

67% of dug wells in the district are affected by fluoride. About 10% of tube wells and dug wells were found to have fluoride concentration of more than 1 mg/l. It was also observed that the level of fluoride in pond water varied from 0.49 to 3.70 mg/l. The contamination of pond water may be due to deposit of airborne particles containing fluorides emitted from the industrial units. A large number of villagers reported fluoride induced symptoms like pain in the lower leg. While Angul is among the worst affected, there are other districts where the problem has assumed serious proportions.

Balsingh-Singhpur: At tether's end

In 1987-88, the people of the twin villages of Balsingh and Singhpur in Khurda district started suffering from a mysterious disease. Some of them even died of the disease. The people got panicky. The affected people made a beeline for the primary health centre (PHC) at Bankoi, where it was revealed that the killer disease was nothing but fluorosis.

In 1989, the district administration started supplying piped water to the two villages. But soon, it was found that even this water had a heavy concentration of fluoride. But the administration washed its hands off this time. It was not until 2002 that the slumber of the administration broke. At a meeting presided over by the then Khurda Collector, Madhusudan Padhi on June 27 that year, it was decided to relocate the two villages at nearby Jogimundia. As per the decision taken at the meeting, those with land in the two villages were to be given compensatory land at the new place and 47 houses constructed under the Indira Awas Yojana for the landless. It was also decided that the CDMO, Khurda and officials of the RWSS would visit the village and suggest measures to fight the menace. The test reports of the village water sources were startling. They revealed that fluoride level in the water in the village tube wells was 3.18 mg/l while it was as high as 7.10 mg/l and 10.55 mg/l in the water in the open wells and ponds. Another meeting was convened on Oct 4, 2002 where it was decided to expedite the relocation of the two villages. But it did not materialize as the land in question was locked up in litigation. On June 13, 2003, the then Revenue minister Biswa Bhusan Harichandan distributed land *patta*s to 88 of the 197 families in the two villages. Ironically, 30 of the intended beneficiaries had died by then.

Four years down the line, the people of the two villages are still without a safe source of drinking water. Several options have been explored, but to no avail. With all water sources in the village sealed, the people first started using the water from a deep bore well at a distance of 1.5 km from the village. But even this water

was later found to be high on fluoride content. In 2004, the state government tested the water of a *nala* flowing by the village and found its water to be free of fluoride. But if the villagers thought the end of their troubles was near, they were sadly mistaken. Till date, no arrangements have been put in place to supply drinking water to the two villages from this *nala*.

There is no sign yet of habitation at the place earmarked for relocation of the two villages. If the people of the two villages are to be believed, over 200 persons have died of fluorosis in the last 16 years. At this rate, the two villages might soon become devoid of any human habitation, they apprehend. But there has been no attempt by the government to allay their apprehensions and to assure them of their place under the sun. The dreaded disease has led to a drastic fall in their productivity. While humans are suffering from swelling of the joints, general weakness and premature death, cattle have lost their ability to procreate and give milk. Even agricultural fields have not been spared.

Fluorosis affects livelihood

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 Dharmagarh had a very good reputation in the undivided Kalahandi district. The consulting doctor in Dharmagarh 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 Giridhari and his wife lost faith on allopathic medicines and took to Ayurvedic medicines but all their efforts were in vain. On Belmati's insistence Giridhari 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. Giridhari 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. Apathy by the state government and the growing suffering of the people have made them frustrated. To quote one villager, our relationship with Orissa government is limited to votes for which the leaders come once in a few years".

Narayan Mishra, a resident of Mahulpali village, has 11 members in his family. Like other villagers, he runs his family by selling milk in the milk society at Turum. Though he has 5 cattle, his milk production is constantly going down due to intake of fluoride-contaminated water threatening his livelihood.

Purna Chandra Rana of Mahulpali village runs his 9-member family by doing labour work. Though he is just 28, he looks like a 50-year old. All his hair has turned white, he is unable to work and feels pain in the body round the clock. He blames the water for it.

Rupin Harpal, a resident of Salepada, Palsipani of Komna block in Nuapada district, has a four-member family. The entire family has symptoms of fluorosis. Last year, the entire family attended a health camp organised by a voluntary organisation working in the area. But the doctor at the camp referred only his 12-year old son Bikram for radiological analysis. After the radiological analysis, it was confirmed that Bikram was a victim of skeletal fluorosis. Bikram, who is a student of class 7th, cannot sit properly in the school. He cannot walk or play and is unable to attend school though he is keen to study. His memory has decreased considerably.

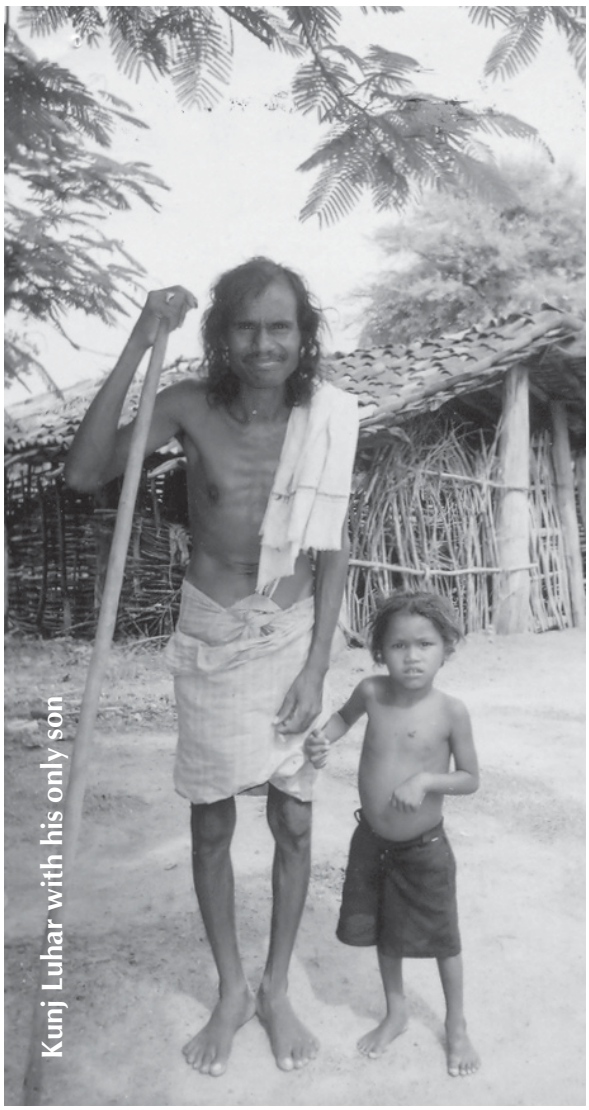
Rupin is even more severely affected than his son. He cannot even move his neck and is experiencing pain in his bones, vertebral column and nerves round the clock. He is unable to work and does not feel thirst or hunger. Whatever little his

wife earns goes towards the purchase of medicines for pain relief. Bijaylaxmi (30), his wife, suffers from such severe back pain that she cannot sleep all night. On top of that, she has to search for some job every morning to manage the family. She suspects that how many days she could be able to run the family. She breaks into tears as she starts talking about the pathetic plight of her family. Her only son has already been found to have contracted the dreaded fluorosis while his 6-year old daughter Jyotshna has developed many symptoms of the killer disease.

Arun Kumar Sahu, a 36-year old youth of Gohiriapadar village in Kalahandi district, was sitting in his small ration shop on 5th Nov 2003, when he suddenly crashed on to the floor and was unable to get up. He was immediately rushed to the district hospital in Bhawanipatna and treated for a number of days by the doctors there. But despite all efforts by the doctors, he was unable to stand on his feet. His condition deteriorated by the day and the pain in his waist, spine, hands and legs became unbearable. After a few days, the bones in his hands and legs started to bend. The doctors advised his family members to take him to Waltair in neighbouring Andhra Pradesh. Arun was admitted into the Seven Hills hospital in Waltair, where doctors diagnosed that he was suffering from the dreaded fluorosis disease. It was, they said, the result of drinking fluoride-contaminated water from either a deep bore well or a tube well. The doctors advised that he should be taken back to the village since no cure was available for the disease. Even operation would be of no use, they said. On return to the village, Arun was confined to the bed. Within a few days, his hands and legs bent completely and his stomach hardened. He needed the support of his mother and wife even for his morning ablutions. The news of Arun's debilitating disease spread like wildfire in the village. Five months later, a team comprising officials of the PHED, health and RWS&S department visited Gohiriapadar. Health checks were conducted on the villagers and water samples from all wells and tube wells of the village sent for testing. The tests revealed that fluoride content in the water from the village wells and tube wells was above 6 ppm/l. Following this revelation, the administration promptly sealed all wells and tube wells in the village. But when it came to providing an alternative source of drinking water, it took the administration eight long months to dig a deep bore well in nearby Saantapur village and lay pipe lines. But that too was not the end of the ordeal for the people of Gohiriapadar as the well did not provide the requisite amount of water. Exasperated villagers now demanded piped water supply from the nearby Ret river, but to no avail. In the end, the Adivasi and Harijan Affairs minister, Mr. Balabhadra Majhi had to contribute Rs. 10 lakh from his local area development (LAD) fund before a pump house and a transformer were set up at Saantapur and seven stand posts erected at Gohiriapadar. Piped

water supply to the village started in 2005. But barely three months after, the transformer burnt down. From then on, the people of Gohiriapadar have had to depend on the water from the sealed wells and tube wells, knowing fully well its implications for their health. No wonder nearly 50% of the people in the village are suffering from fluorosis. Many of them have had their arms and legs bent and are unable to move on their own. Conversation with a cross-section of the villagers makes it clear that they have lost all hope and are waiting for doomsday.

Kunj Luhar (40) is a resident of Jagannathpali Village of Komna block in Nuapada district. His family consists of his wife Hema and 5-year old son Dusmant. Like other villagers, he uses the water of the village tube well for all purposes. A few years back, he started feeling pain in his joints and vertebral column. Since he is landless, he earned his living by doing wage work. Earlier, he used to earn Rs. 50 a day on an average. But now, he is unable to walk– let alone doing any physical work.



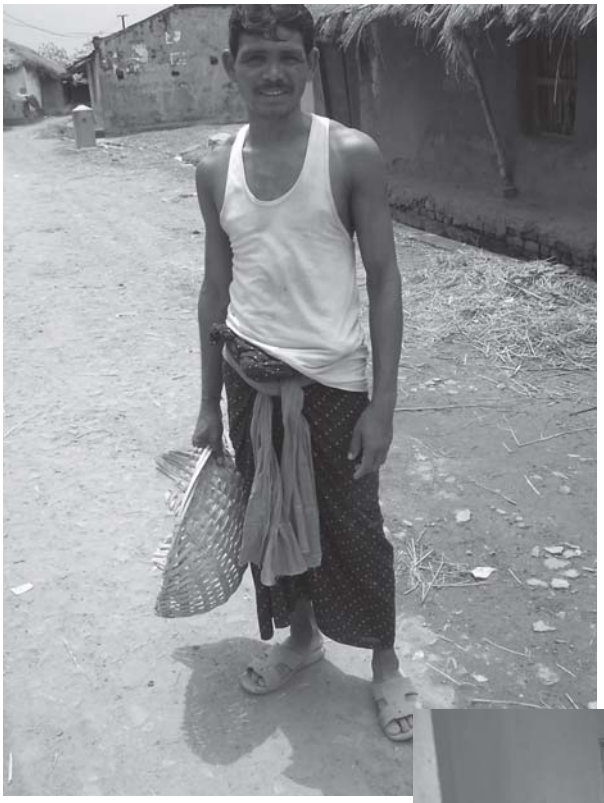
Kunj Luhar with his only son

With Kunj indisposed, the burden of providing for the family has now fallen on the shoulders of Hema, his wife. But she does not get work every day. Even when she does, she gets barely Rs. 20 for a whole day's work, which is scarcely enough to take care of the needs of the family. What has made things even more difficult is the fact his son too has started developing symptoms of the dreaded disease. But she cannot get him or her husband treated. When survival itself is tough, treatment is a luxury she can hardly afford.

The dilapidated house of a fluorosis affected family in Tutu Sahi of Boudh district

A fluorosis victim of Angul district describes how it has affected his livelihood

A woman of Nuapada district sobs as she narrates the plight of her entire fluorosis affected family



A person from Harabhanga block of Boudh district has no work as nobody is willing to hire him as a labourer because of fluorosis.

A tailor in Krushakpalli village of Bargarh district now has no customers as a majority of the people in the village have migrated outside due to fluorosis

People destroy fluoride billboard

Mahulpali is a village in Bargarh district under Bheden Police station. The village, located at a distance of about 40 km. from the district headquarters, has about 199 households a population of 1020. There are about 10 tube wells in the village, but the villagers do not use the water of three of them. Fluoride contamination has been found in 4 more tube wells - near the Panchayat office, Sadanand Tikrra, Harijan Basti and Bhangkur Basti. The district administration has remained content to put a billboard at the place announcing that the tube well water is not suitable for use, but has not bothered to provide any alternative drinking water source to the people. The villagers have developed yellow teeth and are experiencing acute pain in the bone, grey hair, advanced gerontology etc. They have lodged repeated complaints with the RWS&S department, but to no avail. Exasperated, they have brought down the billboard, which mocks at their miserable plight. But even this did not have the desired impact. As a result, they continue to use the fluoride-contaminated water, which is having serious repercussions on their health.

Where patients are treated with fluoride contaminated water

Dhama PHC is about 30 kilometers from Sambalpur, the district headquarters. The village has around 423 households with a population of 2280. The people from Dhama and nearby areas depend on the Dhama PHC for their health needs. For close to 25 years now, the lone tube well in the PHC premises, which yields plenty of tasty water except in the summer, has been meeting the water requirements of the nearby harijan basti, hotels and a sizeable number of labourers, besides the hospital staff, patients and their relatives. The tube well is in great demand since most of the tube wells in Dhama are in a defunct state. Recently, it

was found that fluoride concentration in the water yielded by the tube well has as high as 9.03 mg/l. One shudders to think the impact that years of drinking this water must have had on the unsuspecting people of the area. What makes it particularly galling is the fact that the problem remained undetected for so long though the tube well is in the premises of a public hospital.

Doctor misleads fluorosis patient

Biswambar Hans (48), a resident of Palsipani village in Nuapada distric, experienced pain in bone in 2002. He visited the UGPHC, Khariar where the doctor diagnosed his problem as constipation and advised him to drink 8 to 10 liters of water daily. Biswambar followed his instructions sincerely. But far from improving, his condition deteriorated by the day. In 2003, he went to the district headquarters hospital where Dr. N K Meher identified him as a TB patient. By that time, his frame was completely bent and he could barely walk. He got admitted in the district headquarters hospital again on 11.04.2005 and underwent a series of clinical tests. But a cure was nowhere in sight. After all this, Biswambar lost all faith in allopathy and resorted to local ayurvedic doctors (BAIDYA) instead. He is completely bed ridden now.

Biswambar Hans is bed-ridden due to fluorosis

In 2006, the water of the tube well, which he used to drink, was found to have fluoride concentration of 6.5mg/l. He underwent X-ray and a radiologist based in Bhubaneswar diagnosed his problem as fluorosis.

At least part of the reason for his present condition was the advice given by the doctor at the Khariar hospital to drink plenty of water. The bioaccumulation of fluoride expedited the worsening of his health condition. Now he is completely bed ridden and fighting with death. He is praying for an early death so that his misery ends.

It is not as if Biswambhar's is a stray case. There are thousands like him, who suffer due to the apathy of doctors and their lack of skill to identify non-skeletal fluorosis.

Children lose their vision

Bhoipali, a village of Maneswar block in Sambalpur district, has 240 families and a population of 1055. There are 9 tube wells in the village, out of which three have been found by the RWS&S department to have "bad water". But little do the people know that the 'bad water' is in fact fluoride-contaminated water. The department has not even bothered to seal these tube wells perhaps to avoid having to provide a new one. Till date, the villagers are using it – blissfully unaware of the serious implications it has for their health. No wonder, about 60% of the village population were found to have symptoms of fluorosis in a survey conducted by the Centre for Water for Life (CWL).

Even more worrying is the fact that children in Dunguri Pada and Khadko Pada of the village are very, very weak since their birth and are fast losing their eyesight. Dental fluorosis, graying of hair and premature aging are common among the children of the village.

Social ostracisation

Krusakpalli, a village of Barpali block in Bargarh district, is well known for the high fluoride concentration in all its drinking water sources. The village has around 199 families and a population of 1100. After a lot of media attention following the identification of fluorosis in the village, the RWS&S department was forced to intervene. But its intervention was limited to supply of pipe watery while the root cause of the problem remains unexamined. There are seven stand posts in the village now. But most of the time, there is no regular water supply due to opera-

tion and maintenance problems and lack of electricity. When there is no pipe water, the people have no option but to use the water from the fluoride affected tube wells since they have not yet been sealed by the department.

Forget about the fluorosis patients; even those who are not affected with the dreaded disease are also facing social ostracisation. Relatives seldom visit them. When they do, they make sure that they do not drink water at their places – not even piped water. Establishing matrimonial relations with people in nearby villages has become unthinkable for the people of the village. To avoid this humiliation, some of the villagers have shifted out to Dhirpur and settled there. But social ostracisation has followed them even to their new habitation.

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Animals too: Cattle suffering from dental fluorosis

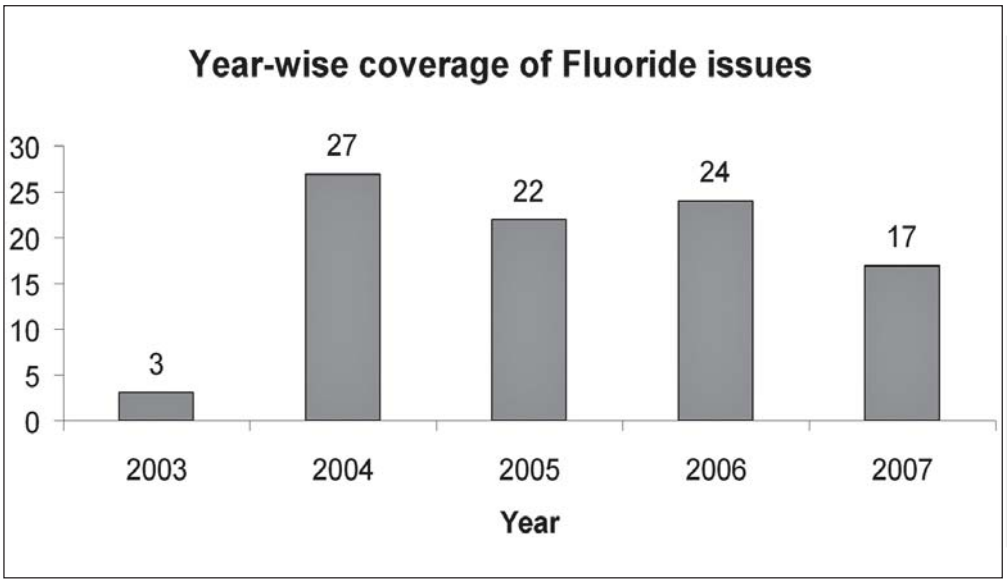
FLUORIDE, FLUOROSIS AND MEDIA IN ORISSA

The media plays a very important role in spreading awareness about issues and putting pressure on the government to act. But has the media in Orissa played the role expected of it in respect of the fluoride menace?

Since its inception, RCDC Centre for Water for Life (CWL) has constantly sought to focus attention on the growing menace of fluoride. Towards this end, it has been monitoring coverage of fluoride-related issues in the local media and has built up an exhaustive database of media reports on the issue since 2003. There are a total of 93 fluoride-related news items and articles in the Press in these four years. An analysis of all news reports and articles that have appeared in the media suggests that while it has periodically reported fluoride-related news - starting from identification of fluoride pockets to deaths due to fluorosis - it could have done much better in view of the seriousness of the problem.

A major failing of the media as a whole has been the absence of articles on the subject. While news reports about individual fluoride affected pockets are fine, they don't really give the bigger picture. It is well-researched and well-written articles that give the macro picture and put things in perspective. How many of us actually know that as many as 27 of the 30 districts in the state are affected by fluoride? Articles go a long way in creating awareness about the hazards of drink-

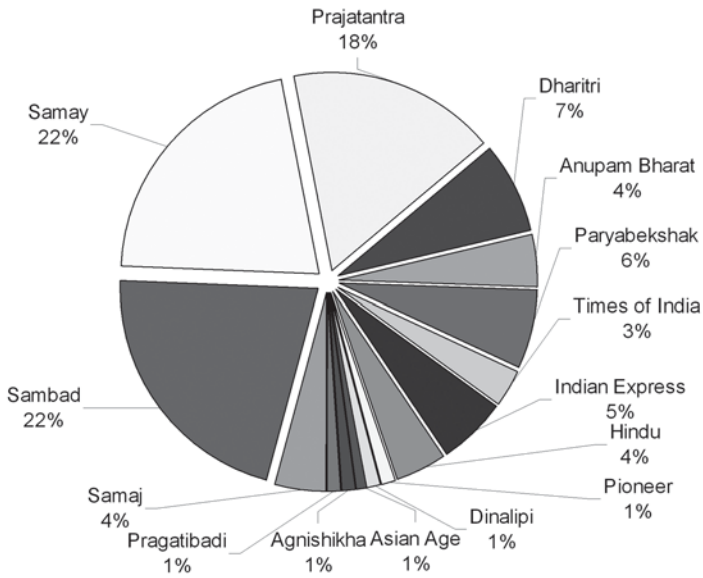
ing fluoride-contaminated water and the incurable nature of the dreaded disease. In this respect at least, the performance of the media in Orissa leaves a lot to be desired at least in this respect. Not a single article on the various dimensions of the fluoride menace has been published in the Orissa media in the five years for which information is available.



As we can see from the above graph, there was a sudden spurt in the coverage of fluoride-related news in 2004, which perhaps partly explains the fact that the government constituted a Task Force on fluoride in 2005. As the media attention waned in the following years, the government too conveniently put the issue in the backburner as evidenced by the fact that the Task Force has had no meeting so far. It corroborates the postulate that we began this chapter with: the media forces the government to act by its coverage of a particular issue.

As can be seen from the graphic on the next page, a total of 15 publications published fluoride-related news reports during the 5-year period under study. 'Sambad' and 'Samay' lead the pack with 22% of the total coverage each, followed by 'Prajantantra' with 18% of the coverage. Among the English newspapers, 'The New Indian Express' has given the maximum coverage (5%) to fluoride-related issues, followed by 'The Hindu' (4%), 'The Times of India' (3%) and then 'The Pioneer' and 'The Asian Age' with 1% of the total coverage each.

PERCENTAGE OF MEDIA COVERAGE OF FLUORIDE ISSUES



Sl No	Name of the newspaper	Fluoride related Article published in					Total
		2003	2004	2005	2006	2007	
1	Samaj	0	1	0	1	2	4
2	Sambad	1	3	8	5	3	20
3	Samay	0	7	2	6	5	20
4	Prajatantra	0	7	2	5	2	16
5	Dharitri	0	2	3	2	0	7
6	Anupam Bharat	0	2	2	0	0	4
7	Paryabekshak	0	1	2	2	1	6
8	Times of India	0	2	0	0	1	3
9	Indian Express	1	0	0	2	2	5
10	Hindu	0	1	3	0	0	4
11	Pioneer	0	0	0	0	1	1
12	Dinalipi	0	1	0	0	0	1
13	Asian Age	1	0	0	0	0	1
14	Agnishikha	0	0	0	1	0	1
15	Pragatibadi	0	0	0	1	0	1
Total		**3**	**27**	**22**	**24**	**17**	**93**

Analysis of the above table reveals that only 'Sambad' has covered fluoride-related news in each of the five years. As many as 12 of the 15 newspapers published no news on fluoride in 2003 while three published one news item each during the year. This suggests that awareness about the fluoride menace was low in 2003. The sudden rise in fluoride-related reporting the following year i.e. 2007 - when no less than 27 reports were published - cannot be easily explained away. But a perusal of the news items reveals that most of the reporting that year had to do with Balsingh-Singhpur in Khurda district.

Five of the 15 newspapers studied published just one fluoride-related report each in the entire five-year period. They are: 'The Pioneer', "The Asian Age', 'Pragativadi', 'Dinalipi' and 'Agnishikha'.

Three publications – 'Anupam Bharat', 'The Times of India', and 'The Hindu' published no reports on fluoride in 3 out of the five years in question. Three others – 'Samaj', 'Dharitri' and 'The New Indian Express' - had no coverage in 2 out of the 5 years. 'Samay', 'Prajatantra' and 'Paryabekshak' had just one zero-reporting year out of the five analysed.

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INTERVENTION BY THE GOVERNMENT

There are a host of international agreements and covenants under which national governments are duty-bound to provide safe drinking water to all the people in the world.

The Millennium Declaration of the United Nations even categorises it as one of the eight millennium development goals (MDGs) to be fulfilled by 2015. The Constitution of India enjoins upon state governments to provide 'safe' drinking water to the people of the country.

The Union government launched the National Drinking Water Mission in 1986 to provide safe drinking water to the 98, 746 'problem villages' in the country. Five sub-missions were created within the Mission, each dealing with a specific problem related to drinking water, including one on fluorosis control. The sub-mission on fluorosis was to provide safe drinking water to all fluoride endemic villages by 1990 by making arrangements for supply of safe drinking water from alternative sources wherever possible and by setting up defluoridation plants in others. The Mission launched pilot projects on fluorosis control in Gujarat, Andhra Pradesh and Haryana, but not in Orissa.

It was not until 1998 that Orissa finally got attention. On April 1, 1998, seven sub-missions were launched in the state, including one on flurosis. The project was to be implemented through the state departments of Public Health & Engineering, Health, Forests, Agriculture and Irrigation. These departments were expected to work in tandem with the NGO sector and the community at large to fulfil the objective of the sub-mission.

But nine years after the launch of the sub-mission, the fluoride menace in the state, far from being controlled, has grown manifold and has assumed alarming proportions in several pockets.

If all this is not enough, there is also the memorandum of understanding (MoU) that the Orissa government – like its counterparts in other states - has signed,

which reiterates the obligation of the state government and Panchayati Raj institutions (PRIs) to ensure access to potable water for the citizenry. Under the MoU, the state government is committed to ensure constant monitoring and surveillance of water quality involving panchayats and in coordination with the health and education departments.

In view of all these covenants, constitutional provisions, agreements and the Technology Mission, one would think that the state government would pull out all stops to provide safe drinking water to the people. But its attitude to water quality has been nothing short of criminal. While bacteriological contamination does get occasional attention from the government, chemical contamination is an altogether different story. Forget about the relatively less hazardous chemicals like iron, nitrates and sulphates. The government has done nothing to suggest that it is even aware of the magnitude of the problem, let alone finding a solution to it. Considering that as many as 27 of the 30 districts in the state are affected by fluoride contamination, fighting the menace should have been at the top of the government's agenda. But its actual response betrays indifference, callousness and worse.

The government does not even know how many water sources, habitations or districts are affected by the fluoride problem. Under the National Drinking Water Mission, the Centre has provided assistance to the state government to set up laboratories in each district to test drinking water quality. But so far, the state government has been able to set up laboratories in just 14 out of the 30 districts in the state.

The Bureau of Indian Standards (BIS) has recommended a set of 18 parameters for water quality testing. But none of the laboratories in Orissa tests drinking water on all 18 parameters. Seven of these parameters are an absolute must while testing groundwater: iron, chloride, fluoride, arsenic, nitrates, sulphates and salinity. But only six district laboratories have the facilities for testing water quality on all these seven parameters. Apart from these six, there are two state level laboratories, which have the necessary facilities. But none of these laboratories are available to the public. They do not entertain requests from the public for testing of drinking water to determine if it contains excess quantities of chemical pollutants, including fluoride.

By its own admission, the government has so far been able to test the drinking water quality of just 19, 519 out of the 1, 41, 099 habitations in the state, which works out to barely 13.09% of the total number of habitations. Out of the 19,

519, 1612 (2.58%) habitations were found to have fluoride content above permissible limits. With just 13% of the habitations tested, the government is simply in no position to determine the extent of fluoride contamination in the state. Even in the few habitations where excess fluoride was found, there has been no subsequent tests to determine whether there has been any change in the fluoride level in drinking water.

As per Central guidelines, water quality of every source has to be tested at least thrice a year – during the pre-monsoon, monsoon and post-monsoon period. But the state government itself admits that only 25% of the tube wells in the state have been tested so far – and that too just once. Hence, the data made available by the government has to be taken with a bagful of salt.

Following the hand-over of all drinking water sources in the state to the PRIs, it is the PRIs that are responsible for the running and maintenance of these sources, including monitoring of water quality. The state government has thus washed its hands off its responsibility without bothering to provide the necessary facilities and building the capacity of the PRIs to undertake the task. There is now talk of supplying water quality testing kits to the PRIs. But it is yet to take off.

The absence of reliable, statewide data has been one of the major problems in finding a solution to the problem of fluoride in Orissa. If state government figures are questionable, the results of periodic tests conducted under the Habitation Survey and by the Central Ground Water Board (CGWB) are no better.

The Habitation Survey, for example, identified 206, 101 and 204 out of the total of 1, 39, 338 habitations in the state affected by fluoride in 2000, 2003 and 2005 respectively. The problem with this set of data is that some habitations were taken up for testing afresh while a few of the previously tested habitations were tested again in the subsequent years. Hence, the Survey does not really reflect the ground reality. We, at CWL, compiled and analysed the data for all three years and concluded that 347 habitations were found to have been affected by fluoride.

CGWB has a total of 1, 068 hydrograph stations in Orissa. But not all of them are monitored every year. Besides, the selection of hydrograph stations for a particular year is often not based on sound logic. Ideally, the hydrograph stations where fluoride has been found to be in excess of the desirable quantity should be tested every year. But that has not been case. The Deokananpur hydrograph station in Sundargarh, which registered an unbelievable 250% rise in fluoride content in just two years, is a case in point. As a result of this anomaly, the annual figures

reeled out by the CGWB present a completely misleading picture of the ground realities. When you ask for the number of fluoride affected stations in the state, CGWB gives the figure for the last year when the monitoring was done and not al the stations found to be fluoride affected over the years. Predictably, the number of such hydrographs has never crossed 100. But read between the lines and you will find that these figures hide more than they reveal. On its part, CWL undertook an exhaustive analysis of the findings for the last five years and found to its dismay that the actual number of hydrograph stations with excess fluoride is 207, which works out to a worrying 19.56% of the total number of hydrograph stations in the state.

Then there is also the problem of lack of inter-agency coordination. The figures given by the Habitation Survey, CGWB and RWSS vary so widely that doubts are certain to be raised about their veracity. For example, CGWB says the fluoride content in its Deokananpur station is as high as 45%, but RWSS repudiated the figure. Such is the maze created by a plethora of figures that it is easy to get misled.

The confusion has come in handy for the state government; it can feign ignorance and put the problem on the backburner rather than take it up on a war footing as demanded by the gravity of the situation.

Sample this. Replying to a question from Mr. Narayan Reddy, Rural Development minister Biswa Bhusan Harichandan made the startling revelation on the floor of the state Assembly on June 6 2007 that it was 'not aware' of people losing their livelihood after falling prey to fluorosis! He went on to say that the RWSS department was 'regularly' checking fluoride levels in drinking water of all sources – tube wells, open wells and pipe water – at its laboratory. The people were being 'warned' not to use the water with high fluoride content and were being 'persuaded' to use fluoride-free water from other nearby sources. [Pray, where are those sources located?] Piped water was being supplied to areas where the fluoride content in drinking water is high, Mr. Harichandan added in his reply. [We have already seen in the cases of Balasingh-Singhpur, Karlakote, Gohiriapadar and Krushakpalli that this particular part in the minister's reply is a complete lie.]

Government response to the problem of fluoride has been largely confined to sealing off wells and tube wells. Efforts to provide alternative, safe sources of drinking water have been conspicuous by their absence.

The state government has displayed a complete lack of concern not just in providing safe, alternative sources of drinking water, but also in acquiring and using available technology for treatment of fluoride contaminated water.

Consider this gem. While replying to a question on the fluoride problem in the state Assembly last year, the government shockingly said that it was not aware of 'Nalgonda technology' that has been in existence since the 60s! For the uninitiated, 'Nalgonda technology' involves treatment of fluoride contaminated water first with lime and then alum, which ensures that the fluoride content gets deposited at the bottom.

The sub-mission on fluoride under the National Drinking Water Mission requires state governments to set up defluoridation plants at places where alternative sources of drinking water are not available. But so far, not even a single defluoridation plant has been in the state.

Fluoride Task Force

The state government constituted a Task Force on fluoride on 24.02.2005 vide Letter no. DWS- 68/2004/3034/Rd of the Rural Development department. At present members of the Task Force are:

1. Subash Chandra Mishra, Director, GWS & I
2. Mr. Panigrahi, Chief Engineer RWS&S, BBSR
3. Chief of State PH Engg. Laboratory, Palasuni
4. D Y Siriskar , Reg. Dir Central Ground Water Board, Khandagiri
5. Achyut Das, Agragamee
6. Regional Director , Unicef
7. B. P. Mishra, Regional Director , Water aid India
8. Er. S. M. Patnaik, Retd. Engineer in Chief ,
9. Mr Bibekananda Mahapatra Supt. Engg, RWSS, PMD& I , Bhubaneswar
10. Mr Saroj K Dash , Member convenor, CAPART, Easter Zone
11. Bibhudendra Pratap Das (Ex MLA)
12. Er. Budhimanta Hota , Chief Engineer, OSWSM
13. Mrs. Smita Das , Director, Geology

The Task Force was entrusted with the task of coming out with a set of recommendations that the government was then to act upon. But two years after its setting up, the Task Force on fluoride is yet to have its first meeting. Shockingly, many of the members do not even know that they are members of the Task Force. CWL talked to a few of them and was surprised to find that they are blissfully unaware of the responsibility supposedly given to them. On its part, the government takes the convenient plea that it is 'waiting' for the recommendations of the Task Force. It is clear that the setting up of the Task Force is a mere eyewash rather than a proof of the government's desire to fight the fluoride menace.

Part of the reason the government has not accorded the control of fluorosis its due priority is the fact that the symptoms manifest themselves gradually and deformity or death do not come instantaneously. In this respect, it is different from diarrhoea or cholera, which invariably result in mass mortality.

Fluoride differs from these communicable diseases in another significant way; there is no cure available. It is like slow poison, which first debilitates man before killing him. Hence, prevention is the only way it can be fought. The two ways the disease can be prevented are i) provison of alternative sources of safe, fluoride-free drinking water and ii) setting up of defluoridation plants. As we have already seen, the government has failed miserably to do either of this.

Prevention, of necessity, has to be preceded by identification of fluoride in an area. But as discussed earlier, the mechanism in place to identify fluoride affected pockets in the state are either grossly inadequate or non-performing. In a majority of the cases, fluoride has been identified only after the symptoms manifest on the human body or there are reports in the Press about deformity or death due to fluoride in a particular area.

It is high time that the government realised that fluoride is unlike any other disease and needs to be tackled as such. The unsuspecting people have no means to know that what they are drinking is in fact slow poison that could maim or even kill them. By the time they do, it is far too late. This is one case where ignorance is not bliss. Hence, it is incumbent on the government to test ALL drinking water sources to determine if they have excess quantities of fluoride and to make expeditious arrangements to provide alternative safe drinking water where excess fluoride has been found.

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CHALLENGES AHEAD

As the preceding chapters have made it amply clear, the challenges in fighting the fluoride menace are many and daunting. With anthropogenic fluoride making its appearance in newer and newer pockets and carcinogenic fluoride too affecting more and more areas as a result of a number of aluminium industries coming up in the state, the challenges are only going to become even more intractable in the days to come. If the state government continues to deal with the problem of fluoride with the callousness that it has done so far, the day is not far when fluorosis - and not malaria, cholera or any other disease – will become the principal killer in the state. It is high time the government woke up to the enormity of the task, identified the challenges, devised well thought out responses to them and then implemented them with missionary zeal.

Some of the major challenges in fighting the fluoride menace are detailed below.

1. Awareness generation

Awareness about the hazardous – even fatal – consequences of prolonged use of drinking water contaminated with excess levels of fluoride is abysmally low in Orissa. The vast majority of the population yet does not know much about the dreaded disease called flurosis and its disastrous effects on human and animal body. Hence, creating awareness about fluoride, its sources, fluoride and its consequences among the public has to be at the top of the agenda.

One of the major reasons for the spread of the disease is the indiscriminate digging of bore wells and use of their water for drinking purposes. It has to be driven into the minds of the people that the quality of the drinking water needs to be tested before use of the source by the people. They also need to be told that water quality testing cannot be a one-off affair and has to be a sustained and regular exercise.

2. Creating awareness among health professionals

The public is not the only one which does not know about fluoride and fluorosis. There is an abysmal level of ignorance even at the government level, including the departments and agencies that are directly involved. As we have seen in an earlier chapter, the ignorance of the doctor at the local PHC about fluorosis can prove fatal for a victim. Surprisingly, even teachers in medical colleges and health administrators know little about the latest developments in the field. Some of them even believe that fluoride is actually good for health in general and teeth in particular. There is, therefore, an urgent need to impart specialised training to all doctors on how to detect the symptoms of fluorosis. Their knowledge base has to be updated on a continuous basis.

As fluorosis provides very little scope for introducing a therapy, it is not a challenging disease in the field of curative medicine. Medical students seldom get to see a flurosis patient in the ward. Fluorosis patients are almost never admitted – unless, of course, somebody wants to study them for clinical and research purposes - since the doctors feel that little can be done about them in the advanced stage of the disease. In the absence of the required expertise, fluorosis is often diagnosed as 'a mysterious disease'. There is an urgent need to launch a special drive to update the faculty in medical colleges with new discoveries and developments in the field of fluorosis.

3. Identification of new pockets

Since the state government itself has admitted that it has tested no more than 25% of the over 2.65 lakh tube wells (on which the overwhelming majority of the population depends for its drinking water requirements) in the state, there is no way one can assess the extent and spread of fluoride contamination.

On its part, the CGWB monitors the water quality through just 1, 068 hydrograph stations for the whole of the state. It goes without saying that the number of hydrograph stations is grossly inadequate to draw a comprehensive scenario of the fluoride problem in the state. Even the 1, 068 hydrograph stations that the state has are not all monitored every year. Moreover, stations where fluoride content has been found to be in excess of the prescribed limit are not necessarily monitored in the subsequent years to find out if there has been any change in the fluoride content in drinking water. The figures reeled out by the CGWB, therefore, are open to questioning. In any case, vast swathes of the state remain outside the

purview of the annual survey of drinking water quality by the CGWB. Another major problem with CGWB data is the fact that they are not put in the public domain and remain largely on government files. With the public in the dark, the state government could perhaps take the initiative in making the data public. But as we have already seen, it has a vested interest in sweeping things under the carpet and even denying the existence of the problem altogether.

The Ground Water Survey & Investigation Board is the agency entrusted with the task of assessing, monitoring and regulating groundwater resources in the state. It has the task of determining the hydro geological composition of the entire state and identify the patched affected by excess fluoride. But so far, it has failed miserably in discharging its responsibility. On its part, the RWSS has the task of supplying safe drinking water to the entire population. It is not as if all its responsibilities have ended with the hand-over of drinking water sources to the PRIs. Had that been the case, the department would have been winded up by now. The least it can do is to upgrade its state level laboratory to determine the extent of fluoride concentration in drinking water and equip its district laboratories with instruments like atomic spectrometer or Orion ion meter and required chemicals like Zirconyl, TISA III etc so that they can quantify the extent of toxic fluoride in drinking water locally. The department has appointed technicians in most of the district level laboratories. But in the absence of the necessary equipment and chemicals, they have nothing to do.

4. Regular monitoring of all drinking water sources

The level of fluoride contamination keeps fluctuating with changes in temperature, rainfall, season, amount of water withdrawn, percolation, groundwater recharge etc. and hence need to be monitored at least thrice a year in the pre-monsoon, monsoon and post-monsoon periods. But the RWS&S department is simply in no position to complete laboratory estimation of the presence and extent of fluoride in all drinking water sources of the state even in the foreseeable future. The best coverage that the department has achieved in a year so far is a measly 20%. At this rate, it is anybody's guess as to how many years more it would take to complete the first round of testing of all water sources in the state – let alone testing all sources three times a year. More than the glassware, chemicals and human resources needed to facilitate an ongoing and continuous monitoring of water quality to identify possible fluoride contamination, there is need for a change in the mindset of the staff, who think it is now the headache of the PRIs to ensure water quality.

5. Dissemination of information

The Government of Orissa had made testing of the water quality mandatory before the hand-over of a drinking water source to the panchayat. But there has not been a single case where water quality was tested and shared with the PRIs or with the community before the hand-over of the source on 20th Oct 2006. Decentralization and empowerment of PRIs through hand-over of drinking water sources to them for management and maintenance no doubt is a step in the right direction. But handing over the water sources without telling them about the dangers that they might contain in the form of pollutants, including fluoride, can be called anything but empowerment. If anything, it can be dubbed breach of trust and even deceit. When the government itself, with all the resources at its disposal, has failed to complete the quality testing of all water sources in the state, is it not unrealistic to expect the PRI functionaries – many of them illiterate or semi literate – to do the testing by themselves and that too without the necessary equipment and training? The department is duty bound to build the capacity of the panchayats to undertake the task and equip them for it. Till such time, the responsibility of ensuring water quality has to rest with the department.

6. Provision of alternative drinking water sources

Drinking water sources identified as fluoride contaminated have to be made defunct with immediate effect. But when neither the government nor the people know that the water of a particular source has excess fluoride, how can it be made defunct? Thus, thousands of people throughout the state continue to drink water heavily polluted with fluoride, blissfully unaware of the poison that is eating into their vitals. In the few cases where the presence of excessive quantities of fluoride has been proved beyond doubt, RWS&S officials are content to put up a billboard announcing "The water of this tube well is not safe for drinking purposes" and then forget all about it. In the absence of a potable drinking water source in the village following the sealing off of the village tube well(s), the people have no choice but to go to the nearby river, rivulet or stream to fetch their stock of drinking water. But when they do so, it is the turn of the health department, concerned about the spread of communicable, water-borne diseases through the use of polluted river water, to stop them. Where do the people go then?

Alternative arrangements to provide fluoride-free drinking water to the people have not been made in the overwhelming majority of cases where fluoride contamination has been well established. Even more shockingly, factors like erratic

electricity supply, low voltage, use of low-power motors and charging of commercial rates for electricity needed to supply drinking water have ensured that the alternative sources, in the very few cases where they have been provided, remain unreliable. It has forced people to continue drinking fluoride-contaminated water despite knowing that it could prove fatal.

7. Networking among key players

One of the major reasons for the confusion about the extent of fluoride contamination in Orissa and the absence of an appropriate response is the complete lack of coordination among various wings and organisations of the Central and state governments. The CGWB conducts its own water quality survey, the CWC and the state Ground Water Survey & Investigation their own. But there is very little sharing of information among them. The figures of one are repudiated by the other. This has to end forthwith and a unified approach found to pull in the resources of all these agencies to do a correct assessment of the extent of fluoride.

Similarly, there is need for inter-linking and coordination among various layers of the healthcare institution for timely detection of symptoms and prompt treatment.

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CHAPTER 8

RECOMMENDATIONS

The challenges in fighting the fluoride menace can be met only through a well-planned strategy carried out diligently by the government and other stakeholders in close coordination with each other. We, at the CWL, have worked out a set of measures that need to be taken on an urgent basis in view of the gravity of the problem in the state. The list of measures recommended is by no means exhaustive or complete. But it can certainly be a good starting point, which can be expanded further by others. Here they are:

1. Creating public awareness

One of the major hurdles in fighting the scourge of flurosis is the abysmal level of awareness about the disease and its damage potential among the public. The unsuspecting people continue to drink heavily fluoride-contaminated water, oblivious of the possible consequences because they do not know what they are drinking. When they finally do, it is already too late. Very few people even in the highly endemic areas know about fluorosis. Even fewer know that it is incurable. Creating awareness in the public about fluorosis and its disastrous consequences, therefore, has to be the foremost task in fighting the dreaded disease.

Needless to say, the government has to be at the forefront of the effort to create public awareness with others playing a complementary role. It needs a sustained campaign on the lines of the ones we have on TB, leprosy and HIV/AIDS. The media – the visual media, in particular – also has an important role in the spread of awareness about the fluoride problem.

In preparing IEC material on fluoride, the accent should be on graphic representation of the various stages of flurosis to the extent possible. As in the case of the de-addiction drive, those already suffering from the disease can be roped in to make the people aware about the effects of the disease on the human body. But the exercise has to be carried out in a humane way with compassion and understanding. The bottomline of all efforts to create awareness should be to grill it into the mind of the public that prevention is the only way to fight fluorosis.

2. Regular monitoring of water quality

Water quality monitoring can no more remain a one-off or occasional activity. It has to be a rigorous, year-round exercise involving the testing of drinking water on all 18 parameters recommended by the Centre. There is an urgent need for a hefty increase in the number of hydrograph stations in the state.

3. Sharing of water quality information with the public

The water quality information collected by government agencies during the process of monitoring is useless unless it is shared with the public at large and the population that is going to be affected, in particular. In complete violation of its own rules, the government handed over all drinking water sources to the PRIs last year without in a single case bothering to hand over the latest quality report. By its own admission, 75% of the tube wells in the state are yet to be tested for quality. The testing of water quality of all drinking water sources should be completed on a war footing. Since the government, through its hand-over process, proposes to wash its hands off the operation and maintenance of drinking water sources, the PRIs need to be intimately involved in the testing exercise and the findings shared with them.

In due course, PRIs need to be provided with necessary kits and encouraged to test the quality of drinking water themselves. These kits can also be made available to individual households at a subsidised rate.

4. Providing alternative sources of safe drinking water

The moment excess levels of fluoride have been detected in a drinking water source, it needs to be closed to public – but not before alternative sources of safe drinking water have been provided, as the government is doing now. Money should not be a consideration in the matter of providing safe drinking water to the people.

A comprehensive plan of action to provide safe drinking water to the vulnerable people needs to be drawn up taking into consideration the raw water quality, the hydrogeochemistry, the terrain, the population to be catered to and annual rainfall.

Prior to providing safe water, it is necessary to carry out a benchmark health survey of the community. The timing of the initial survey should be closer to the date of commissioning of the safe water source. It is equally important to carry out

a second health survey among the same population, 2 or 3 weeks after providing safe/defluoridated water for impact assessment. When health complaints - especially early warning signs of fluoride poisoning – disappear, the community needs to be informed about it.

5. Networking between health & public engineering professionals

Engineers specializing in public health need to know about the characteristics of fluorosis and the defluoridation technology. Networking between Health and Public Health Engineering departments will go a long way in ensuring early detection and timely remedial measures.

6. Inter-linking of SPMs and district head quater hospitals

SPMs and district headquarters hospitals need to be inter-linked to provide timely referral services to victims of fluorosis. A similar linking is also needed between district hospitals and medical colleges in the state.

7. Orientation of doctors

Shocking ignorance about fluorosis prevails even among doctors. Hence, there is a need for a proper, well-planned orientation programme to educate them about the latest findings in the field of flurosis control. It should not be a one-off affair and needs to be followed up at regular intervals. Introduction of flurosis in the medical curriculum is an absolute must in view of the gravity of the problem.

8. Sustainable operation & maintenance of drinking water sources

One of the major reasons for excess fluoride in drinking water is overdrawal of groundwater. The anthropogenic fluoride on the earth's crust tends to find its way into the water oozed out by the source if its is overused. Hence, sustainable operation and maintenance of drinking water sources is of utmost importance. PRIs need to be enlightened and equipped to ensure sustainable use of the source. The community has to be involved in the management of local water resources.

9. Issue of handicapped certificate to fluorosis victims

It is heartless of the government to refuse to issue handicapped certificate to those debilitated by fluorosis. The disease, after all, eats into one's vitals and completely saps the energy to work. If one of the victims goes to court and follows it up

diligently, the government may perhaps have to pay millions in damages for having failed to warn him/her about the excess fluoride in his/her drinking water and to provide an alternative source of safe drinking water. When the government has no compunction about giving unemployment dole to able bodied young men and women, there is no reason why it should refuse to issue handicapped certificates to those who have suffered deformities or are in physical state to earn a livelihood.

10. Epidemiological survey

An exhaustive, statewide, house-to-house survey needs to be carried out to assess the actual magnitude of the fluoride problem in Orissa. During the survey, all the three forms of fluorosis, viz. dental, skeletal and non-skeletal should be identified. In the case of non-skeletal fluorosis, significance should be attached to early warning signs of fluoride toxicity and other clinical manifestations (details provided in the module developed for early detection of fluorosis and given later in this document).

11. Blood (serum) and urine testing

To confirm fluorosis, it is necessary to test the fluoride content in blood (serum), urine and drinking water of a patient. Although 24-hr old urine is ideal, it is impractical to collect such samples from the rural population. Therefore, spot sample of urine can be collected for testing. The samples should be collected only in plastic vials and not in glass bottles. Radiographs and forearm X-ray may be obtained.

12. Nutritional intervention

There also is a need for nutritional intervention. This requires counselling of the patients and educating those who cook and serve food for the family. The importance of consuming food rich in calcium, Vitamin C, E and anti-oxidants on a daily basis should be emphasized. Initially, this needs to be monitored at intervals of short duration (3 to 4 weeks) to reveal to the members of the family the benefits that accrue from such an approach. The regulatory agencies need to consider such issues and set guidelines for MNCs to follow. Alternate approaches for prevention of dental caries and promotion of oral health and hygiene practices, with adequate calcium and vitamin C intake through dietary sources, should be encouraged. The propaganda of MNCs that fluoridated tooth pastes and gels help prevent dental caries has to be fought tooth and nail.

13. Providing cheap defluoridation technology to people

Cost-effective, easy to handle/operate defluoridation technology should be made available to the rural population, who bear the brunt of fluoride contamination. It is estimated that daily per capita consumption of water for all purposes is about 135 lpcd in urban areas and about 40 lpcd in rural areas. For drinking and preparation of food, however, the requirement is only 8 lpcd. Keeping in view the cost involved in defluoridating water, it is desirable that defluoridation of water should be restricted to drinking water only. Hence, the only economical and practicable choice left is domestic defluoridation. It is desirable to test the various domestic defluoridation processes available, especially in terms of their acceptance by people without the need for any supervising agency, and recommend suitable alternatives so that effective long-term implementation can be achieved.

14. Changing dietary habits

Defluoridation of drinking water alone shall not bring the fluoride level to a safe limit. It would still be necessary to overcome the toxic effects of the remaining fluoride ingested through other sources. This can be done by effecting minor changes in the diet and dietary habits of the population compatible with their social system and available resources.

15. Water harvesting as alternative water source

Where defluoridation technology – for whatever reason - cannot be put to use, rainwater harvesting is the best possible option to make fluoride-free water available to both the human beings and domestic animals. Unlike ground and surface water, it is completely free of fluoride and hence safe for drinking. Defluoridating water meant for animals may prove a little too costly for the poor. Such people can always resort to rainwater harvesting as a safe source of alternative drinking water for their animals.

16. Statewide Network on fluoride

There is an urgent need for a statewide network of individuals and organizations dealing with fluoride and fluorosis in any manner. The proposed network should prepare, maintain and update a complete dossier on fluoride-hit areas and fluorosis cases in the state.

17. Regular meetings of Fluoride Task Force

As has been pointed out earlier, the Task Force on Fluoride constituted by the state government has not met even once since being formed. This no doubt is a sad state of affairs. Life has to be infused into this dormant body and its meetings conducted regularly for it to contribute to the formulation of an appropriate response at the government level. The regularity of its meetings and the robustness of its deliberations will be the proof of the government's sincerity in fighting the scourge of fluoride.

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References…

1. *CGWB (2001)- Year book of central ground water board for the year 2000-2001*
2. *CGWB (2002)- Year book of central ground water board for the year 2001-2002*
3. *CGWB (2003)- Year book of central ground water board for the year 2002-2003*
4. *CGWB (2005)- Year book of central ground water board for the year 2004-2005*
5. *CGWB (2006)- Year book of central ground water board for the year 2005-2006*
6. *Data Base of RCDC Centre for water Foe Life, Bhubaneswar.*
7. *Fabiani L, Lioni V, Vitali M(1999)-Bone fracture incident rate in two Italian regions with different fluoride concentration levels in ground water. Trace. Elem. Med. Biol. Dec 13(4)232-7*
8. *Fabiani L. Lioni V and Vitali M in 2000 found that consuming water with equal or greater concentration than 1.45 mgl fluoride concentration resulted fracture incidents at several parts of the body in particular with femur fractures.*
9. *Littleton J(1999)-palaeo pathology of skeletal fluorosis. Am. J. Phys. Anthropology. 109(4) 465-483.*
10. *Mahapatra M K (2005)- Residual fluoride toxicity of community ecosystem, Ph. D thesis of Pt. Ravishankar Shukla University, Raipur*
11. *Maheswari R (2004) – The fluoride menace – a review, Agrobios news letter, Vol 3, issue no 2 p 11-13.*
12. *Mark D & Sutton R N (1991) – Fluoride : New grounds for concern, Encology, Vol 6-7, p 1-32.*
13. *Mahapatra M K , Mishra A & Das B P (2005) – Fluorosis 1st reported in Nuapada district of Orissa, India.*
14. *Sinha A. K. (2003)-fluoride concentration in ground water-focus on arid to semiarid regions of Rajasthan, India Pwl. Of working on ground water contamination*
15. *Susheela A K (1990) – Fluoride: Too much can cripple you : health for the millions*
16. *Water quality report of different districts of the state from the concerned Executive Engineers office.*

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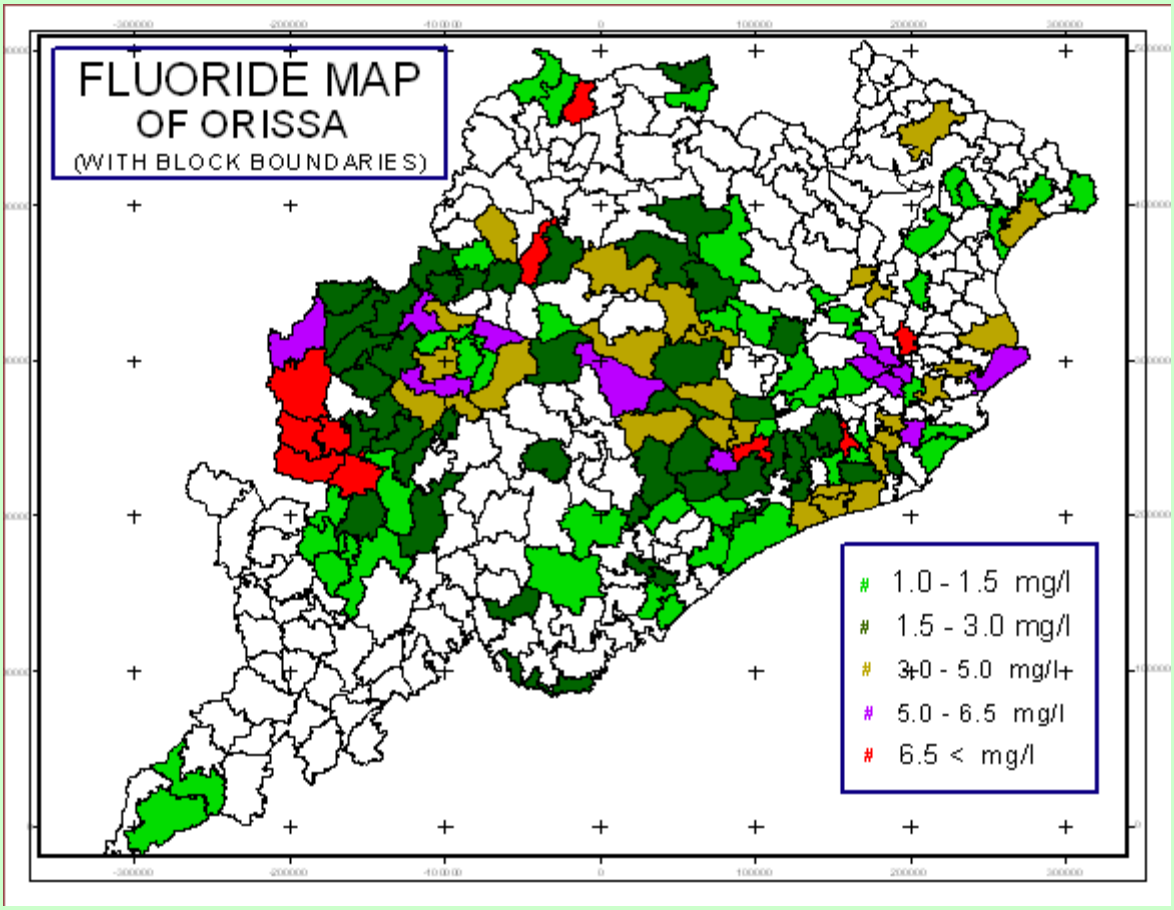
FLUORIDE MAP
OF ORISSA
(WITH BLOCK BOUNDARIES)
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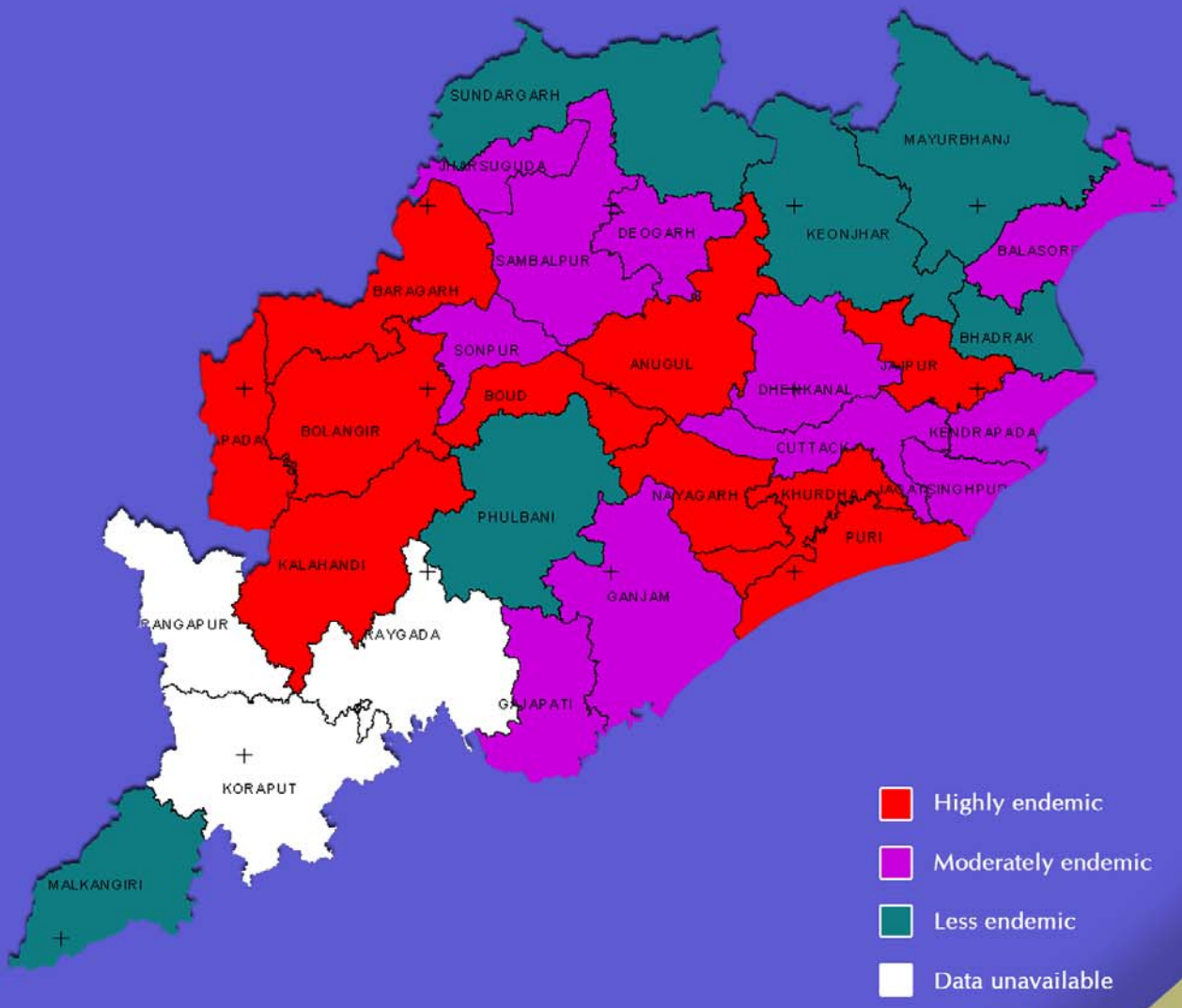
1.5 - 3.0 mg/l
3.0 - 5.0 mg/l
5.0 - 6.5 mg/l
6.5 < mg/l



RCDC Centre for Water for Life
424, Sahid Nagar, Bhubaneswar-751 007, Orissa
Ph.: +91 674 2547585 / 2547897
Fax: +91 674 2540716
E-mail: rcdccwl@bsnl.in, cwlfmd@gmail.com
Website: www.rcdcindia.org