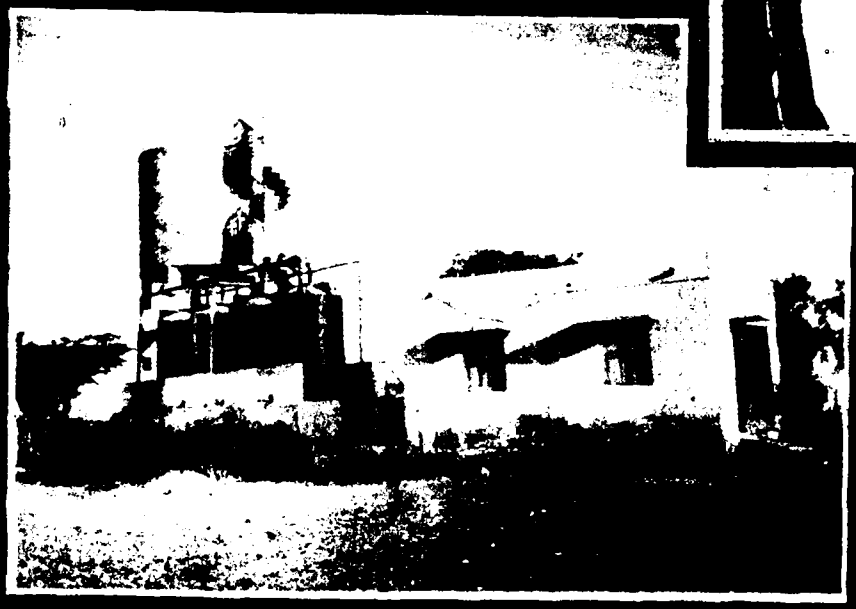
NATIONAL FLUORIDATION CAMP AT AMRELI

20th - 25 th April 1987



Under
Technology Mission
on Drinking Water
in Villages & Related
Water Management

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE NEHRU

NATIONAL CAMP ON DEFLUORIDATION AMRELI (GUJARAT)

APRIL 20-25, 1987

REPORT

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE
NEHRU MARG, NAGPUR - 440 020

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Inauguration of the Camp

INTRODUCTION

Nalgonda Technique of Defluoridation is the technology identified for solving the problem of excess fluoride in drinking water and related health problems. This well established technique of defluoridation of drinking water supplies is the contribution of National Environmental Engineering Research Institute (NEERI), Nagpur, one of the National Laboratories, under Council of Scientific & Industrial Research (CSIR), New Delhi.

The CSIR Headquarters, New Delhi, and NEERI, Nagpur, are participating significantly in the 'Technology Mission on Drinking Water in Villages and Related Water Management' on the aspect of defluoridation of drinking water supplies. The efforts of State Level implementing agencies are of crucial importance if the rural masses are to harvest the benefits of advancement of scientific and engineering knowledge in the control of fluorosis. It may be re-emphasized that fluorosis cannot be cured and ill effects can be controlled by preventive measures. All these facts were well recognised in the meeting of Technology Advisory Group III (TAG.III) held on 22nd December, 1986, at CSIR Headquarters, New Delhi. The TAG.III decided that NEERI will organise urgently a Workshop on Defluoridation at Amreli (Gujarat). A series of actions were initiated at various levels of concerned agencies and finally the 'National Defluoridation Camp' was organised at Amreli (Gujarat) during 20th-25th April, 1987. The National Defluoridation Camp, Amreli, hereinafter referred to as 'Camp' for brevity, received guidance from CSIR Headquarters and Mission Directorate, was the joint action of NEERI, Nagpur, and Gujarat Water Supply & Sewerage Board(GWS & SB), Gandhinagar.

AMRELI DISTRICT

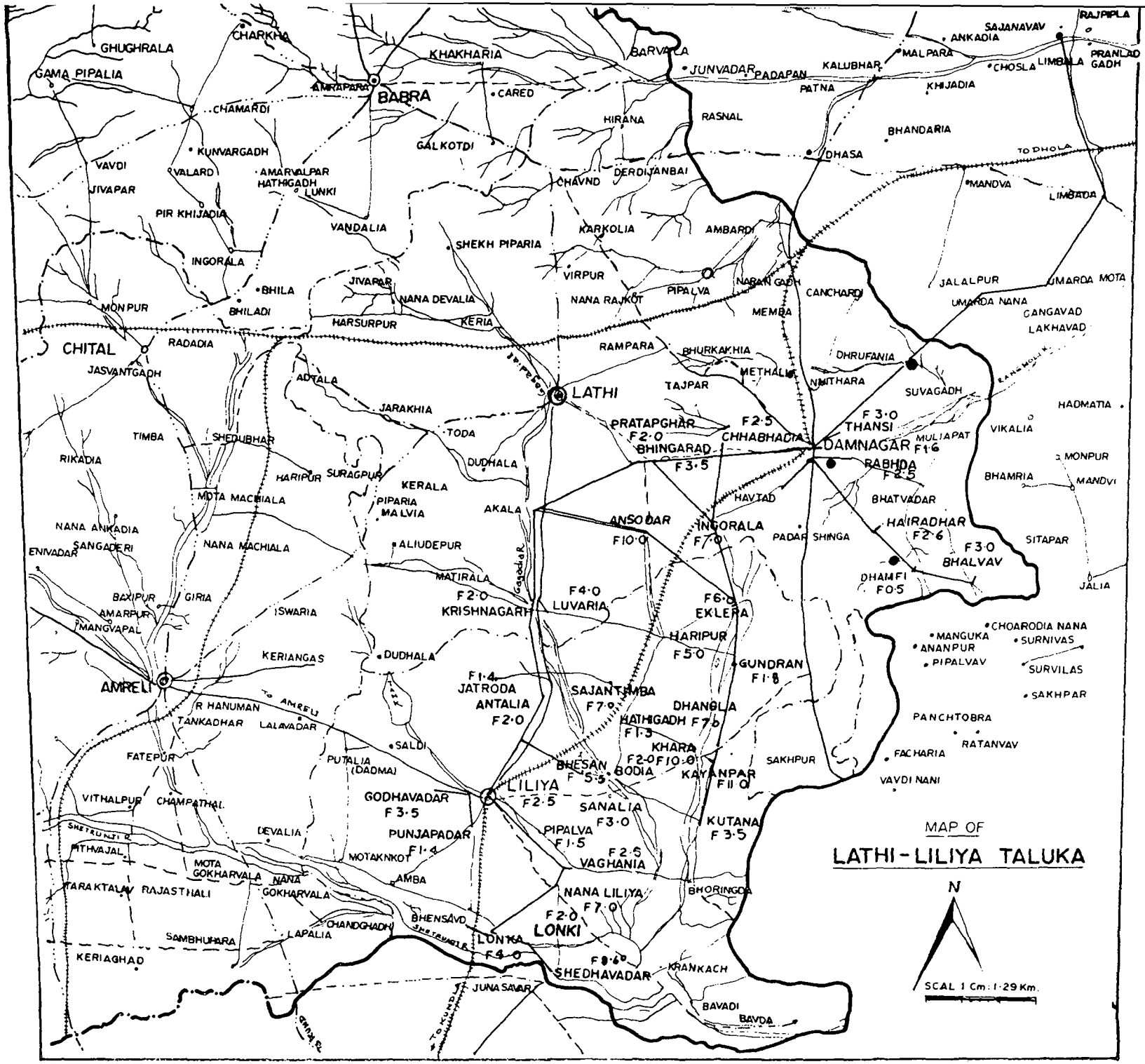
Amreli in Saurashtra region is one of the 19 districts of the State of Gujarat. Amreli district has the district of Rajkot on North side and part of Junagadh district and Arabian sea on South. East and West borders of Amreli district are lined by the borders of Bhavnagar and Junagadh districts respectively. Entire Gujarat State is within 800 metres above mean sea level except small area of Dang district, which has the ranges of Satpura in Southernmost part. The major part of Amreli district is within 150 metres above mean sea level. The famous Somnath temple near Virawal is South-West about 250 Km from Amreli.

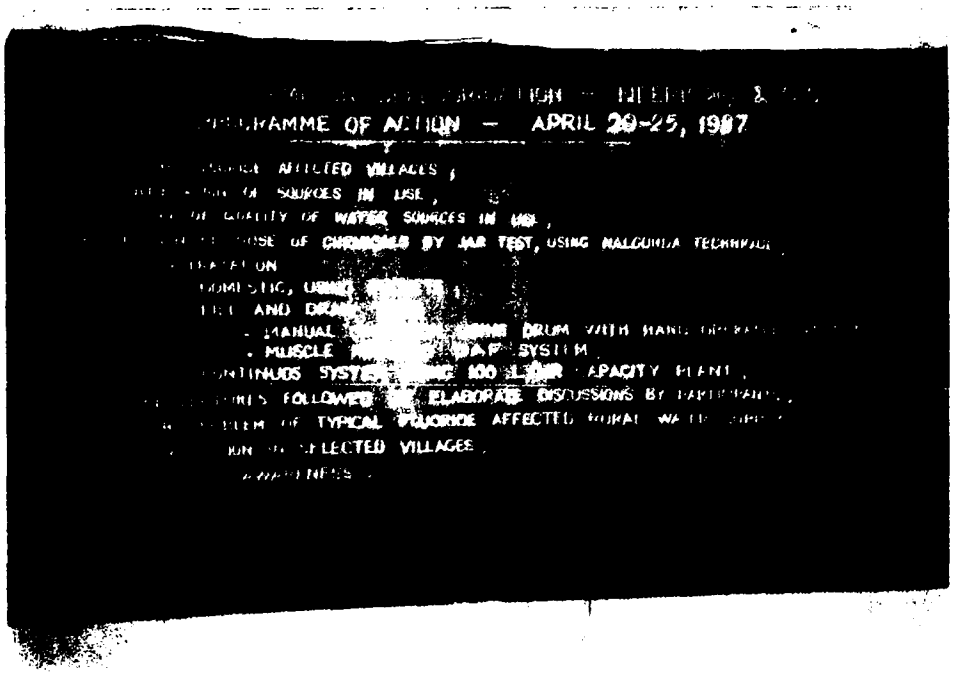
Nearest airport is Bhavnagar, about 160 Km from Amreli and major transport is by road. The rail line network is metre gauge which makes road transport a choice and road conditions are fine.

The population of Amreli District is 1,075,766 which is 3.17 % of the population of Gujarat State. The total area of the district is 6760 sq.km and is divided in 10 taluks which are : Amreli, Dhari, Khambha, Rajula, Jufarabad, Kodinar, Kukewaw-Vadiya, Babra, Lathi, and Liliya.

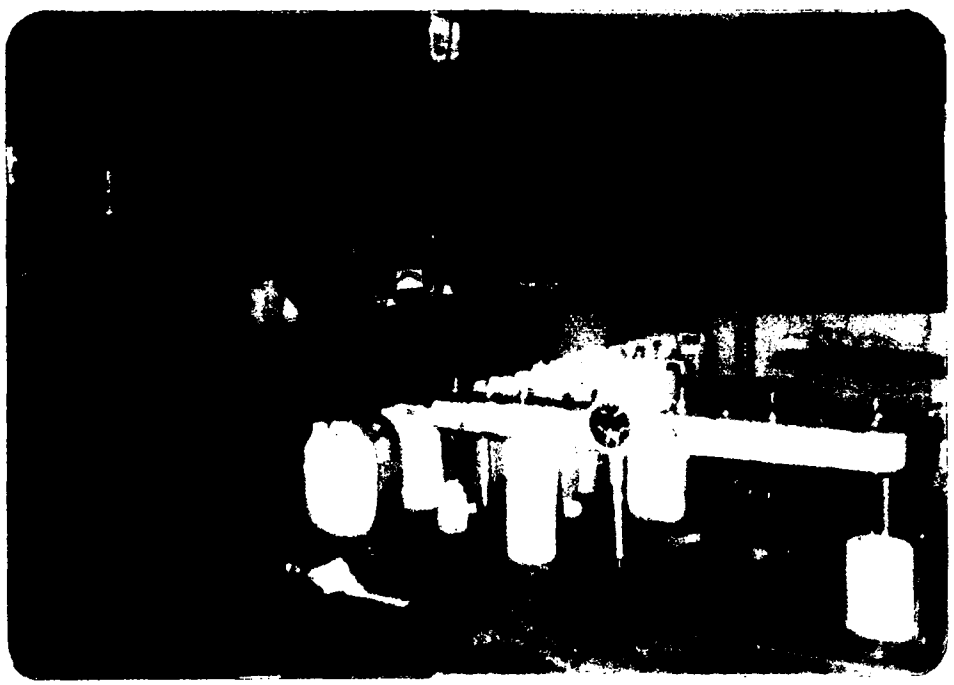
Fluorosis in Lathi and Liliya Taluks

Out of these 10 taluks, some of the villages in Lathi and Liliya taluks are having groundwater sources containing excess fluorides. The Government of Gujarat through its GWS & SB has taken commendable measures and planned a systematic programme to fight this menace. The GWS & SB is mentiond hereafter as 'Board' in this communication. Surveys conducted in Lathi and Liliya taluks revealed that many villages are affected by the adverse health effects of excess fluorides in drinking water and the victims are suffering miserably. The preliminary survey revealed that 18 villages out of 24 covered in the programme had water sources with excessive fluorides. The highest level of fluorides was observed to be 10.0 mg/l. The average high level of drinking water fluoride was observed to be 3-6 mg/l. (A map showing fluoride levels in different villages affected by fluorosis is enclosed).


MAP OF
LATHI - LILIYA TALUKA
N
SCAL 1 Cm : 1·29 Km.
BABRA
LATHI
LILIYA
AMRELI
CHITAL
DAMNAGAR
LONKI
GHUGHRALA
CHARKHA
KHAKHARIA
BARVALA
JUNVADAR
PADAPAN
KALUBHAR
MALPARA
SAJANAVAV
ANKADIA
RAJPIPLA
PRANLAD GADH
LIMBALA
CHOSLA
KHIJADIA
PATNA
GAMA PIPALIA
AMRAPARA
CARED
CHAMARDI
HIRANA
RASNAL
BHANDARIA
DHASA
TO DHOLA
MANOVA
LIMBADA
KUNVARGADH
VAVDI
VALARD
AMARVALPAR
HATHIGADH
LUNKI
GALKOTDI
CHAVND
DERDIJANBAI
JIVAPAR
PIR KHIJADIA
VANDALIA
KARKOLIA
AMBARDI
SHEKH PIPARIA
INGORALA
VIRPUR
PIPALVA
NABAN GADH
CANCHARDI
JALALPUR
UMARDA MOTA
UMARDA NANA
GANGAVAD
LAKHAVAD
BHILA
BHILADI
MONPUR
JIVAPAR
NANA DEVALIA
NANA RAJKOT
MEMBA
HARSURPUR
KERIA
RADADIA
RAMPARA
BHURKAKHIA
METHALA
DHRUFANIA
NAITHARA
SUVAGADH
JASVANTGADH
ADTALA
TAJPAR
JARAKHIA
TODA
PRATAPGHAR
F 2·0
F 2·5
CHHABHACIA
F 3·0
THANSI
MULIAPAT
VIKALIA
HADMATIA
TIMBA
SHEDUBHAR
BHINGARAD
F 3·5
F 1·6
RABHDA
F 2·5
MONPUR
RIKADIA
DUDHALA
HARIPUR
SURAGPUR
KERALA
BHAMRIA
MANDVI
MOTA MACHIALA
PIPARIA
MALVIA
AKALA
HAVTAD
BHATVADAR
NANA ANIKADIA
ANSODAR
F 10·0
INGORALA
F 7·0
HAIRADHAR
F 2·6
SITAPAR
SANGADERI
NANA MACHIALA
ALIUDEPUR
PADAR SHINGA
F 3·0
BHALVAV
ENIVADAR
MATIRALA
F 2·0
F 4·0
LUVARIA
F 6·0
EKLERA
DHAMFI
F 0·5
JALIA
BAXIPUR
GIRIA
KRISHNAGARH
AMARPUR
ISWARIA
MANGVAPAL
HARIPUR
F 5·0
CHOARODIA NANA
MANGUKA
SURNIVAS
ANANPUR
PIPALVAV
SURVILAS
KERIANGAS
DUDHALA
GUNDRAN
F 1·8
F 1·4
JATRODA
ANTALIA
F 2·0
SAJANTHIBA
F 7·0
DHANOLA
HATHIGADH F 7·6
F 1·3
SAKHPAR
R HANUMAN
TANKADHAR
LALAVADAR
TO AMRELI
PANCHTOBRA
RATANVAV
SALDI
KHARA
F 2·0
F 10·0
FACHARIA
FATEPUR
PUTALIA
(DADMA)
BHESAN
F 5·5
BODIA
KAYANPAR
F 11·0
SAKHPUR
VAVDI NANI
VITHALPUR
CHAMPATHAL
GODHAVADAR
F 3·5
SANALIA
F 3·0
KUTANA
F 3·5
SHETRUNJI R.
DEVALIA
PUNJAPADAR
F 1·4
PIPALVA
F 1·5
F 2·5
VAGHANIA
MOTAKNKOT
MOTA
GOKHARVALA
NANA
GOKHARVALA
AMBA
BHORINGDA
TARAKTALAV
RAJASTHALI
NANA LILIYA
F 7·0
F 2·0
CHANDGHADH
BHENSAVD
SHETRUNJI R.
LONKA
F 4·0
F 8·0
SHEDHAVADAR
KRANKACH
SAMBHUPURA
LAPALIA
KERIAGHAD
JUNASAVAR
BAVADI
BAVDA
TO KUNDLA
GHEE R.



Programme of Action During the Camp



Laboratory Set-up for the Camp

NATIONAL DEFLUORIDATION CAMP

Preparations and Participation

The Camp at Amreli during April 20-25, 1987, a joint venture of Board and NEERI, was organised at the instance of Technology Mission Directorate, as spelt out by TAG.III. The Camp programme was planned by Shri K.R. Bulusu, Deputy Director and Co-ordinator, Technology Mission, NEERI, Nagpur. The Camp was basically aimed at training the representatives of the participating agencies of various States afflicated with the problem of excess fluorides in drinking water.

Considering the severity of problem of fluorosis in the villages of Lathi and Liliya Taluks of Amreli district, public awareness campaign was made an integrated component of the Camp. The programme included the following activities.

i) Lecture and discussion sesssions.
ii) Demonstration of technologies at the Camp site.
iii) Visit to fluorosis affected villages.
iv) Demonstration of Nalgonda Technique under field conditions.
v) Evaluation of water quality and fixing the dose of chemicals for the identified sources.
vi) Public meetings and demonstration at important places.

Starting on 11th April, 1987, after preliminary preparations for the Camp at NEERI Headquarters, Nagpur, and Ahmedabad Zonal Laboratory, the team reached Amreli on 15th April, 1987. A total of 10 members comprised NEERI team for Camp. On 13th & 14th April, 1987, Shri K.R. Bulusu and senior scientists of his team held discussions with Shri V.B. Buch, Secretary, Water Supply; and Shri Y.N. Nanjundiah, Chief Engineer, R & D, Training and Technology Mission, GWS & S Board, Government, of Gujarat, regarding the Camp programme. NEERI team surveyed the fluoride affected villages of Lathi and Liliya Taluks during 15th-19th April,1987.

Dr. J.C. Srivastava, Joint Adviser & Co-ordinator, T.U. Division, CSIR Headquarters and Convenor - TAG.III, Technology Mission, announced the Camp programme to 28 Chief Engineers and Secretaries responsible for water supply requesting them to send the participants (List enclosed - Annexure I). Council for Advancement of Public Action and Rural Technology (CAPART), New Delhi, is a Society under the Technology Mission on Drinking Water. CAPART circulated information on training programme to the different voluntary agencies suggesting that they should sponsor appropriate candidates for the training in the camp(vide letter No.8-44(11)/87-TRG dated 2nd March, 1987, from shri P.V.L.N. Rao, Consultant (WR) CAPART, to Shri K.R. Bulusu). These voluntary agencies are enlisted in Annexure II. In response to these circulars, in all 22 participants representing the States of Andhra Pradesh, Uttar Pradesh, Karnataka, Gujarat, Manipur, Himachal Pradesh, Punjab, and Madhya Pradesh, attended the Camp. The participants are listed in Annexure III.

Novel feature of the Camp was the participation of thousands of villagers in the Camp activity to get themselves acquainted with Nalgonda Technique, hundreds of them travelled to Amreli at thier own cost to see the units installed at Camp site. Details of these units were explained to them in Gujarathi.

Programme

The Camp was inaugurated by Chief Guest Shri Rajesh Kishore, IAS, Collector & District Magistrate, Amreli, on 20th April, 1987. Shri Kodidas Bhai Thakker, MLA, Lathi, presided over the function. Shri Nanjundiah was the Guest of Honour. The distinguished invitees to the function included Zilla and Taluka Panchayat Presidents, Principals of Technical Institutes and Colleges, Gram Panchayat Pramukhs and several social workers. The Medical and Health Services personnel and Water Supply personnel were associated with all the Camp activities. Shri J.M. Barot, Chief Seientific Officer, Public Health Engineering Laboratory, GWS & S Board, Vadodara, was associated with the Camp activity and presented information on fluorosis problem in Lathi-Liliya and Bhesan Defluoridation Plant to the trainees. The daily programme of the Camp

Participants Demonstrating Domestic Defluoridation to the villagers

Fluorosis victim

Muscle Powered Fill & Draw Defluoridation Unit

Defluoridation by Muscle Powered Floation Unit

is given in Annexure IV. Shri Rajesh Kishore visited the Camp during installation of the Defluoridation Units, before commencement of the Camp, and Shri Bulusu explained him Nalgonda Technique of Defluoridation. The demonstration included bucket and rod unit, hand operated (100 L) Defluoridation Unit, Dissolved Air Floatation Defluoridation Unit (Muscle power unit) and Defluoridation Plant of 1 M^3/hr capacity. Estimation of fluoride content in water sample by ion-selective electrode method was also included in demonstration. All these units and methodologies were subsequently demonstrated to all the visitors, including Shri Kodidas Bhai Thakkar, several Health, Medical and Water Supply authorities, and hundreds of villagers who travelled from their villages to Camp site, all at their own cost, to learn the techniques.

Shri Nanjundiah held deliberations with participants on 20th April, 1987, encompassing the fluorosis problems in Lathi-Liliya area and enriching the discussions with practical suggestions based on four decades of his experience as practising Water Supply Engineer. Shri Bulusu opened the topic of fluoridation and defluoridation and development of techniques taking the participants into the details of chemistry and technology of defluoridation and posing the nature of the problems the trainees are expected to solve back-home.

Design problem to be solved as an exercise by the participants was yet one more special feature of the Camp programme. This enabled the participants to mobilize their own ideas in finding the solution to the problem of excessive fluorides in drinking water with a bearing on the local conditions faced by them. This also helped in setting away the concept of typed designs or standard designs and making the participants aware of the freedom they have in design of appropriate defluoridation plants which suit their local needs.

Defluoridation Exercise and Field Visits

Participants from various States attended the Camp. Specific training programme included lectures, demonstrations and field visits. After the lectures and demonstrations, participants carried out the experiments on defluoridation.

Testing of the Muscle powered DAF System

The package water treatment plant using "Dissolved Air Floatation Technology" was extensively tested in the field using water containing fluorides from natural sources. Water containing 7.2 mg/L fluorides was used. This water was also diluted to various concentrations and defluoridation studies were carried out. It is observed that proper floatation treatment can be achieved upto the fluoride (raw water) concentration of 5.5 mg/L. Raw waters having concentrations above 5.5 mg/l exhibit settling tendencies after alum addition and hence the treatment is achieved partly by settling and partly by floatation. One of the identified reasons for this fact is inadequate supply of dissolved air with respect to the suspended solids (i.e inadequate a/s ratio). The system is being modified accordingly. Even though there was marginal settling, the water containing 7.2 mg/L fluoride could be treated to achieve 1.2 to 1.7 mg/L fluorides in treated water, corresponding to 980 to 840 mg/L alum dose for treatment.

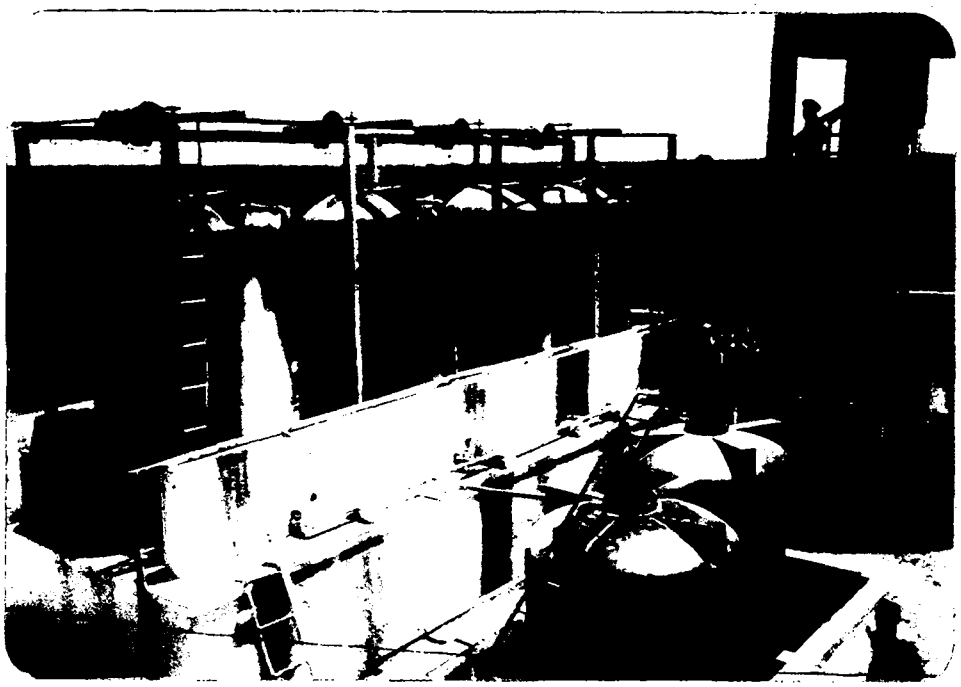
Shri Nanjundiah, Chief Engineer, Gujarat Water Supply & Sewerage Board, requested Shri Bulusu, Deputy Director, NEERI, to retain the Dissolved Air Floatation (DAF) Unit at Ahmedabad for further demonstration to the Government officials and other dignitaries.

Bhesan Defluoridation Plant

Gujarat Water Supply & Sewerage Board commissioned Bhesan group of villages water supply scheme as sanctioned in Health Resolution No.VWS/2971/11021/KH dated 19-8-1982. The scheme is based on Nalgonda Technique of Defluoridation and works on fill-and-draw pattern. Bhesan is 6 km North-East of Liliya, a Taluka place in Amreli District. The scheme supplies defluoridated water to Bhesan, Sanaliya, and Bodia, with population of 626, 1380, and 431 respectively as per 1981 Census.

This effort of the Board is commendable, especially so, as the engineers of Amreli Division designed the scheme only on the basis of literature available to them on Nalgonda Technique and no consultation of any form was availed from any external agencies.

120 cu m/day Fill & Draw Defluoridation Plant
for Bhesan, Sanaliya & Badiya villages



NEERI team visited Bhesan Defluoridation Plant several times during the Camp period and analysed raw and treated water samples. The plant performance was found to be satisfactory with respect to defluoridation capacity of the plant. The raw water fluoride content of 6.6 mg/L was brought down to 1.5 mg/L on treatment.

Visit to Bhesan Defluoridation Plant was organised during the Camp and the participants were acquainted with the plant details.

The copies of Bhesan Water Supply Scheme were supplied to the participants by the Board. The scheme document contains detailed information on draft of the scheme, financial approval, specification of materials, commissioning and operation & maintenance. High density polyethylene (HDPE) containers of Sintex made are used in the plant design. These containers are installed on concrete platform. The electrical motor driven stirrer device is used for flash and slow mixing of alum dose. The design is apparently simple. The plant is in working condition and supplying defluoridated water to Bhesan, Sanaliya and Bodia villages regularly.

Apart from the analysis of raw and treated waters from Bhesan Defluoridation Plant, the samples from various villages in Lathi-Liliya area were analysed during the Camp period. The results are given in Table 1.

Observations of Lathi-Liliya excessive fluoride problems

1) The Board is aware of the problem of excessive fluoride in drinking water in Lathi-Liliya area and has taken certain commendable steps to solve the problem.

2) The Board has undertaken extensive survey of water supply sources involving the Public Health Engineering Laboratory at Baroda.

3) Commissioning of Bhesan Defluoridation Plant on the basis of literature available to the Board is a commendable step in the effort of providing a solution to the fluoride-affected water supply condition.

Follow-up Action in Lathi-Liliya Talukas

Considering the severity of the problem in Lathi-Liliya Talukas and as a result of the tremendous awareness amongst the fluoride affected villagers in these areas, the following action is recommended consequent to the discussions between the NEERI team of Scientists and concerned senior engineers of the Board to ameliorate the sufferings of the several thousands in that area and to prevent adding fluoretics to the society hereafter.

* Domestic Defluoridation in all the fluoride villages until such time community water supply comes to these villages; this will prevent adding daily incurable fluoretics to the society and consequent problems.
* Installation of Fill-and-Draw type Community Defluoridation Water Supply Schemes in the evidently worst affected problem villages, viz. Ingorala, Khara, and Nana-Liliya villages to supply at the rate of 40 lpcd to the 1264, 1131, and 1141 populations respectively.
* Group Water Supply Schemes with or without external aid to cover all or part of the fluoride affected villages by bringing water from a distance as a long range solution, where and when such low fluoride water becomes available within a reasonable distance from the fluoride areas.

While the efforts to think on a long range basis are commendable in the form of bringing water from a distance to quench the thirst of the fluoride affected areas, it is necessary and, in fact, highly essential that until such time the long range plans reach the people, some alternatives as indicated above, viz. domestic defluoridation and some fill-and-draw type defluoridation systems are implemented without any further loss of time. As and when group water supply schemes materialise from surface sources with low fluoride, the domestic defluoridation and fill-and-draw type plants can be discontinued and the plants shifted to those places where then they are still required, i.e. to those villages which may still not be fortunate to have been covered under group schemes.

Interaction between Participants and villagers

Demonstration by Village Surpanch to Community

Domestic Defluoridation

Domestic defluoridation by Nalgonda Technique is an acceptable way of reducing fluorides. Once the level of fluoride and the alkalinity are known, and provided the water is otherwise suitable, the method can be used with ease. The process besides fluorides will also remove suspended impurities, bacterial contamination and excessive alkalinity in the Lathi-Liliya waters.

During the demonstration and the participation of the villagers and the participants from the States using buckets and natural waters in the villages visited, the treated water was tasted by several of those assembled at each village. While a change in the taste of the treated water is inevitable, there were no discernible objections to it when specifically and repeatedly enquired about it. IT HAS TO BE ENSURED THAT NOT MORE THAN WHAT IS REQUIRED TO BE ADDED IN THE FORM OF ALUM DOSE IS ADDED. Otherwise, a possibility of a residual metallic taste due to excess alum becomes perceptible, causing objections. Fortunately, the Lathi-Liliya waters are characterised by excessive alkalinity and such a situation seldom arises unless deliberately excessive alum doses are added out of ignorance. IT IS, THEREFORE, ESSENTIAL THAT THE DOSES ADDED ARE ON THE BASIS OF THE ACTUAL RECOMMENDATIONS OF THE N.E.E.R.I. TEAM OF SCIENTISTS.

Taste : As Lathi-Liliya waters are highly alkaline (600 to 1600 mg/L), the villagers are used to the alkaline taste, which is not desirable. Even the tea prepared from these highly alkaline waters is typical in taste as compared to the tea prepared from waters with 100-300 mg/L alkalinity. This is possibly due to the differences in the tannin-like material extracted during the preparation. NEERI studies have shown that these highly alkaline waters extract 400-600 mg/L tannin-like substance which is nearly 3 to 5 times higher than in low alkaline wates. These excessive tannin-like substances impart a typical woody-taste and odour. Excessive alkalinity caused by bicarbonates as in this case is generally considered to be a disadvantage in brewing and for beverages.

During the domestic defluoridation by Nalgonda Technique, the excessive alkalinity is destroyed and excessive bicarbonates are removed. This is an advantage which improves the taste of tea and other beverages due to lesser extraction of tannin-like substances by the treated water. Since the villagers are used to the preparations from alkaline waters, it takes time and creation of awareness among them to make them realise the usefulness of the changed taste brought about by the process of defluoridation.

Villages which can immediately go in for Domestic Defluoridation : Out of the 37 villages in the belt, 31 do need defluoridation of water. Twenty villages have fluorides in the range of 2-5 mg/L and 11 have fluorides exceeding 5 mg/L. These eleven villages should resort to domestic defluoridation immediately, pending alternatives.

The names of the 37 villages, fluorides in raw water, population, estimated water requirements per day, alum needed per day and cost of defluoridation per capita per annum are listed in the Table 2.

The total population of 31 villages with fluorides is 44,118 (Table 2) and the cost of treatment per M^3 defluoridated water varied from Re 0.75 to Rs 3.20 depending on the raw water fluoride and alkalinity; this corresponds to Rs 10.95 to Rs 46.72 per year per person supplied at the rate of 40 litres defluoridated water, which is reasonable and good public health measure, that requires serious consideration and motivation. The villagers and village Chiefs when explained about the costs and benefits were very keen to implement it from the very day, and they have been doing it as per reports. What is needed is a missionary follow-up.

Installation of Fill-and-Draw type Community Defluoridation Plants

Three Fill-and Draw type Defluoridation Plants are recommended at the villages Ingorala, Khara, and Nana-Liliya. These villages with a respective population 1264, 1131 and 1141, are showing extreme cases of dental and skeletal fluorosis with waters having excessive alkalinity

Pilot Plant Demonstration to Village Chiefs

and fluorides; the corresponding levels of fluorides in these three villages are 7.0, 10.0, and 7.0 mg F/L as compared to permissive 1.0 mg F/L. Hence, there exists an urgent need to install defluoridation plants at these villages, pending the arrival of group water supply schemes. Here too, as and when the group schemes are successfully commissioned, the operating defluoridation fill-and-draw-type plants can be shifted to other fluorids affected villages which shall not be covered under the group scheme then.

The quantity of defluoridated water required at Ingorala, Khara, and Nana-Liliya villages is 50,560; 45,240; and 45,640 litres respectively. This can be achieved through the installation of removable/shiftable HDPE systems. A battery of 10,000 litres capacity HDPE one-piece moulded cylindrical vertical containers will be installed at each of these villages to treat fluoride waters on a batch process and supply the treated water through public stand posts. The estimated cost of these systems are Rs 3.5, Rs 3.0, and Rs 3.0 lakhs for Ingorala, Khara, and Nana-Liliya. The cost is exclusive of civil works and stand posts, which are to be constructed by Board. The Board can make provision for these systems and make payments directly on the production of suppliers' bill for HDPE systems.

The costs of treatment of water at these villages are Rs 1.98-2.22; Rs 1.99-2.21; and Rs 1.97-2.02 per M^3. These correspond to Rs 28.91 - 32.41; Rs 29.05 - 32.27; and Rs 28.76 - 29.49 per year per person, which is reasonable and workable proposition. The Board should take up immediate measures to install the systems.

Group Water Supply Schemes

As a permanent measure, the GWS & S Board prepared plans and estimates for the Lathi-Liliya Regional Water Supply Scheme based on Kalubhar dam, situated 35 Km away, as a source of water, covering 36 villages and one town and a total population of 61,207 (1981 Census). The Scheme costing Rs 7,27,41,700/- is submitted to Government of India for inclusion under Dutch Bilateral assistance on 22-1-1987. The Board

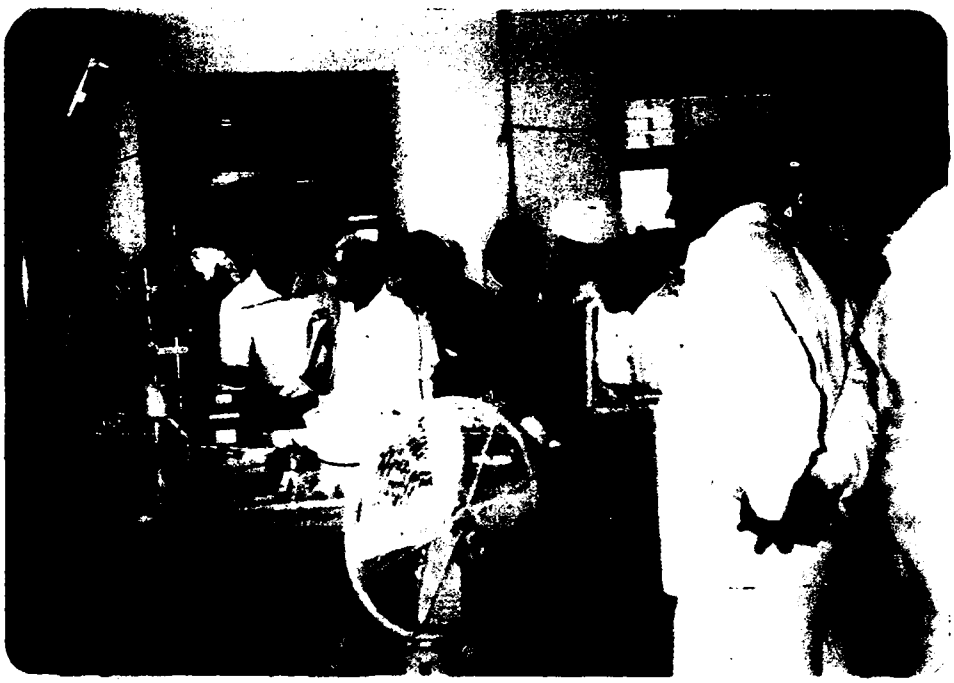
proposes to commission this Scheme within 24 months of receiving the sanction from Government of India.

The participants from the various States having taken active participation in the Camp and following Demonstrations at several villages acquired the basic requirements for using Nalgonda Technique in the fluoride affected areas in various parts of the country. They were receptive, inquisitive, and innovative and were keen to propagate the idea to their respective areas. A single page report was submitted by each participant at the conclusion of the Camp and a gist of their observations is given in Annexure VI. It is fervently hoped that participants and voluntary agencies may take follow-up action in their respective problem zones and contribute to the amelioration of the sufferings of the fluoride affected people.

The responsibility rests with the concerned States. They should take up remedial measures by actively advocating domestic defluoridation in various villages and wherever possible install Fill-and-Draw type shiftable defluoridation plants without further delay. Some group of villages might require community continuous defluoridation plants. Such places may be identified and work commenced using the detailed design information contained in the "Defluoridation" Package prepared and widely circulated by NEERI. The copies were given to the participants and were also sent to the Chief Engineers for guidance.

Audio-Visual Coverage of the Camp

The over-whelming participation and mass-movement during the Camp, is depicted in a Video coverage of the entire Demonstration Camp. The original cassette lasting 90 minutes has been edited to give nearly 20 minute version.



Shri Kodidas Bhai Thakkar, MLA, Lathi (Gujrat) at the Village Camp

Participants to the Camp from Various States

ACKNOWLEDGEMENTS

The National Camp on Defluoridation was decided at a Meeting of the Technology Advisory Group III (TAG.III) on 30th May, 1986. The concept has been highly acclaimed by one and all who participated in the Camp. The guidance from the Ministry of Agriculture, Department of Rural Development and CSIR Headquarters is really commendable and NEERI is grateful for the same.

The main source of inspiration is from the unflinching support and constant encouragement from Prof. P. Khanna, Director, NEERI. The strength of the Camp is derived from Shri Y.N. Nanjundiah, Chief Engineer, Gujarat Water Supply & Sewerage Board, whose constant presence, guidance and direction were valuable in organising this Camp.

NEERI is grateful to Dr. G. Ghosh, Mission Director, Water Technology Mission, Government of India; Dr. Ram K. Iyengar, Additional Director General, CSIR; and Shri V.B. Buch, Secretary (Water Supply), Health & Family Welfare Department, Government of Gujarat; for their kind help in giving shape to the Camp. NEERI expresses its gratitude to Shri Rajesh Kishore, IAS, Collector & District Magistrate, Amreli (Gujarat) for his keen interest and support to this programme. The active services offered by his staff are acknowledged. The Institute is grateful to Shri Kodidas Bhai Thakkar, M.L.A., Lathi (Gujarat) for presiding over the function and valuable suggestions and look forward to his continued support to ameliorate the sufferings of fluoride affected people in Amreli District.

NEERI would like to place on record its appreciation of the States who have deputed their officials for the Camp. The Institute also thanks all the participants for sharing their rich experiences with the Faculty and also for their active involvement in village demonstration campaigns during the Camp.

NEERI's thanks are also to Shri K.H. Shah, Superintending Engineer; Shri S.G. Nagrecha. Executive Engineer; Shri J.B. Bhatt, and Shri

Doshi, Deputy Executive Engineers; and all other staff of Gujarat Water Supply & Sewerage Board, Amreli, for their active involvement and support in organising this Camp. The Institute is also immensely thankful to the Principal and Vice Principal of the Polytechnic, Amreli, for generously making available their premises to set up Camp.

This Camp is basically for the benefit of the rural public. It is their active participation in thousands that gave colour and meaning to the Camp. It is this aspect that assures the desired objectives of the Mission and its fulfilment. Thanks are to all those villagers and Sarpanchas who took active interest in the Camp.

The organisation of the Camp by NEERI is a complex exercise under the guidance of Prof. P. Khanna, Director, NEERI. Preparations required the active participation of several Divisions at Headquarters and Zonal Laboratory, Ahmedabad. The Faculty for the Camp is also drawn from various Divisions to make the Camp a meaningful learning and sharing ground. Space makes it difficult to enlist all those who directly assisted in making the exercise a cherishable success; but special credits are due to the staff of Water Division, Technology Demonstration Division, Technical Publications Division, Workshop; and Zonal Laboratory, Ahmedabad. Their whole-hearted participation, co-operation, and involvement are gratefully acknowledged.

TABLE - 1 : Chemical Characteristics of Water in some Villages of Lathi-Liliya Area

Sl. No.	Source of Water	Conductivity, µS/cm.	pH	P-alkalinity ($CaCO_3$) Mg/L	M-alkalinity ($CaCO_3$) Mg/L	Total Hardness ($CaCO_3$) Mg/L	Ca-Hardness ($CaCO_3$) Mg/L	Mg-Hardness ($CaCO_3$) Mg/L	Chloride (Cl) Mg/L	Sulphate (SO_4) Mg/L	Fluoride (F) Mg/L
1	2	3	4	5	6	7	8	9	10	11	12
1.	Mhaisana Village (defluoridation plant) well water.	1800	8.2	0	760	74	40	34	110	-	6.6
1a.	Mhaisana Village (defluoridation plant) treated water.	2050	7.0	0	336	100	68	32	90	180	1.5
2.	Haripar Village Well No.1.	3600	7.7	0	476	252	92	160	790	-	2.2
3.	Haripar Village Well No.2.	2000	8.3	0	570	64	32	32	275	-	4.0
4.	Akala Village Head Work Composite Sample.	1600	8.2	0	220	172	96	76	320	55	1.7
5.	Akala village Bore Well No.1 (Near Jade Well).	2300	7.6	0	260	360	208	152	476	79	1.1
6.	Akala Village Bore Well No.2.	1200	8.2	0	328	124	88	36	130	36	2.0
7.	Akala Village Jade Well.	1700	8.1	0	228	240	152	88	338	79	1.2
8.	Asodar Village Well No.1.	2000	8.2	0	784	72	36	36	120	43	7.8

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Sl. No.	Source of Water	Conductivity, µS/cm.	pH	P-alkalinity ($CaCO_3$) Mg/L	M-alkalinity ($CaCO_3$) Mg/L	Total Hardness ($CaCO_3$) Mg/L	Ca-Hardness ($CaCO_3$) Mg/L	Mg-Hardness ($CaCO_3$) Mg/L	Chloride (Cl) Mg/L	Sulphate (SO_4) Mg/L	Fluoride (F) Mg/L
9.	Asodar Village Well No.2.	3500	7.6	0	584	368	136	232	442	94	5.6
10.	Ingorala Village Well Water.	1600	8.3	0	624	36	20	16	80	30	6.5
11.	Ingorala Village Hand Pump Water.	1700	8.2	0	680	64	32	32	90	33	9.2
12.	Kalyanpur Village Talao Well.	1900	8.3	0	408	60	28	32	244	49	1.9
13.	Kalyanpur Village Washing Well.	3000	8.0	0	728	112	40	72	406	50	9.8
14.	Khara Village Pond Well.	1600	8.3	0	328	72	36	36	224	59	0.7
15.	Khara Village Awada Well.	6000	8.0	0	608	420	112	308	1464	86	6.0
16.	Jambarwala Village Tan-Babla, Dist.Amreli Bore Well Water.	3400	7.8	0	160	600	448	152	864	-	0.7
17.	Bhesan Village Private Hand Pump (very old type) Water.	7000	7.5	0	506	412	180	232	1745	290	3.3
18.	Khara Village Hand Pump near Harijan Basti.	3000	8.2	0	668	80	40	40	410	99	9.4

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Sl. No.	Source of Water	Conductivity, µS/cm.	pH	P-alkalinity ($CaCO_3$) Mg/L	M-alkalinity ($CaCO_3$) Mg/L	Total Hardness ($CaCO_3$) Mg/L	Ca-Hardness ($CaCO_3$) Mg/L	Mg-Hardness ($CaCO_3$) Mg/L	Chloride (Cl) Mg/L	Sulphate (SO_4) Mg/L	Fluoride (F) Mg/L
19.	Nanaliliya Govt. Hand Pump - close to small building.	2200	8.3	0	786	40	20	20	120	44	4.7
20.	Nanaliliya Open Draw well fitted with Pump.	2400	8.3	0	797	52	28	24	195	75	4.2
21.	Nanaliliya Hand Pump near Harijan Basti.	1800	8.3	0	722	36	24	12	150	40	5.0
22.	Village Chhabhadia, 150 mm Bore with submercible pump.	940	8.2	0	244	212	160	52	115	35	1.6
23.	Village Jhansa : Private Wadi Well of Shri Javaraj Parbat.	4000	7.8	0	264	940	492	448	1050	--	1.3
24.	Village Havtad: 100 mm Bore with hand pump near Ramji Kaka's residence.	1400	8.2	0	432	144	100	44	115	50	2.8
25.	Village Havtad : Panchayat Well with pump house.	1400	8.4	8	428	160	60	100	130	47	2.6
26.	100 mm Bore with Hand pump in Magalia pora.	1500	8.3	0	370	192	108	84	200	50	2.3

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Sl. No.	Source of Water	Conductivity, µS/cm.	pH	P-alkalinity ($CaCO_3$) Mg/L	M-alkalinity ($CaCO_3$) Mg/L	Total Hardness ($CaCO_3$) Mg/L	Ca-Hardness ($CaCO_3$) Mg/L	Mg-Hardness ($CaCO_3$) Mg/L	Chloride (Cl) Mg/L	Sulphate (SO_4) Mg/L	Fluoride (F) Mg/L
27.	Village Damnagar 150 mm Bore near Dhikudi Wadi.	1400	8.3	0	344	168	100	68	180	--	1.3
28.	Village Damnagar 100 mm Bore with deep well near Jivanlal Mill.	1400	8.4	10	388	152	68	84	175	--	1.3
29.	Village Damnagar 100 mm Bore with Hand Pump (in Harijanwas).	2000	8.0	0	390	280	128	152	310	--	1.2
30.	Damnagar Village Bore (in Bhavani Chowk)	1800	8.3	0	356	308	96	212	235	--	1.4
31.	Village Damnagar 100 mm Bore with Hand Pump in Magal pora (near Abbas Bhai's residence).	1400	8.2	0	296	188	112	76	245	--	1.0
32.	Village Damnagar 150 mm Bore with deep well (in Najat pora).	3000	8.0	0	112	700	664	36	790	--	0.7
33.	Village Damnagar 100 mm Bore Well with Hand Pump in Ward No.1 near Vallabha's residence.	3600	7.9	0	134	1232	968	264	970	--	0.7

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Sl. No.	Source of Water	Conductivity, µS/cm.	pH	P-alkalinity ($CaCO_3$) Mg/L	M-alkalinity ($CaCO_3$) Mg/L	Total Hardness ($CaCO_3$) Mg/L	Ca-Hardness ($CaCO_3$) Mg/L	Mg-Hardness ($CaCO_3$) Mg/L	Chloride (Cl) Mg/L	Sulphate (SO_4) Mg/L	Fluoride (F) Mg/L
34.	Lathi - 100 mm Bore with Deep Well (in Smashan).	4400	8.1	0	356	952	100	852	985	--	0.6
35.	Lathi - Pratap Kand Well	1400	8.2	0	228	248	64	184	200	--	0.6
36.	Lathi - 150 mm Bore with submercible (near Palace).	920	8.2	0	398	272	144	128	145	--	0.6
37.	Village Bhingrad Panchayat Public Well.	1400	8.3	0	496	200	48	152	130	45	5.4
38.	Village Bhurakhia 150 mm Bore with submercible	1800	8.2	0	276	428	92	336	360	--	0.8
39.	Village Damnagar 100 mm Bore with Hand Pump in Ward No.2.	3800	7.7	0	74	992	948	44	990	--	0.5
40.	Village Rampur - 100 mm Bore with Deep Well Behind Gayatri Mandir.	3600	8.2	0	212	328	152	176	175	--	0.4
41.	Village Tajpur - Scheme Well.	780	8.3	0	222	252	40	212	70	--	0.9
42.	Pomdi Talwada Water Works.	2200	7.0	0	330	144	100	44	340	--	2.1

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Sl. No.	Source of Water	Conductivity, µS/cm.	pH	P-alkalinity ($CaCO_3$) Mg/L	M-alkalinity ($CaCO_3$) Mg/L	Total Hardness ($CaCO_3$) Mg/L	Ca-Hardness ($CaCO_3$) Mg/L	Mg-Hardness ($CaCO_3$) Mg/L	Chloride (Cl) Mg/L	Sulphate (SO_4) Mg/L	Fluoride (F) Mg/L
43.	Nagji Govind - Well Water.	4400	7.2	0	54	348	96	252	775	--	2.0
44.	Uka Hari - Well water.	3800	7.7	0	292	580	240	340	650	--	1.0
45.	Narshi - Purushottam Well Water	7400	7.3	0	442	556	160	396	2000	--	1.6
46.	Dhakersha - Purushottam Well Water.	5200	7.7	0	260	420	170	250	850	--	2.0
47.	Amreli - Well Water from Batarwadi	1600	7.6	0	386	184	148	36	235	--	1.2
48.	Sample by Mr. Thekadi from Amreli.	800	7.3	0	226	180	104	76	70	--	0.5
49.	Well Water from Manekpara area - Amreli.	3000	7.2	0	290	700	364	336	560	--	0.4

TABLE - 2 : Villages in Lathi and Liliya Taluks showing high fluorides, population, water requirements, alum needed per day, and per capita cost per annum.

(Cost of alum is taken as Rs 2,000/- per tonne at Amreli)

Sl. No.	Name of the Village	Raw water fluorides mg F/L	Official population	Water requirement per day (Lit.)	Alum requirement per day (Kg.)	Cost of treatment of water (Rupees)	
						per cubic meter	per capita per annum
1.	Antaliya	2.0	905	36,200	14 - 15	0.77 - 0.83	11.24 - 12.12
2.	Godhavpur	3.5	1,689	67,560	33 - 34	0.98 - 1.01	14.31 - 14.75
3.	Vechania	2.5	525	21,000	8 - 9	0.76 - 0.86	11.10 - 12.56
4.	Nana-Liliya	7.0	1,141	45,640	45 - 46	1.97 - 2.02	28.76 - 29.49
5.	Lonka	4.0	610	24,400	12 - 13	0.98 - 1.07	14.31 - 15.62
6.	Lanki	2.0	929	37,160	14 - 15	0.75 - 0.81	10.95 - 11.83
7.	Shedhavpur	8.6	891	35,640	39 - 40	2.10 - 2.24	31.97 - 32.70
8.	Kalyanpur	11.0	607	24,280	28 - 30	2.31 - 2.47	33.73 - 36.06
9.	Mota-Liliya	2.5	6,256	2,50,240	100 - 110	0.80 - 0.88	11.68 - 12.85
10.	Eklera	6.0	1,490	59,600	53 - 55	1.78 - 1.86	26.00 - 27.16
11.	Haripur	5.0	1,120	44,800	31 - 35	1.38 - 1.56	20.15 - 22.78
12.	Dhangle	7.0	856	34,240	32 - 35	1.87 - 2.04	27.30 - 29.78
13.	Khara	10.0	1,131	45,240	45 - 50	1.99 - 2.21	29.05 - 32.27
14.	Kutna	3.5	1,224	48,960	24 - 26	0.98 - 1.06	28.91 - 15.48
15.	Sajantimba	7.0	928	37,120	35 - 40	1.89 - 2.16	27.59 - 31.54
16.	Bhesan	5.5	626	25,040	23 - 25	1.84 - 2.00	26.86 - 29.20
17.	Bodya	2.0	385	15,400	6 - 8	0.78 - 1.04	11.39 - 15.18
18.	Sanalya	3.5	1,380	55,200	22 - 25	0.80 - 0.91	11.68 - 13.29

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Sl. No.	Name of the Village	Raw water fluorides mg F/L	Official population	Water requirement per day (Lit.)	Alum requirement per day (Kg.)	Cost of treatment of water (Rupees)	
						per cubic meter	per capita per annum
19.	Thasa	3.0	1,627	65,080	35 - 38	1.08 - 1.17	15.77 - 17.08
20.	Rabhada	2.5	993	39,720	23 - 25	1.16 - 1.26	16.94 - 18.40
21.	Hajiradhar	2.0	921	36,840	18 - 20	0.98 - 1.09	14.31 - 15.91
22.	Dhamel	5.0	2,279	91,160	65 - 70	1.43 - 1.54	20.88 - 22.48
23.	Bhalvav	3.0	1,170	68,000	40 - 45	1.18 - 1.32	17.23 - 19.27
24.	Halvad	3.0	3,880	1,55,200	90 - 100	1.16 - 1.29	16.94 - 18.83
25.	Ingorala	7.0	1,264	50,560	50 - 56	1.98 - 2.22	28.91 - 32.41
26.	Pratapgarh	2.0	875	35,000	14 - 16	0.80 - 0.91	11.68 - 13.29
27.	Ansodar	10.0	2,810	1,12,400	168 - 180	2.99 - 3.20	43.65 - 46.72
28.	Bhigrad	3.0	995	39,800	20 - 22	1.01 - 1.11	14.75 - 16.21
29.	Luvaria	4.0	1,195	47,800	28 - 32	1.17 - 1.34	17.08 - 19.56
30.	Chhabhadiya	2.5	2,032	81,280	40 - 45	0.98 - 1.14	14.31 - 16.64
31.	Krishangadh	2.0	854	34,160	13 - 15	0.76 - 0.88	11.10 - 122.85
32.	Damnagarh	1.6	10,677	4,27,080	-	-	-
33.	Jatroda	1.4	2,163	86,520	-	-	-
34.	Punjapadar	1.3	1,787	71,480	-	-	-
35.	Pipalva	1.5	848	33,920	-	-	-
36.	Gunjaram	1.6	1,640	65,600	-	-	-
37.	Hatigarh	1.3	1,458	58,320	-	-	-

It may be recalled that in the domestic deflurodiation, there is no other expenditure except that of the chemical, aluminium sulphate, which is taken as Rs 2/- per Kg. at Amreli; all other material required is a bucket of 60 litres capacity, where 40 litres of water to be treated is taken, chemicals added, stirred for ten minutes and then settled for an hour or overnight where possible; the settled water is withdrawn from the tap provided to the bucket and the settled sludge is thrown away.

Alum is to be added in the form of 10% solution and the local merchants can prepare, store and sell it to the villagers to suit with the specific requirements of the water source, decided earlier on the basis of alkalinity, fluoride and other water characteristics.

(ANNEXURE - I)

List of Chief Engineers/Secretaries of Govts.

1. Shri N. Das, Chief Engineer-cum-Special Secretary, Public Health Engineering Department, Nirman Bhavan, Bailey Road, PATNA 800 001.

2. Shri R. Chaudhury, Chief Engineer, Public Health Engineering, Hengrabari, Gauhati-6.

3. Shri D.C. Debnath, Chief Engineer, IFC 7 PHE Department, Government of Tripura, Kunjaban, Agartala, Tripura 799 001.

4. Shri A.K. Poddar, Chief Engineer, PHE Directorate, 1, K.S. Roy Road (6th Floor), Calcutta 700 001.

5. Shri R. Dayal, Chief Engineer, 6-Rana Pratap Marg, U.P. Jal Nigam, Lucknow 226 001.

6. Shri S.S. Kalsi, Chief Engineer, Public Health Department, the Mall Patiala, Patiala.

7. Shri K.K. Gandhi, Chief Engineer, Public Health Engineering Department, Haryana, Sector-19-B, Chandigarh 160 019.

8. Shri A.K. Patnaik, Chief Engineer, Public Health Engineering Department, Bhubaneshwar.

9. Shri P.C. Patel, Member Secretary, Gujarat Water Supply & Sewerage Board, Sector-16, Gandhi Nagar, Gujarat.

10. Shri P.R. Kulkarni, Chief Engineer, Maharashtra Water Supply Board, CIDCO Bhavan, South Wing, 2nd Floor, Belapur, New Bombay.

11. Shri G.S. Raghavendra, Chief Engineer, Public Health Engineering Department, Satpura Building, Arera Hiss, Bhopal.

12. Shri. N. Buoy Kumar Singh, Chief Engineer, Public Health Engineering Department, Government of Manipur, Impahal 795 001.

13. Shri H.B. Khajuria, Chief Engineer, Public Health Engineering Department, B.C. Road, Jammu-Tawi.

14. Shri Akangmeren, AO, Additional Chief Engineer, Public Health Engineering Department, Government of Nagaland, Kohima.

15. Shri C.J. Mathews, Managing Director, Kerala Water Authority, Water Works Campus, Trivandrum.

16. Shri Gulam Ahmed, Chief Engineer, Public Health Engineering Department, Anand Rao Circle, Bangalore.

17. Shri L. Ahmedali Chief Engineer, Tamil Nadu Water Supply & Drainage Board, 31 Kamarajar Salai, Madras 600 005.

18. Shri C.K. Hazarika, Adviser, PHE, Functioning as Chief Engineer, Public Health Engineering Department, Shillong.

19. Shri M.C. Vakil, Chief Engineer, Irrigation & Public Health Department, U.S. Club, Shimla 171 001.

20. Shri M.B. Jain, Chief Engineer, Public Health Engineering Department, Bungalow No.2, Civil Lines, Jaipur.

21. Shri N.S. Lepcha, Chief Engineer, Rural Development Department, Tashiling, Gangtok, Sikkim 737 103.

22. Shri Mohd. Inamul Haq, Chief Engineer, Panchayat Raj Engineering Department, Government of Andhra Pradesh, Hyderabad.

23. Shri T.K. Mukherjee, Chief Engineer, Rural Works Department (Rural Water Supply), Government of Arunachal Pradesh, New Itah Nagar, Arunachal Pradesh.

24. Shri Dunglone, Chief Engineer, Public Health Engineering Circle-I, Government of Mizoram, Aizwal (Mizoram).

25. Shri Hazarika, Additional Chief Engineer, Public Health Engineering Department, Government of Meghalaya, Shillong.

26. Shri S. Lawrence Karunakaran, Principal Engineer (PH) Andaman Public Works Department, Port Blair 744 101.

27. Shri Joso F. De, Albuquereque, Chief Engineer (PWD), Public Works Department, Goa, Daman & Diu, Althinho, Panaji 403 001.

28. Shri K. Martin, Director (PWD) & Secretary, Public Works Department, Pondicherry.

(ANNEXURE - II)

List of Voluntary Agencies

1. Mr. Satyajit Bhattacharya, Social Work & Research Centre, Tilonia - Tal. Madan Ganj, Dist. Ajmer, Rajasthan.

2. Dr. M.A. Ghare, NAWDA, 3-C, Shankershet Road, Poona 305 812.

3. Mr. L.V.R. Reddy, AFPRO, GIT I Rose Cottage, Station Road, Ahmednagar.

4. Mr. Nanji Reddy, MYRADA No.2, Service Road, Dolmur Layout Bangalore 560 071.

5. Mr. K.M. Namboodiri, AFPRO GIT Unit III 212, Dr. Radhakrishnan Road, Tatabad Coimbatore 641 012.

6. Dr. V.K. Dikshit, AFPRO, 25/1A Institutional Area Pankha Road, D-Block, Janakpuri, New Delhi.

7. Mr. R.K. Pande, AFPRO GIT Unit V, 5-20/56, Kennedy Road Varanasi 221 002.

8. Dr. B.B Chaudhary, Lutheran World Service 212, Sonari North, New Layout Jamshedpur, Bihar.

9. Col. R.B.J. Snaize, MYRADA, Nelsie Den Upper Shillong 793 006. Meghalaya.

10. Dr. P.L.K.M. Rao, NRDCS Ltd., P.B. No.1067, 3-5-886/4/A, Himayat Nagar, Hyderabad 500 029, AP.

11. Dr. B.V. Parameshwara Rao, Bhagavatula Charitable Trust Orugautvari Street. Yellamenchalli 531 055, AP.

12. Shri B.E. Vijayam, Professor in Geology, Osmania University, Prakash Nilayam 12-13-623, Nagarjuna Nagar, Hyderabad 500 017.

13. Shri H.R. Parkash, ARTIC, Kotturu, Srikakulam, AP.

14. Shri D.L.N. Simha, Ground water Research and Development Trust, Santapeta, Ongole, AP.

(ANNEXURE - III)

List of Participants

1. Shri S.G. Nagrecha, Executive Engineer, Amreli.
2. Shri J.B. Bhatt, Deputy Executive Engineer, Amreli.
3. Shri E.K. Subramanium, Deputy Executive Engineer, Kurnool (Andhra Pradesh).
4. Shri V. Krishnamurthy, Deputy Executive Engineer, Kurnool (AP).
5. Shri P. Maheshwariah, Assistant Executive Engineer, Andhra Pradesh.
6. Shri P. Nagendra Meitei, Assistant Engineer, Imphal, Manipur.
7. Shri Pritam Singh Dhanotia, Junior Engineer, Shimla (Himachal Pradesh).
8. Shri Harbhajan Singh, Assistant Engineer, Newora, Shimla (Himachal Pradesh).
9. Shri K.V. Sharma, Project Officer, GWRT, Ongole (AP).
10. Shri D. Ramamurthy, Lab. Incharge, NRDCS Ltd. (AP).
11. Shri A.C. Misra, Assistant Engineer, J.P. Jal Nigam, Raibarali (UP).
12. Shri G.T. Chandrasekhariah, Deputy Engineer, Dhawod (Karnataka).
13. Shri J.D. Sheth, Supdtg. Engineer, GWS&SB, Gandhinagar (Gujarat).
14. Shri R.J. Sudhar, Deputy Executive Engineer, Gandhinagar (Gujarat).
15. Shri A.B. Chaudhari, Assistant Engineer, Patan (Gujarat).
16. Shri Kalyanappa, Junior Engineer, PHE Dn. Buildings (Karnataka).
17. Shri Navin M. Talati, Lecturer in Chemistry, Deptt. of Chemistry, Dr. J.N. Mehta Govt. Polytechnic Amreli (Gujarat).
18. Shri M.R. Kamboj, SDE, Public Health (RWS) Sub-Divn. Guruharsahb (Ferozapur) (Punjab).
19. Shri J.M. Makwana, State Saniterian, Ahmedabad.
20. Shri S.N. Bhatnagar, Deputy Executive Engineer (R&D, Trg-Tech.)
21. Shri M.V. Anjaria, Lecturer in Chemistry, Dr. J.N. Mehta Govt. Polytechnic, Amreli.
22. Shri S.P. Shuthar, Assistant Engineer, PHED, Shahdol (Madhya Pradesh).

(ANNEXURE - IV)

NATIONAL DEFLUORIDATION CAMP
Training & Demonstration
(Technology Mission on Drinking Water)
Amreli, Gujarat
April 20-25, 1987

DAILY PROGRAMME (TENTATIVE)

Monday	Inauguration Presentation of topics and
20th April, 1987	Discussion
0830 - 1020	Inaguration
1020 - 1100	Tea
1100 - 1300	Discussions between invitees and participants on Technology Mission
1300 - 1400	Lunch
1400 - 1510	Fluoridation and Defluoridation and Development of Techniques - Shri K.R. Bulusu Presentation .. 40 minutes Discussions .. 30 minutes
1510 - 1520	Tea
1520 - 1600	Fluoride - Human health and Drinking Water Quality Guidelines - Dr. M.V. Nanoti Presentation .. 15 minutes Discussions .. 25 minutes
1600 - 1645	Estimation of Fluorides in Water Samples - Shri W.G. Nawlakhe Presentation .. 15 minutes Discussions .. 30 minutes
1645 - 1730	Demonstration of Ion Selective Method of Fluoride Estimation in Water Samples - Shri D.N. Kulkarni - Shri S.L. Lutade
Tuesday	Nalgonda Technique Demonstration
21st April, 1987	
0930 - 1000	Nalgonda Technique of Defluoridation - Shri W.G. Nawlakhe Presentation .. 15 minutes Discussions .. 15 minutes

1000 - 1030	Muscle Power Defluoridation Plant - Dr. A.S. Bal Presentation .. 15 minutes Discussions .. 15 minutes
1030 - 1045	Tea
1045 - 1300	Demonstration
1300 - 1400	Lunch
1400 - 1730	Demonstration continues
Wednesday 22nd April, 1987	Field Visits & Designing
0930 - 1700	Visit to excessive fluoride problem villages of Amreli District
1700 - 1730	Design of defluoridation plant by participants, introduction of topic by Dr A.S. Bal. The participants will prepare the designs independently and keep these ready for discussions on 24th April, 1987
Thursday 23rd April, 1987	Field Visits
0930 - 1700	Visit to excessive fluoride problem villages of Amreli District
Friday 24th April, 1987	Designing and Water Analysis
0930 - 1300	Discussions on designs prepared by the participants
1300 - 1400	Lunch
1400 - 1730	Exercise on Water Analysis
Saturday 25th April, 1987	Demonstration and concluding Session
0930 - 1115	Demonstration of defluoridation techniques with participation of trainees
1115 - 1130	Tea
1130 - 1300	Exercise on water analysis
1300 - 1400	Lunch
1400 - 1600	Concluding Session

(ANNEXURE - V)

Impressions, Assurances & Suggestions from Participants

Trainees have highly appreciated the efforts of Water Technology Mission to conduct such course through NEERI. They have equivocally assured that they will implement the defluoridation on domestic as well as community level in their respective States wherever the fluorosis problem is prevalent. They felt the need for creating awareness in villagers on long term intake of excessive fluorides in their daily drinking water. The participants suggested that the R&D efforts of NEERI, Nagpur, should be brought to the notice of all engineers in India down to District level regularly.

Participants who recorded their suggestions at the end of the camp.

Sl.No.	Name & Designation	Organisation
1.	Shri J.D. Sheth Supdtg. Engineer	Gujarat Water Supply & Sewerage Board, Ahmedabad. (Gujarat).
2.	Shri P.C. Rath Assistant Engineer	Public Health Engineering Department, Cuttack (Orissa).
3.	Shri P. Maheswariah Asstt. Exe. Engineer	Panchayati Raj. Hyderabad (Andhra Pradesh).
4.	Shri S.P. Shuthar, Assistant Engineer	Public Health Engineering Department, Shahdol (Madhya Pradesh).
5.	Shri P.C. Misra Assistant Engineer	U.P. Jal Nigam, Raibareli (Uttar Pradesh).
6.	Shri E.K. Subrahmanyam Deputy Exe. Engineer	Atmakur, Kurnool (Andhra Pradesh).
7.	Shri M.R. Kamoj Sr. Dy. Engineer	Public Health Engg.Department, Ferrozabad (Punjab).
8.	Shri A.B. Choudhari Sr. Dy. Engineer	Public Health, (Projects) Madarasa (Gujarat).
9.	Shri P.N. Meitei Asstt. Engineer	Imphal, Manipur.

10.	Shri U.K. Murthi Dy. Exe. Engineer	Technology Mission, Kurnool (Andhra Pradesh).
11.	Shri P.S. Dhanotia	Public Health Engg. Department, Himachal Pradesh.
12.	Shri K.V.S. Sarma Project Officer	Ground Water Resources Development Trust, Ongole (Andhra Pradesh).
13.	Shri D. Ram Murthy Laboratory Incharge	N.R.D.C.S., Ongole (Andhra Pradesh).

(ANNEXURE - VI)

NEERI TEAM AT THE DEFLUORIDATION CAMP AMRELI

Shri K.R. Bulusu.
Dr. A.S. Bal.
Dr. M.V. Nanoti.
Shri P. Nema.
Shri W.G. Nawlakhe
Dr. N.C. Kankal.
Shri A.V. Bhoi.
Shri D.N. Kulkarni.
Shri S.L. Lutade.
Shri B.H. Gokhe.
Shri C.G. Mehta.
Shri P.G. Dave.
Shri A.D. Kedar
Shri N.D. Golait.