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...ORIENTATION CAMP
...AT PALAKKODDI
...AND
...TARTUR

...2th & 13th
...December 198...

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UNDER TECHNOLOGY MISSION ON DRINKING WATER IN VILLAGES AND RELATED WATER MANAGEMENT

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE, NEHRU MARG, NA...

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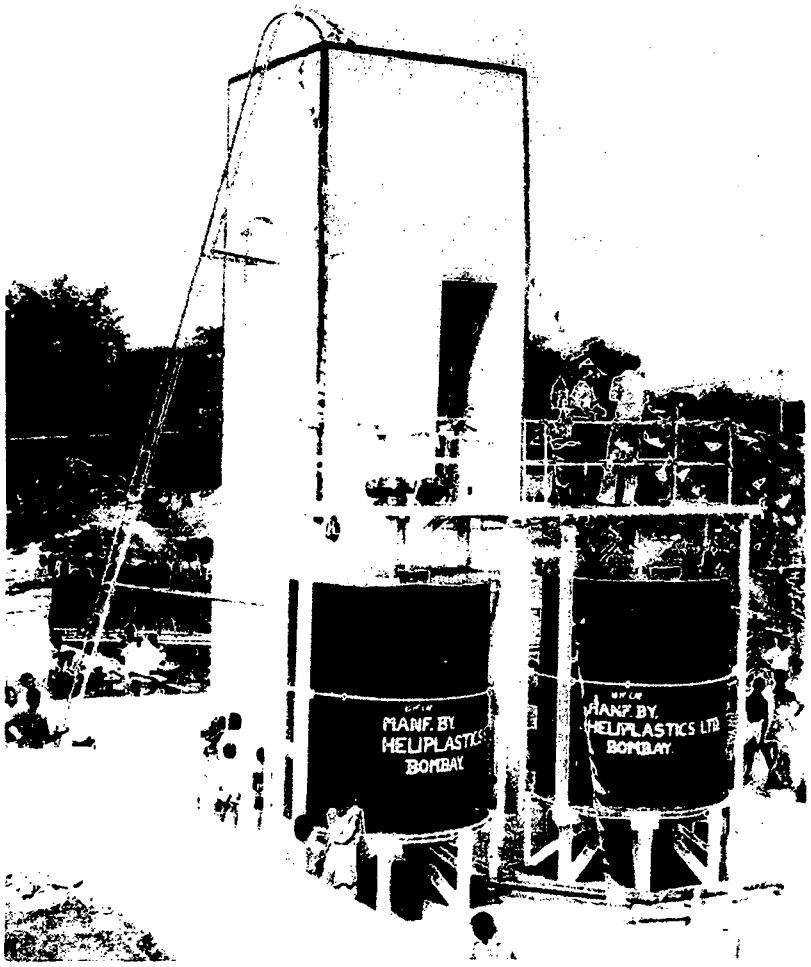
TECHNOLOGY MISSION ON DRINKING WATER IN VILLAGES AND RELATED WATER MANAGEMENT

REPORT
ON
DEFLUORIDATION CAMP AT PALAKUDODDI AND TARTUR
In Kurnool District, Andhra Pradesh

ISN 5278
LO: 257 88RE

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

WTM/CSIR/NEERI/036 & 046 **FEBRUARY 1988**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INTRODUCTION

The Council of Scientific and Industrial Research (CSIR) New Delhi and the National Environmental Engineering Research Institute (NEERI), Nagpur a National Laboratory under CSIR are actively engaged in the "Technology Mission on Drinking Water in Villages and Related Water Management," which has been launched by the Government of India. NEERI's role in this Technology Mission is to assess the quality of water and to transfer technologies developed by NEERI which can be easily replicated by the Implementing Agencies of State Governments. One of these technologies is the removal of excess fluorides from drinking water.

It is well-known that the excess fluorides in drinking water causes fluorosis. Once the fluorosis is set in person, it can not be cured. The ill-effects of fluorides can be controlled only by preventive measures. It is of utmost importance therefore to educate the rural masses on the bad-effects of water with high fluorides content and advise them to use the defluoridated water.

The technology developed by NEERI for the removal of excess fluorides from drinking water is popularly known as "Nalgonda Technique of defluoridation". In brief, the technique involves addition of requisite dose of alum to the water, flocculating and settling of the flocs along with the excess fluorides. The clear supernatant water contains fluorides in acceptable levels and is used for drinking and cooking. The fluoride removal treatment can be adopted at domestic level in individual houses or at community level with a treatment plant of continuous operation or fill and draw type.

The meeting of Technology Advisory Group III (TAG III) held on 22nd December 1986 approved that NEERI shall take up the awareness and training programme at different places on the technique and importance of excess fluoride removal. NEERI accordingly drew an Action Plan in this regard. It organised a National Defluoridation Camp at Amreli in Gujarat State during April 1987. On December 12th and 13th, 1987, NEERI with Panchayati Raj Engineering Department, Andhra Pradesh organised an awareness programme at Tartur village along with the inauguration of Community Water Defluoridation Plant and also, a domestic Defluoridation Camp at Palukudoddi in Kurnool District, Andhra Pradesh.

KURNOOL DISTRICT.

Kurnool District is situated in the South-West part of Andhra Pradesh. It is surrounded by Mahboobnagar district in the North, Prakasham district in the East, Cuddapah district in the South-East, Anantapur district in the South-West and Raichur district of Karnataka State in the West. The Population of the district is about 25 lakhs, 75 percent of which is residing in rural areas. The district has 13 talukas namely: Kurnool, Nandikotkur, Atmakur, Kodmur, Dhone, Adoni, Alur, Pattikonda, Yemmiganur, Nandyala, Koilkuntla, Banaganapalli and Allagadda (Fig. Kurnool district map).

FLUOROSIS IN KURNOOL DISTRICT :

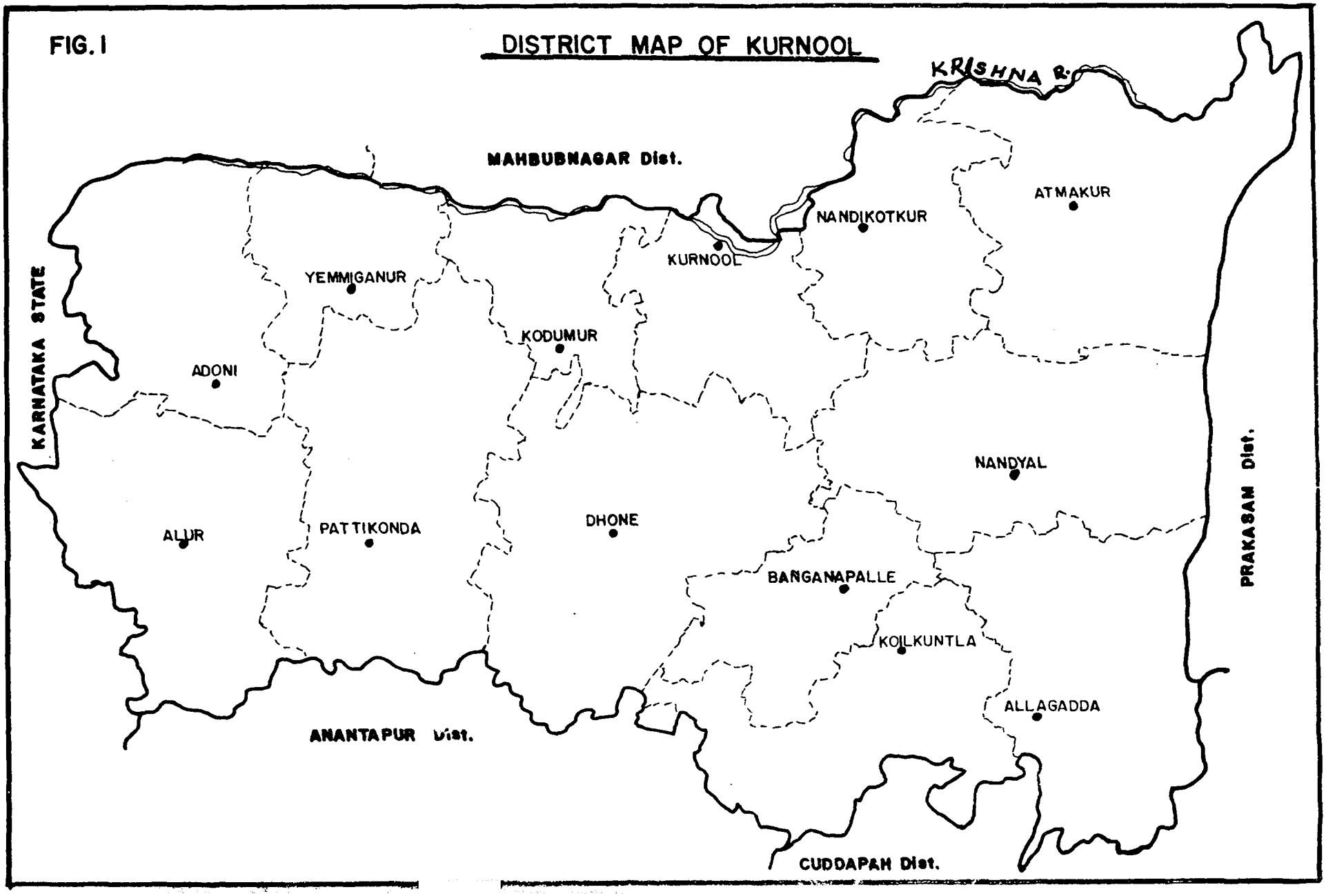
Assessment of the water quality of the available sources is a primary step for planning treatment methods for water. Considering the magnitude of the task of the assessment of water quality, some generally identified problem villages were selected for water quality evaluation. NEERI team visited 134 villages covering all the 13 taluks and collected 143 water samples. It is decided to continue this water quality assessment by screening the water sources from all the remaining villages by Panchayat Raj Engg. Department with the help of rapid test kit. PRED had also established regional laboratories effecting the complete analysis of the suspected samples. The data obtained during the limited survey conducted by NEERI (Table 1) showed that excess fluorides were observed in 11 to 13 talukas. Out of 143 water samples, 83 sources had higher fluorides ranging from 1.6 - 8.5 mg/l F.

Based on these findings, the Chief Engineer, Panchayati Raj Engineering Department, the Project Director, Water Technology Mission, for Kurnool District and the NEERI Scientists had visited those problem villages and selected two villages - Tartur in Nandikotkur Taluk and Palakudoddi in Kodmur Taluk, for implementing defluoridation of drinking waters based on NEERI's technology.

DEFLUORIDATION TECHNOLOGY TRANSFER :

Since Tartur and Palakudoddi Villages were selected for the demonstration of defluoridation technology, detailed survey of all the major water sources in these villages was necessary. NEERI team visited these two villages and

FIG. I


DISTRICT MAP OF KURNOOL
KRISHNA R.
MAHBUBNAGAR Dist.
KARNATAKA STATE
ATMAKUR
NANDIKOTKUR
KURNOOL
YEMMIGANUR
KODUMUR
ADONI
NANDYAL
PRAKASAM Dist.
ALUR
PATTIKONDA
DHONE
BANGANAPALLE
KOILKUNTLA
ALLAGADDA
ANANTAPUR Dist.
CUDDAPAH Dist.

collected water samples from all available sources at Tartur and palakudoddi. The Panchayati Raj Engineering Department provided approximate yield data for these water sources.

TARTUR :

Tartur Village is situated in Nandikotkur Taluk and has a population of 1686 as per 1981 census. Symptoms of Fluorosis was observed among the residents of this village. There are 5 bore wells and an open well. According to Panchayati Raj Engineering Department Officials, the open well has good yield and it has water throughout the year. PRED has established a public water supply system from this well. The water from bore wells are only used during Jatra period, when there is an influx of pilgrims. Water samples from all the six sources were collected by NEERI team and the data on water quality is given in Table 2.

As only open well water is used by the villagers for their day to day requirements, it was decided to treat open well water for removal of excess fluorides. Experiments were done on a Jar test machine to arrive at the optimum dose of alum to bring down the fluoride level in water to below 1 mg/lF. An optimum dose of 380 mg/l alum was determined to get water containing 0.8 mg/l of Fluoride from the original value of 2.6 mg/l of Fluoride.

The water requirement of Tartur village is not very high. Therefore, it was decided to install fill-and-draw type defluoridation plant instead of a continuous operation plant. The matter was discussed with PRED Engineers and action was started with collaboration of PRED. A small piece of land adjoining the well was acquired and the whole area was cleared to arrest any surface seepage entering the well.

A design of 10 M^3 capacity fill-and-draw type defluoridation plant was prepared by NEERI and quotations were called for two units made of high density polyethelene (HDPE) Containers as per NEERI's designs. These units received from the manufacturer were installed by the side of the well on concrete platform. The design is simple (Fig.). The water from the well is pumped to the containers. Requisite dose of alum is added in solution. The stirrer device, driven by electrical motor, is used for mixing the alum. Then, the

contents are allowed to settle for 2-3 hours. The supernatant water, after settling of the flocs, is collected in a sump and pumped to the overhead tank for distribution in the village.

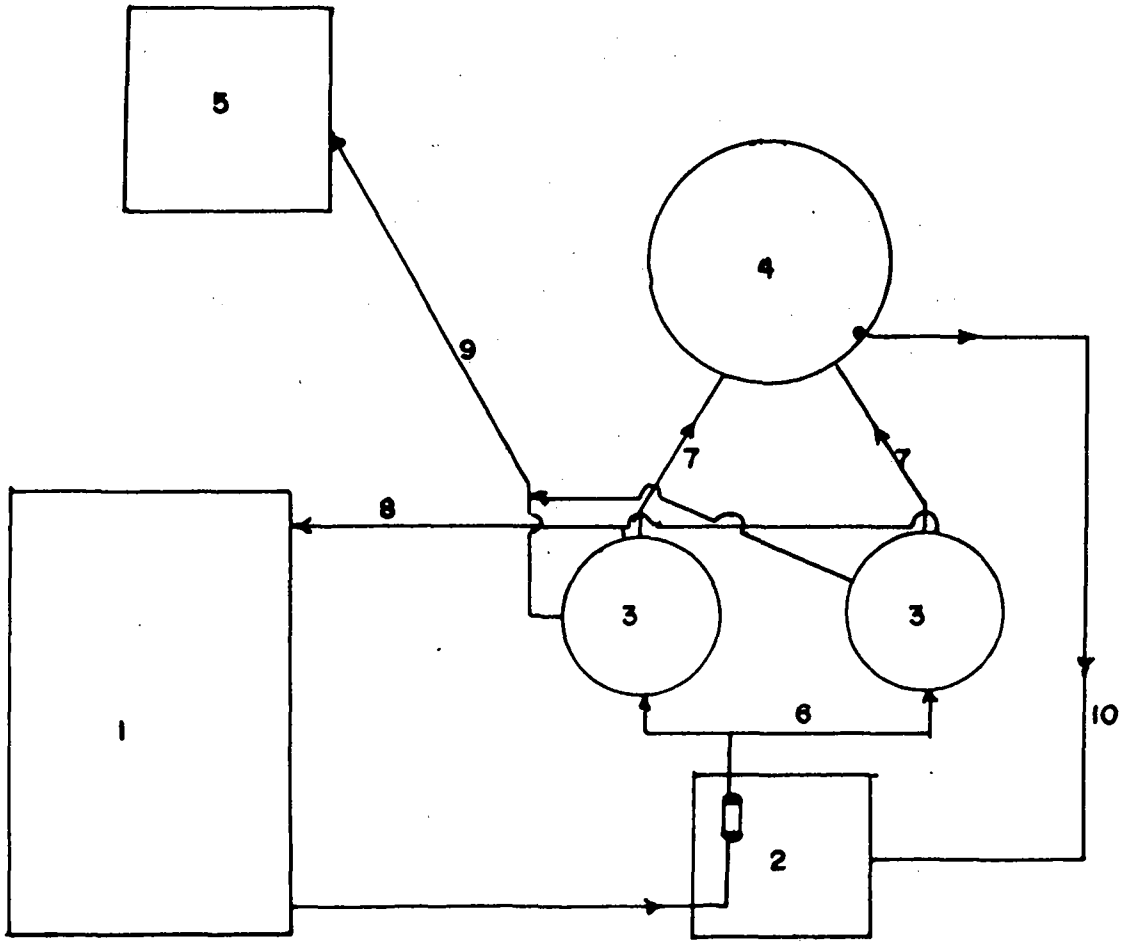
After completion of the erection, the plant was run a few times to observe the performance and any short-commings as against manufacturer's guarantee. The data on the performance of the plant is given in Table 3.

TARTUR : Programme :

On 12th December 1987 at 11 a.m. the Defluoridation Treatment Plant was inaugurated by Dr. A.K.Susheela, Associate Professor of Histocytochemistry, Fluoride and Fluorosis Research Laboratories, All India Institute of Medical Sciences, New Delhi, in the presence of PRED Engineers, Officials of connected departments, and the participants of the camp & villagers. The participants were taken round the plant and the unit processes were explained to them in detail. After the inauguration ceremony, subsequently, a largely attended public meeting was held, where Sri M.Inamul Haq, Chief Engineer, PRED had presided over the function.

Dr. A.K.Susheela addressed the gathering high-lighting the effects of excess fluorides on health. She emphasised that once the deformation of bones took place, there was no cure available to set them right. She described the acute forms of fluorosis and told the villagers to use the water from which excess fluorides were removed. Shri K.R.Bulusu described the technology of excess fluoride removal in simple words and told the villagers to come forward to use the defluoridated water. Dr. M.Vittal Rao, Scientist & Head, NEERI Zonal Laboratory, Hyderabad translated the lectures of Dr. A.K.Susheela and Shri K.R.Bulusu in simple Telugu language for the benefit of the villagers. Also, he spoke in Telugu elaborating effects of fluorides and the benefits accuring from the use of defluoridated water. The Sarpanch of Tartur and Sri Inamul Haq congratulated NEERI and PRED Officials for putting up this model Defluoridation Plant and appealed to the villagers to make best use of the facility. Shri N.Rangappa, Executive Director, Technology Mission, Kurnool proposed the vote of thanks.

DEFLUORIDATION PLANT AT TARTUR-KURNOOL(dt)



1. OPEN WELL
2. PUMP HOUSE CUM OVER HEAD TANK
3. REACTION TANK
4. CLEAR WATER SUMP
5. SLUDGE DRYING BED
6. RAW WATER INLET
7. CLEAR WATER OUTLET
8. OVER FLOW
9. SLUDGE OUT-LET
10. CLEAR WATER PUMPING TO OVER HEAD RESERVOIR

PALAKUDODDI :

Palakudoddi is a small village in Kodmur Taluk and has a population of 924 (1981 Census). It has four borewells and a small open well situated at a long distance from the village. One of the borewells does not yield water. Water samples from the open well and 3 bore wells were collected for water quality assessment and also for experiments for the removal of excess fluorides. The water quality data is given in Table. 4.

The content of fluorides in these waters varied from 3.4 to 11.0 mg/l F. The effect of these waters were strikingly visible among residents especially among young children, who had deformed leg bones and bad teeth (Figs.).

From the experiments conducted on Jar Test Machine for fluoride removal, it was observed that for the treatment of open well water, 600 mg/l alum dose was needed and lime addition was not required. For three bore well waters however, lime addition was required to the tune of 100-200 mg/l with the alum doses between 1000-1400 mg/l to get a water below 1 mg/l F from the initial values of 6.6 to 11 mg/l F.

As per the information provided by the PRED officials, none of the four sources had enough water-yield to cater to the whole community. Therefore, it was thought that the domestic model defluoridation system might be adopted here until a regular continuous source of water would be made available.

For the success of the domestic level defluoridation, active participation of the villagers is essential. The villagers, especially, their women folk have to be educated on the importance of the use of defluoridated water, so that they shall spend some time for this work. The technique, though simple, has to be demonstrated to them and got done from them to have a first hand experience. Also, there is a need for the training of officials of the implementing agency (PRED) regarding 1) the awareness as to the health aspects of water containing high fluorides 2) use of Nalgonda Technique under field conditions etc.

With the above facts and also, the recommendations of Chief Engineers' conference held at NEERI in July 1987, steps were taken to organise demon-

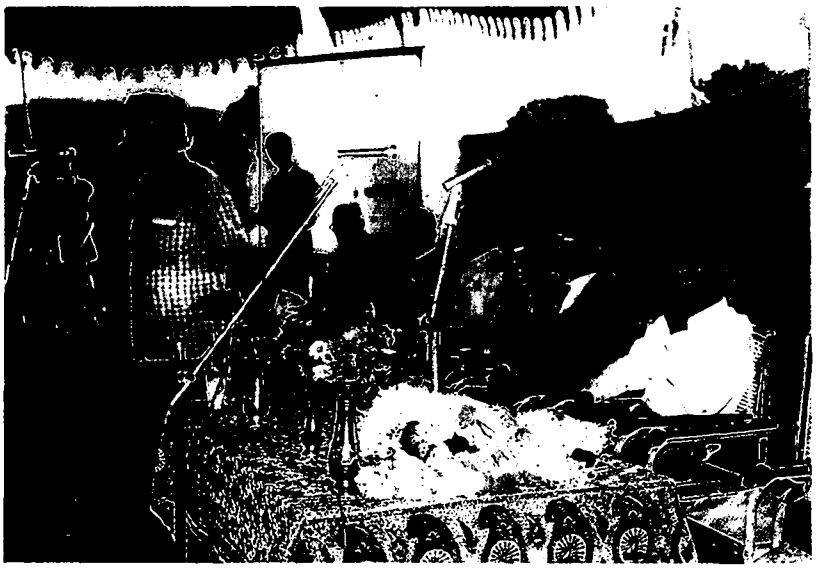
stration and awareness camps on defluoridation at Tartur and Palakudoddi villages with the collaboration of Panchayati Raj Engineering Department of Andhra Pradesh.

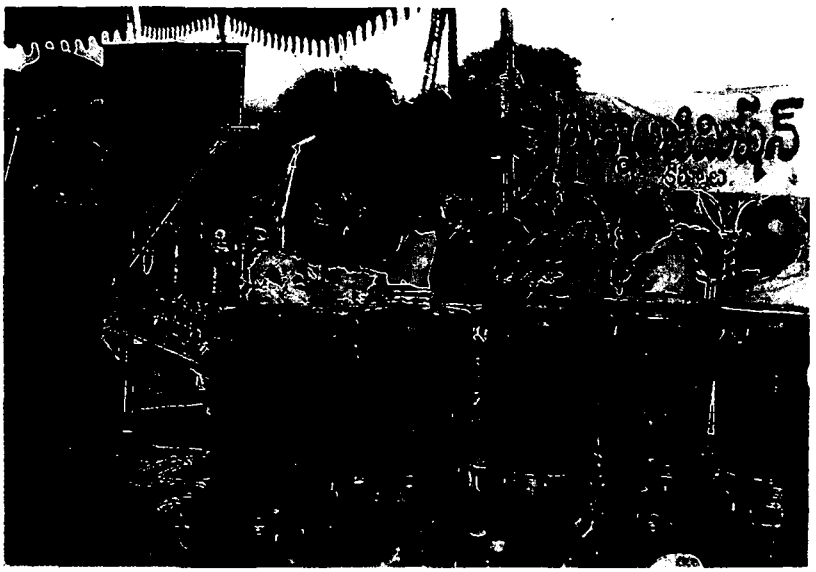
DEFLUORIDATION CAMP AT PALAKUDODDI :

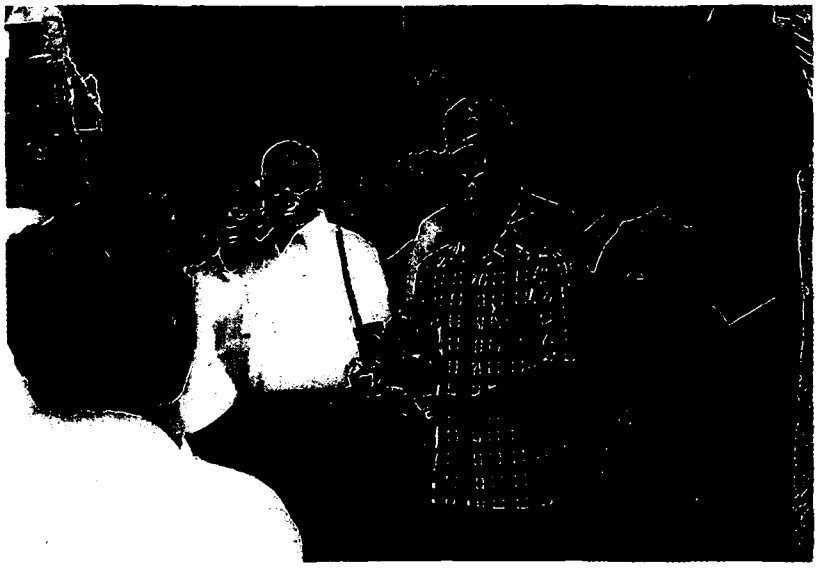
In the afternoon of 12th December 1987, the Domestic Defluoridation Camp was inaugurated by Dr. A.K.Susheela. The inaugural meeting was presided over by Shri M.Sahoo I.A.S., District Collector, Kurnool. Apart from the participants of the camp, the inaugural function was attended by almost the whole village which included a large number of women.

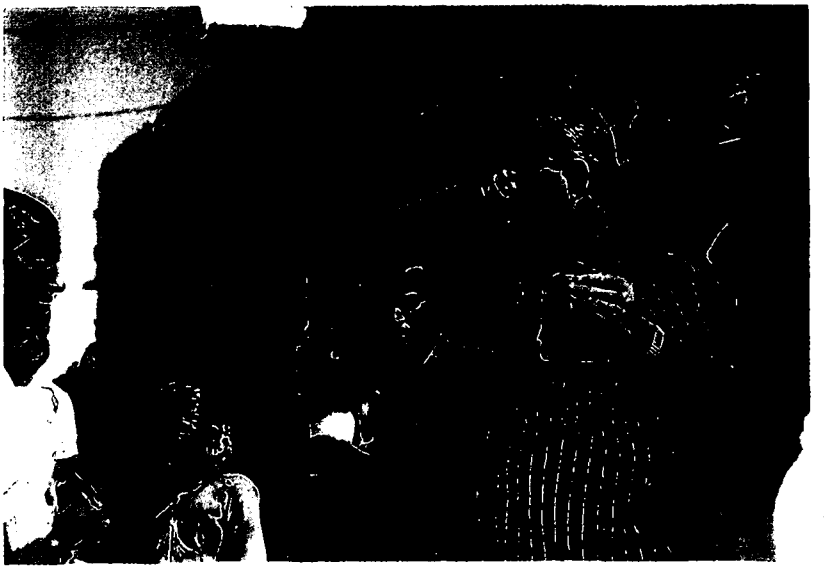
Shri K.R.Bulusu spoke on the objective of this camp. He explained the defluoridation process and the cost-benefits of its use. Dr. Susheela spoke with the help of slides on the grave effects of fluorides on the health which was heard with rapt attention. Dr. M.Vittal Rao explained those facts in Telugu for the benefit of the villagers. He further told the villagers to come forward to utilise knowledge of NEERI for the benefit of their health, and that NEERI Scientists would explain them how to use the chemicals to treat the water and would demonstrate to them. Dr.Sant and Dr.Harshvardhan of PTC (CSIR), Hyderabad also spoke on the importance of public participation in making the technology acceptable to the local people. Shri. Inamul Haq, advised the participants (PRED Engineers) to actively participate in the deliberations of the camp as they were the people who had to deal with the implementation of the technology in the field. The District Collector commended the efforts of NEERI Scientists & PRED Engineers and wished the programme a success. The materials such as bucket and pockets of alum powder were distributed to the villagers. The inaugural function was concluded with the vote of thanks by Shri. N.Rangappa, Executive Director, Technology Mission, Kurnool.

On 13th December 1987, the Camp programmes commenced with the "door to door demonstration of domestic defluoridation method". Printed metal (aluminium) sheets on domestic defluoridation scheme were nailed to the doors of the houses in the village. Women were assembled in small groups and the procedure for using the chemicals were explained to them in Telugu









after filling the bucket with raw water. When asked, how they would use the set, the participating women repeated back the procedure clearly. A few of them tried the use of the bucket & Chemicals before the organisers. After this programme, the women were asked to put questions to organisers on the related matters to get any calrification.

Next Programme was the lectures and discussion sessions for the participants. The lectures were given by NEERI Scientists giving information about extent of fluorides in water sources in Andhra Pradesh in general, effects of excess fluorides on health and how Nalgonda Technique can be effective costwise in bringing down the fluoride levels in water. Community and domestic level methods were explained. Maintenance aspect and financial implications were discussed.

ACKNOWLEDGEMENTS

Without Prof. P. Khanna's (Director, NEERI) unflinching support and constant encouragement, this field camp could not have been performed successfully. Organisers of the field camp are also to acknowledge Dr. Ghosh, Mission Director, Water Technology Mission, Government of India, Director General, CSIR and Additional Director General, CSIR, for their support in conducting these camps. Shri. Inamul Haq, Chief Engineer, PRED, Andhra Pradesh has always shown keen interest and helped in making this programme successful. Shri N. Rangappa, Executive Director, Water Technology Mission, Kurnool has helped immencely in implementing the defluoridation technology in Kurnool District. NEERI expresses its thanks to Sri P. Ramakrishnaiah, Executive Engineer, PRED Kurnool and officials of his Department for their help rendered in success of the programmes. NEERI expresses its gratitude to Dr. A.K. Susheela, AIIMS, New Delhi and Shri M. Sahoo, District Collector, Kurnool for participating in the inaugural functions.

NEERI thanks the participants of the programme who showed great interest in the technology and its transfer in the field. The Sarpanchas of Tartur and Palakudoddi and the villagers especially women folk came in big number to attend the functions. The women showed keen interest in adopting domestic defluoridation method. The Sarpanchas inspired the men and women of the

villages for accepting the defluoridated water for their potable use. NEERI thanks the Sarpanchas and the villagers for their active participation.

The creditable work put in by the staff of NEERI Zonal Laboratory, Hyderabad and Water Division and Technology Demonstration Division of NEERI, Nagpur are gratefully acknowledged.

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TABLE : 1

Water Quality of the Villages in Kurnool District

Taluk/ Village	Source	Physico-chemical Parameters*													
		Turbidity NTU	pH	Total Diss. Solids	P.Alkalinity as $CaCO_3$	M.Alkalinity as $CaCO_3$	Total Hardness as $CaCO_3$	Ca. Hardness as $CaCO_3$	Mg. Hardness as $CaCO_3$	Fluorides as F	Sulphates as SO_4	Chlorides as Cl.	Nitrate as N	Iron as Fe	Manganese as Mn
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
KURNOOL TALUK															
Bastipadu	Private bore well of Shri Ishwarappa	2.0	8.3	840	-	256	154	96	58	4.0	290	150	8.0	0	0.05
Cheltamalla puram	Bore well	1.5	8.3	840	-	422	162	84	78	4.0	185	100	98	0.1	0.1
Cheltamalla puram	Open well	1.0	8.4	1080	-	496	196	68	128	2.6	85	140	11.3	0	0
Dupadu	Bore well	2.5	8.4	1080	-	504	226	46	180	0.7	95	95	11.4	0	0
Kalwa	Bore well	1.0	8.1	1200	-	242	424	250	174	2.0	33	235	8.0	0	0
Pandipadu	Bore well	8.0	8.1	2400	-	402	1102	354	748	1.3	840	550	41.2	0	0
Pedda Tekur	Bore well	2.0	8.0	840	-	460	260	92	168	5.2	120	80	8.0	0	0
Mungalpadu	Bore well	-	7.9	696	0	302	368	356	12	0.4	100	136	8.0	0.048	
Mammidalpadu	Bore well	0.5	7.8	910	0	362	1464	240	1224	0.7	264	170	5.5	0.2	

* All parameters are expressed in mg/l except p^H and turbidity.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
NANDIKOTKUR TALUK															
Dommaguntla	Step well	-	7.3	695	0	298	348	264		0.9	200	371	78	0.04	
Mandlem	Bore well	0.4	7.2	909	0	432	296	120		1.9	208	92	18.0	0.13	
Malyala	Step well	1.0	7.4	588	0	222	280	100		0.5	20	102	2.0	0.07	
Sankesuls	Bore well	0.4	6.7	4173	0	336	1190	610		8.0	270	1000	9.0	0.09	
Talamudipi	Bore well	-	6.5	1016	0	296	208	132		1.2	80	228	26.0	0.05	
Veepanagandla	Water supply	0.8	7.0	1070	0	418	220	112		2.3	98	102	19.3	0.08	
Tartur	Water supply	0.5	7.0	856	0	348	480	204		1.9	380	218	26.3	0.05	
Gudipadu	Bore well	-	6.7	1175	0	324	372	204		2.8	126	233	30.0		
ATMAKUR TALUK															
Kothapalli	Open well	2.5	7.6	324	-	224	196	140		1.5	11	73	2.0	0	0
Kothapalli	Bore well	1.5	7.5	1800	-	348	550	196		1.4	170	510	32.0	0	0
Krishnapuram	Bore well	2.0	7.7	1200	-	450	232	90		1.5	100	265	23.3	0	0
Krishnapuram	Bore well	10	7.2	3600	-	552	1084	190		1.2	310	1060	12.9	0	0
Krishnapuram	Bore well	7.5	7.6	540	-	368	332	114		1.1	23	56	2.7	0	0
Nandikuntala	Bore well	8.0	7.4	1080	-	262	496	128		1.0	70	330	11.7	0	0
Nandikuntala	Bore well	2.0	7.5	2760	-	460	514	174		1.1	260	810	41.6	0	0.05
Veerapuram	Bore well	1.0	7.5	1800	-	252	294	180		1.1	70	135	9.5	0	0
KODUMUR TALUK															
Burandoddi	Bore well No;702	-	7.1	735	0	272	136	72		1.7	5	82	31.5	0.16	
Chintamanpalli	Bore well No.694	0.4	7.9	374	0	236	232	140		1.0	10	24	9.3	0.07	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Chintamanpalli	No.696	-	6.5	4815	0	478	1460	530		2.8	650	772	12.0	0.02	
Edurur	Open well +Stand post	3.5	8.0	900	-	298	278	132		1.1	280	150	2.4	0	0
Enagandla	Bore well No.729	0.2	6.8	1123	0	520	24	24		5.8	440	37	4.5	0.1	
Gudipadu	Canal water	18	8.0	132	-	72	54	38		0.4	8.0	1.3	0.7	0	0
Gudipadu	Canal water	30	8.2	120	-	82	52	38		0.3	16	1.3	0.7	0	0
Kalaparri	Bore well	-	6.9	802	0	382	96	44		3.0	390	121	11.0	0.11	
Kambadahal	Bore well	0.2	7.8	588	0	250	356	192		0.9	308	192	20.0	0.17	
Krishnapuram	Bore well	3.0	7.8	480	-	160	142	86		2.5	48	39	13.4	0	0
Krishnapuram	Bore well	10.0	8.1	780	-	416	78	34		3.1	87	23	5.8	0	0
Mallapuram	Bore well	4.0	8.0	960	-	460	86	28		5.1	180	114	9.7	0	0
Mallapuram	Bore well	4.0	7.8	960	-	414	200	106		5.8	240	112	6.8	0	0
Murugudoddi	Bore well	-	7.1	735	0	380	152	84		2.8	59	83	8.3	0.2	
Palakudoddi	Bore well No.715	0.1	6.1	2800	0	520	450	200		4.2	120	107	90.0	0.08	
Palakudoddi	No.717	-	7.1	588	0	442	72	36		7.6	25	80	6.3	0.08	
R. Khanapuram	Bore well	0.6	6.9	1391	0	560	236	120		2.8	970	112	5.0	0.05	
Ramachandra-puram	Bore well	35	7.7	216	-	130	70	48		0.6	11.5	25	1.3	0	0
Ramachandra puram	Bore well	3.5	7.6	2400	-	540	592	262		1.2	1420	326	2.2	0	0
Remata	Bore well	4.5	7.2	1320	-	436	620	410		0.2	160	282	16.0	0	0.15
Remata	Bore well	3.5	7.9	384	-	236	218	160		0.7	25	36	2.4	0	0

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DHONE TALUK															
Bontherala	Bore well	-	8.5	348	-	246	428	384		1.4	50	37	11.8	0.48	
Devarabanda	Open well	-	8.2	588	0	290	856	232		2.1	110	92	8.0	0.44	
Gosanepalli	Bore well	-	7.8	905	0	376	444	160		2.3	240	72	18.0	0	
Karlakunta	Bore well	-	7.0	1765	0	610	440	224		1.6	108	44	55.0	0.1	
Koelakonda	Bore well	-	6.7	1872	0	88	480	280		0.9	114	417	95.0	0.8	
Kosanepalli	Bore well	1.0	7.8	455	0	292	128	72		1.0	24	85	13.0	0.44	
Madhapuram	Bore well	0.3	5.8	14124	0	626	1070	380		3.0	6240	5388	14.5	0.16	
Malyala	Bore well	-	7.3	830	0	124	616	52		4.0	39	116	9.0	0.09	
Rekulakunta	Step well	1.6	7.9	856	0	346	656	228		1.0	200	218	11.5	0.13	
Venkatapuram (Narlapuram)	Bore well	-	7.4	1612	0	394	340	112		2.5	590	262	40.0	0.1	
Dhone Town	Water supply	-	8.2	588	0	460	456	184		0.8	110	58	4.0	0.1	
Yenugumarri	Step well	-	7.8	535	0	450	136	134		3.5	16	315	6.0	0.29	
ADONI TALUK															
Agasaladinne	Open well	10.0	8.0	5460	-	564	1546	358		1.9	4600	570	24	0.1	Trace
Badinehal	Bore well	18.5	8.0	1800	-	380	682	186		2.0	1140	220	0.8	0	Trace
Baladur	Bore well	2.5	8.3	3960	-	512	436	162		6.0	2000	680	11.5	0	0
Bapuram	Bore well	18	8.4	5400	-	504	760	202		6.4	4400	840	21.0	0.1	0.05
Dommaladinne	Open well	3.0	7.7	2880	-	480	672	242		2.5	1520	450	21.5	0	0
Edavalli	Open well	4.5	8.3	1440	-	674	116	48		8.5	260	185	1.1	0	0.05
Hanawal	Bore well	4.0	8.4	504	-	220	102	64		1.8	50	62	6.7	0	0

1	2	3	4	5	6	7	8	9	10	1	12	13	14	15	16
Kuntanahal	Bore well	55.0	7.6	1380	-	382	734	88		0.5	155	360	13.4	0	Trace
Katriki	Bore well	3.0	8.4	1080	12	384	102	66		0.9	150	120	10.8	0	0
Lingaladinne	Bore well	2.5	8.3	840	-	386	138	62		3.5	145	104	4.8	0	0
Pedda Harivaram	Bore well	3.5	8.3	1320	-	448	158	68		6.6	390	185	11.3	0	0
Veraladinne	Bore well	6.0	7.9	2640	-	434	990	240		1.5	1240	615	9.6	0	Trace
ALUR TALUK															
Arikera	Bore well	-	7.7	535	0	380	224	108		3.0	138	72	4.3	0.8	
Balluran	Open well	1.5	7.3	1605	0	274	456	36		0.9	430	432	1.7	0.1	
Benigiri	Bore well	-	6.8	3531	0	680	512	288		1.2	700	689	1100.0	0.09	
Chinnahaita	Bore well	-	6.5	2033	0	594	568	312		1.5	94	514	45.0	0.16	
Holagunda	Bore well	0.1	6.8	1658	0	310	488	232		2.0	50	452	46.0	0.08	
Kogilatota	Bore well	-	7.5	1017	0	476	196	116		3.5	198	185	5.5	0.13	
Kurukunda	Bore well	0.3	7.4	1284	0	410	276	96		2.0	650	314	4.5	0.05	
Maddilingahalli	Bore well	-	6.5	4013	0	522	732	360		0.5	620	874	32.5	0.03	
Marlamaddi	Bore well	-	7.6	1445	0	374	176	172		2.5	200	300	7.5	0.26	
Marakottu	Bore well	-	6.9	1500	0	664	322	128		3.6	110	291	27.5	0.16	
Nagarore	Bore well	1.0	7.1	1337	0	658	320	220		0.5	150	257	19.0	0.09	
Peddagonehal	Borewell	-	7.4	1819	0	492	376	180		3.8	690	248	4.5	1.4	
Tongardone	Bore well	0.4	6.8	2247	0	334	284	210		3.6	146	510	160	0.4	
Veerupapuram	Bore well	-	7.8	535	0	378	208	84		3.6	50	77	5.0	0.6	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PATTIKONDA TALUK															
Alardinne	Bore well	0.8	7.3	3242	0	436	320	240		1.8	1900	388	8.0	0.16	
Bondimadugulla	Bore well	3.5	7.7	552	-	220	362	168		1.3	42	96	24.3	0	0
	Bore well	3.5	7.9	420	-	266	244	98		1.6	23	28	11.4	0	0
Burjula	Bore well	3.5	7.3	9600	-	326	3740	1780		2.3	2120	3640	175.0	0	0.5
Chennahuthi	Bore well	2.0	8.1	564	-	452	68	20		3.5	54	29	3.0	0	0
Chikkiralla	Bore well	4.0	7.6	2160	-	336	1012	432		1.8	210	480	150.0	0	0
Chikkiralla	Open well	2.5	7.8	564	-	352	294	112		2.7	25	48	15	0	0
Jutur	Bore well	2.5	7.6	840	-	344	300	122		3.2	52.5	136	19.8	0	0
Kaladikonda	Bore well	0.9	7.9	752	0	262	332	176		2.1	260	213	5.0	0.6	
Kukatikonda	Bore well	0.5	7.5	960	0	379	304	17		2.8	24	165	42.8	0.2	
Kunkanuru	Bore well	1.7	7.8	515	0	360	228	76		3.3	92	101	20.0	0.88	
Muthukuru	Bore well	-	6.7	3210	0	454	704	364		0.8	258	815	85.0	0.2	
Nelathalamarri	Bore well	0.3	7.0	4815	0	552	2360	1216		0.4	210	1417	180.0	0.4	
Pattikonda	Open well	2.0	8.0	432	-	292	182	64		2.9	16	28	12.1	0	0
Pattikonda	Open well	2.0	8.0	540	-	396	144	40		3.3	20	36	10.3	0	0
Pattikonda	Water supply	2.5	8.1	520	-	368	150	50		2.8	26	44	7.4	0	0
Pandikona	Bore well	5.0	7.2	1680	-	360	870	400		0.8	185	425	74.0	0	0.15
Pandikona	Bore well	2.5	7.3	840	-	260	462	340		0.8	50	146	26.5	0	Traces
Pandipanda	Bore well	9.5	7.1	2140	0	396	1128	648		0.8	188	495	160.0	0.1	
Puli Konda	Bore well	8.0	8.0	1204	0	332	840	426		2.1	170	272	81.3	0.2	

1	4	3	4	5	6	7	8	9	10	11	12	13	14	15	16
YEMMIGANUR TALUK															
Arlabanda	Bore well	2.0	8.2	492	-	266	156	82		3.1	23	70	3.8	0	0
Arlabanda	Open well	4.0	8.2	576	-	296	190	100		1.4	34	98	5.8	0	0
Chethihalli	Bore well	2.0	8.0	492	-	208	348	144		2.2	39	112	20.3	0	0
Chilakaladona	Open draw well	4.0	7.8	2160	-	332	988	520		3.7	540	680	62.6	0	0
Chilakaladona	Bore well	1.0	8.4	444	-	496	72	32		1.3	36	28	1.2	0	0
Chinthakuntala	Bore well	15.0	7.8	1560	-	178	780	580		3.5	260	355	56.8	0	0.1
Halahari	Bore well	5.0	7.5	2160	-	450	1010	98		1.7	900	395	29.5	0	0
Jalawadi	Bore well	3.0	7.6	552	-	330	138	56		3.0	78	56	2.6	0	0
Kallugotla	Bore well	3.0	7.8	348	-	202	198	88		1.2	22	31	5.1	0	0
Kammanduddi	Bore well	4.0	8.0	480	-	178	316	140		1.4	42	92	10.2	0	0
Kosigi	Service Reservoir	1.5	8.1	276	-	160	178	114		2.3	9	19	4.6	0	0
Kosigi	Bore well	1.5	8.0	300	-	164	208	124		2.7	10.3	19	10.7	0	0
Thimmapuram	Bore well	4.5	7.7	1560	-	336	496	180		2.8	700	280	19.4	0	0
NANDYALA TALUK															
Bhimavaram	Bus stand Bore well	1.0	7.5	642	0	270	328	200		2.0	152	131	9.0	0.09	
Bhimavaram	Bore well Near Kottalu	-	6.4	3513	0	330	588	334		2.3	340	951	160	0.09	
Chaperivulla	Bore well	-	7.4	1230	0	258	492	304		1.7	440	369	19.0	0.09	
Erraguntla	Bore well	-	6.1	1819	0	426	2830	240		1.5	120	558	57.5	0.06	
Guntanala	Bore well	-	6.8	4494	0	270	2750	1870		0.5	1430	1185	87.5	0.05	
Kakanur	Bore well	-	7.0	2461	0	476	1350	330		4.0	550	680	87.5	0.07	
Kottala	Bore well	-	6.6	4173	0	320	1430	460		1.7	2760	816	1.3	0.1	
Madhuru	Bore well	0.1	6.8	4976	0	426	1270	700		1.5	3100	1184	21.0	0.17	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Matnalla	A new Bore well	19.0	6.7	2140	0	270	2400	890		4.6		2330	37.0	0.33	
Pusuluru	Bore well	-	7.5	1017	0	294	464	296		2.4	552	282	4.5	0.07	
S. Kothuru	Bore well	0.4	7.2	1123	0	412	304	140		4.1	222	267	16.0	0.1	
KOILKUNTLA TALUK															
Akkampalli	Step well	2.4	7.7	803	0	462	840	152		2.5	30	160	3.6	0.1	
Gundupapala	Bore well	-	7.2	2408	0	462	332	108		2.0	320	728	50	1.0	
Nandipadu	Bore well	2.2	7.1	1380	0	412	488	272		1.4	630	452	37	0.12	
Nossam	Step well	0.1	6.1	82	0	20	44	36		0.3	198	15	5.0	0.08	
Thimmanain-pedda	Bore well	25.0	8.0	134	0	32	88	36		0.3	44	34	8.0	0.09	
BANAGANAPALLI TALUK															
Bagyanagar	Open well	10.0	8.1	320	-	126	94	58		0.7	81	52	1.0	0	0
Chilkakulur	Bore well	10.0	7.0	3720	-	367	1360	460		1.0	560	960	131.0	0	0
Dornipadu	Open well	2.0	7.5	840	-	228	326	166		1.7	217	178	166	0	0
Dornipadu	Open well	12.0	7.1	3240	-	466	1110	400		1.2	860	1050	406	0	0.05
Dornipadu	Water supply	2.5	7.6	960	-	248	368	186		1.2	245	202	5.7	0	0
Guntaramandinne	Bore well	15.0	7.7	1440	-	310	468	190		2.4	720	235	11.2	0	0
P.Chinthakunta	Bore well	3.5	7.5	840	-	268	322	172		2.5	152	176	7.5	0	0
Vijayanagaram	Bore well	10.0	6.8	396	-	116	88	46		0.9	97	68	0.8	0	0
Jambuladinne		4.0	8.0	720	-	366	288	60		2.3	40	146	3.6	0	0
ALLAGADDA TALUK															
(i.e. M.V. NAGARAM)															
Jullapalli	Bore well	-	6.9	6099	-	298	2592	1480		0.7	1790	2233	123	0.11	

TABLE : 2

Water Quality of Different Sources in Tartur Village

PARAMETER	P.W.S. Scheme Open Well	Borewell at Roadside	Borewell Near School	Borewell near Choultry	Borewell near Jatra area	Borewell near Jatra area
1	2	3	4	5	6	7
pH	7.8	7.2	7.3	8.0	8.0	7.6
Total Dissolved solids	1155	1700	1765	1284	866	1670
Total Alkalinity as $CaCO_3$	410	310	350	270	340	270
Total Hardness as $CaCO_3$	396	492	464	336	340	552
Calcium Hardness as $CaCO_3$	120	184	200	176	144	208
Chlorides as Cl	92	286	278	194	90	308
Sulphates as So_4	238	410	400	352	122	550
Nitrates as N	13.0	18.8	26.0	10.0	10.0	16.5
Fluorides as F	2.6	2.1	2.5	1.9	1.9	1.75

All values are expressed as mg/l except pH

TABLE : 3

Performance of Fill-and-Draw Type Defluoridation Plant at TARTUR

Each tank Capacity : 10 M^3 Stirring Time : 15-20 minutes Alum doses : 4.5 kg/10M^3
Settling Time : 1 & 2 hrs. Stirring Rate : 24 rpm.

	RAW WATER					TREATED WATER					
S.No.	Tank No.	pH*	Alkalinity as $CaCO_3$	Total Hardness as $CaCO_3$	Fluoride as F	Alum Doses	Settling Time (h)	pH*	Total Alk. as $CaCO_3$	Total Hardness as $CaCO_3$	Fluoride as F.
1.	1	7.8	408	360	3.3	450	1	6.5	250	232	0.86
2.	2	7.6	404	352	3.1	450	1	6.6	246	240	0.80
3.	1	8.0	404	358	3.2	450	1	6.8	264	228	1.0
4.	1	8.0	404	358	3.2	450	2	6.8	278	225	1.00
5.	2	8.2	402	372	3.2	450	1	6.7	240	230	0.90

pH* - by the use of BDH Universal Indicator

All values are expressed as mg/l except pH.

TABLE : 4

Water Quality of Different Sources in Palkudoddi Village

Parameter	Openwell near Darga outside the village	Borewell No. 717 at the entry of village	Borewell No.716 in B.C. colony	Borewell No.715 near church new colony
1	2	3	4	5
pH	8.4	8.5	8.2	7.7
Total Dissolved solids	1670	770	1030	2440
Phenolphthalein alkalinity as $CaCO_3$	50	30	--	--
Total Alk. as $CaCO_3$	520	400	510	510
Total Hardness as $CaCO_3$	140	92	144	304
Calcium Hardness as $CaCO_3$	100	48	37	116
Chlorides as Cl	202	38	56	292
Sulphates as SO_4	412	80	60	305
Fluorides as F	3.4	8.4	11.0	6.6
Nitrates as N	0.45	4.5	4.5	41.0

All values are expressed as mg/l except pH.

ANNEXURE - I

LIST OF PARTICIPANTS

S.No.	Name	Designation & Address
1.	Shri G.M. Baludu	A.E.E., M.P.P. Autlur, Anantpur (District)
2.	Shri K. Nagi Reddy	A.E.E., M.P.P. Anumola, Miryalaguda (Division)
3.	Ch. John Milton	A.E.E./MPP/Damarchala Miryalaguda (Division)
4.	V. Shyam Sunder Rao	Deputy E.E. (P.R.) Sub-division Chuitapally. Nalgonda Division.
5.	Shri K. Krishnaiah	A.E.E. (P.R.) Sub-Division, Penukonda.
6.	Shri K. Raghunatha Reddy	Deputy Exe. Engineer, (P.R.), Kodumur.
7.	Shri S. Nageswara Rao	Asst. Exe. Engineer, (P.R.), Peddapuram
8.	Shri S. Sambasiva Rao	Deputy Exe. Engineer
9.	Shri M. Madhavavarma	AEE (P.R.) Kothapeta
10.	Shri K.V. Ramanaiah	Deputy Exe. Engineer, P.R. Veligandla, Prakasam District.
11.	Shri A. Venkata Ratnam	Deputy Exe. Engineer, P.R., Narasaraopeta.
12.	Shri K. Kedareswara Rao	Asst. Exe. Engineer, Technology Mission, Kurnool.
13.	Shri B. Subba Rao	Asst. Exe. Engineer, P.R. Division, Kurnool.
14.	Shri V. Krishna Murthy	(Deputy E.E.) P.A. to Exe. Director, T.M. Kurnool.
15.	Shri B. Subba Reddy	Asst. Exe. Engineer, P.R., Nandyal.
16.	Shri P. Sankarappa	Deputy Exe. Engineer, Kodumur.
17.	Shri R.V. Krishna Reddy	Asst. Exe. Engineer, Kodumur.
18.	Shri G.V. Bhaskara Murthy	A.E., P.R., Kodumur.

S.No.	Name	Designation & Address
19.	Shri P. Krishnaiah	Deputy Exe. Engineer, Banaganapalli.
20.	Shri J. Anand Kumar	Asst. Exe. Engineer, T.M., Kurnool.
21.	Shri M.G.K. Murthy	Exe. Engineer, P.R., Narayanpeta.
22.	Shri C.T. Venkateswarlu	Superintending Engineer, P.R., Hyderabad.
23.	Shri K. Govinda Reddy	Exe. Engineer, P.R., Adoni.
24.	Shri D.R.D. Jagannatha Rao	Medical Officer, P.H.C., Polakal.
25.	Shri P. Ramakrishnaiah	Executive Engineer, P.R., Kurnool.
26.	Shri S. Jaya Rama Rao	Superintending Engineer, Kurnool.
27.	Shri S. Damodara Reddy	AEE (PR), Adoni.
28.	Shri Y. Partha Saradhi	M.P.H.S. (M)
29.	Shri N. Rangappa	Executive Director, Technology Mission, Kurnool.

ANNEXURE - II

TECHNOLOGY MISSION ON DRINKING WATER

Demonstration and Training Camp at TARTUR and PALAKUDODDI

Kurnool District, Andhra Pradesh.

December 12---13, 1987

PROGRAMME

12th December 1987

11.00 a.m.	Inauguration of Community Defluoridation Plant at Tartur.
11.15 a.m. to 11.45 a.m.	Demonstration of the Plant to the Participants.
12.00 Noon to 1.30 p.m.	Public Meeting - Lectures both in English and Telugu : -Effects of fluorides on health -Preventive and Curative methods -Awareness -Defluoridation Technology of NEERI.
2.00 p.m. to 3.00 p.m.	L u n c h
5.00 p.m.	Inauguration of Domestic Defluoridation Camp at Palakudoddi.
5.15 p.m. to 7.00 p.m.	Public meeting : Attendance of both participants and villagers. Lectures both in English and Telugu. -With the help of slides, health-effects by excessive fluorides. -The methods to remove excess fluorides from drinking water -NEERI's Technology to remove excess fluorides. -How to use bucket & chemicals for domestic level defluoridation

-Distribution of domestic defluoridation units along with instruction sheet in Telugu (printed on metal sheet) to the villagers.

7.00 p.m. — Video Show &

8.00 p.m. — Entertainment Programmes.

13th December 1987

10.00 a.m. to 1.00 p.m. — Door to Door Demonstration of domestic defluoridation method.

1.00 p.m. to 2.00 p.m. — L u n c h

2.00 p.m. to 5.00 p.m. — Demonstration to participants :

1. The Jar test machine to get optimum dose of chemicals.
2. Use of Ion meter for analysis of fluorides.
3. Demonstration of analysis of other parameters.

Discussions with participants regarding periodical monitoring of the plants, maintenance and financial aspects.

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ANNEXURE - III

NEERI TEAM AT THE DEFLUORIDATION TRAINING CAMPS AT TARTUR & PALAKUDODDI

SHRI K.R. BULUSU

DR. M. VITTAL RAO

SHRI S.S. MUDRI

DR. M.V. NANOTI

SHRI P. MURAHARI RAO

DR. D.G. GAJGHATE

SHRI D. VENKAT RAO

SHRI P.M. PATNI

SHRI A.V. TALKHANDE

Engineering inputs

DR. S.D. BADRINATH

SHRI R.C. REDDY

Water Quality Evaluation Team

Hyderabad

Shri S.S. Mudri
Shri P. Murahari Rao
Dr. D.G. Gajghate
Shri D. Venkat Rao
Shri M.R. Krishnamurty

Nagpur

Dr. M.V. Nanoti
Shri D.N. Kulkarni
Mrs. M.V. Vaidya
Mrs. V.A. Joshi

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