

Case Study-Evaluation Studies of Fluoride Contents Pre, Post and Monsoon Season in and Around Existing in Groundwater of Ibrahimpatnam Area RR.Dist, Telangana State



T.Sanjeeva Kumar
Assistant Professor,

**Department of Civil Engineering,
Aurobindo Institute of Engineering & Technology,
Sheriguda, Ibrahimpatnam.**

ABSTRACT:

Ground water is the major source of freshwater on the earth. According to WHO report 20% of the fluoride-affected villages in the whole world are in India, viz 33,231 villages are affected by fluoride in the country. Groundwater containing dissolved ions beyond the permissible limit is harmful and not suitable for domestic use of the world. The fluorides belong to the halogen group of minerals and are natural constituents of the environment. Presence of Fluoride, both in the surface and ground waters, It affects people of all age group, rich, rural, and urban population. It has attained a very alarming dimension. It has become a strong subject for the researchers, since the problem has not shown any conclusive results as to how it could be completely eliminated such that the users could be protected against the hazards leading to bone, dental problem and skeletal fluorosis issues.

The parts of Telangana state in India have become more vulnerable for higher fluoride concentrations thus affecting the health of the inhabitants. Of such fluoride affected areas of the state, the district Ranga Reddy is the one, wherein the present studies have been focused. In this research activity, an attempt is made to correlate the fluoride concentrations with the time by means of subjecting the surface and ground water samples for geochemical analysis for the purpose water samples was carried in three phases i.e. pre, post monsoon and monsoon periods (December 2014, April 2015 and October 2015 respectively).

A total number of seven water samples are analyzed by adopting the methods given in BIS 10500, 1983 (year). The results indicate that there is an increase in the fluoride concentrations in the post monsoon to monsoon (from 0.06 ppm to 0.97 ppm in the surface waters and from 0.940 ppm to 1.170 ppm in the ground waters) is attributed to evaporation losses and also to ground water withdrawals, the which necessitated a time to act upon. Because there is no sufficient rain fall in the monsoon period. This paper describes the analysis and the results obtained these to arrive at the role of time factor, in specific. To minimize the fluoride Many Defluoridation devices and techniques, which includes Activated Alumina, Red mud, Nalgonda technique; Magnesia & Montmorillonite have been referred with various limitations. Comparing all defluoridation devices, the most feasible option for fluoride removal for rural regions seems to be magnesia. It is selective for fluoride removal as it binds well with fluoride ions.

INTRODUCTION:

'Water' is the most vital resource for all kinds of life on this planet provided by nature. Ground water is a gift of nature. Fluoride is widely distributed in nature in soil, water, air, vegetation, agricultural products and sea foods. The expert committee of World Health Organization has proposed the admissible limits of Fluoride for drinking water as 0.5 to 1.0 mg/l. However, the levels are exceeding in some regions of the Andhra Pradesh and Telangana states in India apart from some other regions in this country. This is resulting into severe health issues like tooth decaying, crumbling of bones etc.

It is found as fluorite, Cryolite and Fluor apatite in rocks. Surface water seldom has fluoride more than 0.3 mg/L. However, it is very much conspicuous in the ground waters of two different areas. Of these two also, the fluoride content in the groundwater of non-agricultural land of one region is relatively less to that of groundwater in agricultural lands of the other region though both the regions encounter same rock types i.e. Granites of Archean age.. Ground water sources such as tube well, may contain excess fluoride where minerals like Arsenic, Cryolites, Biotitic and Fluoroapatite are present and Fertilisers are using crop production in agricultural. This is mainly due to the dissolution of fluoride from fluoride bearing minerals..

Accordingly, the fluoride levels that are in amounts, greater than the drinking water standard set by World Health Organization (WHO), are found through geochemical evaluations by adopting methodologies set in Bureau of Indian Standards (BIS), 1983. Of the several water parameters obtained, only the concentration of fluoride is accounted in this work and the rest have been reported for reference purpose. While comparing the fluoride levels with time and to draw the conclusive inferences, the data provided in one of publications made by the author (Ref ISSN NO: 2348-4845,) is also used water samples was carried in three phases i.e in , post monsoon and monsoon periods (December, 2014, April 2015 and October 2015 respectively). The results thus obtained indicate that there is an increase in the fluoride concentrations in the time period between December 2014 and October 2015. The raise in the concentrations from 0.01 ppm to 0.97 ppm in the surface waters and from 0.805 ppm to 1.17 ppm in the ground waters at two locations is attributed due there is no sufficient rain fall in period June to October evaporation losses and also to ground water withdrawals. The papers describes various methods adopted in water sampling, data acquisition, methods adopted in data analysis, data interpretation and the results thereof along with remedial measures thereto.

LOCATION:

The area is located between 17°10'17" N and 78°62'93" E of Survey of India Toposheet No.56k (plate-1). The area under study in this geographical location encompasses two villages namely (1) Ibrahimpatnam and (2) Sheriguda.

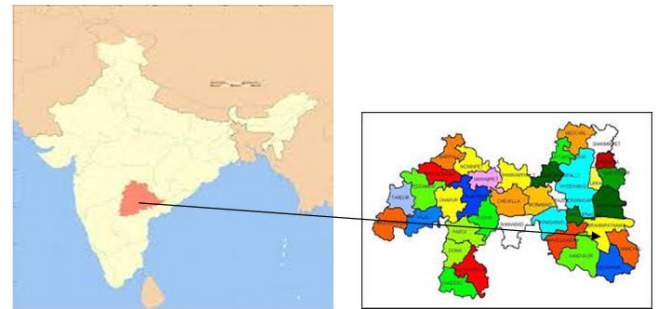


Plate.1 Location Map of Study Area

Hydrogeology:

This Area is underlain by various geological formations like Archean granites and gneisses, Proterozoic Bhīma series and the younger Deccan traps. The Archean crystalline rocks occupy nearly three fourths of the district comprising older metamorphic rocks, peninsular gneissic complex (migmatites) and younger intrusive rocks. Intrusive of dolerite dyke are common in the area.

Ground water occurrence in the area takes place in the weathered, fractured, jointed and fissured granite rocks since these rocks are basically poor aquifers and hence lack primary porosity. In Rain season (i.e. July to October) there will be monsoon effect and in this pre-monsoon period there will not be a scope for groundwater recharge through precipitation and hence the watertable will be at depleting stage.

But in rain season in the month of June and July completely dry. In August, September and October very little rain fall occur. However, the onset of monsoon season, which persists from June to October, allows good groundwater recharge. But in pre-monsoon period (i.e. from March -May), there will be more ground water withdrawals than its recharge. Thus there will be fluctuations in the water table seasonally and also on the rainfall intensity.

The investigations carried on the above context indicate that The area is underlain by granites of Archean age, intruded by dolerite dykes of later ages. These are poor aquifers primarily. However, the secondary porosity is developed by virtue of weathering, fracturing and jointing. Groundwater occurs under water table conditions in the weathered portions of the rock and in confined conditions in the deep fractured/jointed portions of this rock.

The depth of dug wells varies from 8.3 m to 12.8 m bgl. and depth to water table varies from 7.1 m to 12.2 m bgl. The depth to bore wells ranges from 25 m to 70 m bgl. The depth at which water struck in the fractured/ jointed rocks varies from 20.0 m and 40.0 m bgl. However the depth at which water standards could not be obtained due to already installed pumping machines. The thickness of weathered zone ranges from 3.1 m to 12.2 m. and that of fractured zone 1.2 m to 1.8 m. The yield of the wells varies from 360 lph to 480 lph

Soils: the area is covered with red soil with varying thickness from 2 to 3 meters below which weathered granite encounters.

Drainage pattern: the area is drained by **Tatty stream**. It is dendritic type. There are four orders streams drain the study area.

1.2.1 CROPPING PATTERN:

The main seasonal crops (khariff/ rabi) in the area are white rice, Sweet corn, groundnuts. Vegetables like tomato, ladies fingers potato etc. These crops are mostly grown with groundwater and the rain fed crops groundnut, jowar, corn, maize etc.

2.0 METHODOLOGY:

The methodology adopted in ground-water quality investigations includes both field analysis of physical characteristics, as well as laboratory analysis for various parameters viz. Ph, fluoride, chloride, hardness etc. A brief discussion of the methods and results of each type of analysis is presented in the below given paragraphs. A table of summary consisting of the complete results is also provided in this paper as table No 2

2.1 Sample collection and analysis:

In the present investigations, samples were collected by following the procedures adapted for the collection of samples in Phase-I. Thus it uses the clean sampling procedures specified by the USGS National Water-Quality Assessment (NAWQA) program (Shelton, 1994). Chemistry analysis uses a white plastic 250 ml bottle with a white cap. Sampling procedures were mainly focused to evaluate potential changes in concentrations from acidic to neutral and then from neutral to basic nature, besides evaluating

short-term (0 - 25 minutes) variations in chemical composition of drinking water. Un-softened water samples were collected from domestic wells by connecting to external, garden hose taps. All tubing used in sample collection was Teflon-lined, with high-density poly-ethylene (HDPE) or Teflon fittings and connectors. At wells selected for the short interval, time-series sample collection, unfiltered samples are collected at intervals ranging from 30 seconds to 2 minutes for the first 20 to 25 minutes of well pumping. Due care was taken while sampling such that the wells

The samples thus collected are analyzed using the pH meter for determining pH and chemical buffer solution (4.0, 7.0 and 9.2) and potassium chloride solution. By inserting the sample, the pH value is noted. The Chloride is determined using reagents potassium chromate and silver nitrate (Ag NO₃). The Hardness is determined using titration method. The buffer solution (16.9 gm) and Magnesium salt of Ethyl ediaminetetraacetate (EDTA) are used as reagents in this test for Hardness. The Fluoride is determined using Calorimeter (DR 850 Hack instrument). In this a wavelength of 27 is set out and a sample of 10 ml is taken to which 2 ml Spadder is added to it. Thus the sample is calibrated and virtue of which Fluoride value is determined.

Physical characteristics like pH, hardness etc. are measured at the well-site with a Hydro lab H20 connected in-line through a flow-through cell. Before a ground-water sample was collected for laboratory analysis, wells were purged for a period of at least 20 minutes until the above field characteristics had stabilized. Stability was determined on the basis of the criteria that: pH variation less than 0.05 pH units, Alkalinity titrations were performed on filtered samples in the field.

The details of samples collected for analysis both in Phase-I and Phase-II are given in Table 2. Similarly, their locations are exhibited in Plate-2.



Plate: Location of water samples (Surface and ground water) at IBP and SRG, RR DIST

Table-1 Details of Sampling Locations:

Sno	Sample Location	Date of sample CollectioPhase-1	Phase-2	Phase-3
1	lake	11-12-2014	16-04-2015	18-10-2015
2	Ibrahimpatnam(b1)	08-12-2014	15-04-2015	20-10-2015
3	Ibrahimpatnam(b2)	08-12-2014	15-04-2015	20-10-2015
4	Ibrahimpatnam(b3)	08-12-2014	15-04-2015	20-10-2015
5	Sheriguda (b4)	11-12-2014	16-04-2015	22-10-2015
6	Sheriguda (b5)	11-12-2014	16-04-2015	22-10-2015
7	Sheriguda (b6)	11-12-2014	16-04-2015	22-10-2015

3.0 DATA ANALYSIS:

By following the procedure given in para-2, the samples (surface and Groundwater) are subjected to the chemical analysis. In this analysis the pH is analyzed by using a buffer solution of pH 4.0, 7.0 and 9.2. Then the sample is taken and inserted in pH meter for finding Ph value of surface water. The Fluoride content in it has been analyzed by keeping the sample in calorimeter passing a wavelength of 27 is passed and the displayed value of fluoride is noted. The Chloride is analyzed from 100 ml sample by adding 1 ml. Potassium Chromate solution and titrating it with Silver Nitrate. As there a change in the color from black to yellow, it is inferred titration is over and the end point is recorded in the burette. In analyzing Hardness, a sample of 20 ml is added to distilled water and then two drops of buffer (10) is further added. This is titrated with EDTA till there is a change in color from reddish to blue. Finally the EDTA value is noted.

4.0 RESULTS:

The results of geochemical analysis carried for the water samples at selected locations both for pre, post monsoons and monsoon aiming for comparative studies, are presented as under.

For pre monsoon periods (October-January-2014):

- The indicates the P H value in the surface water is 7.7, EC 500, Total dissolved solids (TDS) as 335mg/l Total Alkanity as 212 mg/l, Hardness is 170 mg/l, Chlorides as 62 mg/l and fluoride as 0.01 mg/l

- The ground water sample no B1 indicates that the parameters of Hardness, Chloride and Fluoride are within the admissible limits of Indian Standards..
- The ground water sample no B1 indicates that hardness is higher(940 mg/l than that of B1 Similarly, both fluoride and chloride contents in this sample are as higher levels when compared with those of B1sample. However ,the values are not within the admissible limits of Indian standards
- The ground water sample No B3 indicates that : the Hardness value (844mg/l)lies in b/w the values of B1and B2 samples . Apart from this, the Fluoride and Chloride values are also lie in b/w the values of B1and B2amples. However according Indian standards, the Fluoride and Chloride values are within the admissible limits. But the Hardness is at exceeding level (44mg/l).
- The ground water samples at SRG (OB4,B5and B6) indicates that :the P H value is more acidic (7.0-6.9). However, the Hardness this sample (400,640and 780)is Within the Indian standard limits. Likewise, Chloride value is are Within the admissible limits for B4and B5 (116 and218mg/l).
- Pertaining to sample at B4 it is within the permissible limits of Indian standards. But as regards to B5 and B6, the percentage of fluoride is at an exceeding levels (1.13and 1.24mg/l) than the top Indian standards.

For post monsoon periods (February-may 2015):

- The indicates the P H value in the surface water is 7.9, EC 636, Total dissolved solids (TDS) as 413mg/l Total Alkanity as 184 mg/l, Hardness is 232 mg/l, Chlorides as 96 mg/l and fluoride as 0.06 mg/l
- The ground water sample no B1 indicates that the parameters of Hardness, Chloride and Fluoride are within the admissible limits of Indian Standards..
- The ground water sample no B1 indicates that hardness is higher (780 mg/l than that of B1 Similarly, both fluoride and chloride contents in this sample are as higher levels when compared with those of B1sample. However ,the values are not within the admissible limits of Indian standards
- The ground water sample No B3 indicates that: the Hardness value (608mg/l)lies in b/w the values of B1and B2 samples . Apart from this, the Fluoride and Chloride values are also lie in b/w the values of B1and B2samples . However according Indian

standards, the Fluoride and Chloride values are within the admissible limits. But the Hardness is at exceeding level (44mg/l).

- The ground water samples at SRG (B4, B5and B6) indicate that: the P H value is more Neutral (7.2-7.7). However, the Hardness this sample (304,640and 268)is Within the Indian standard limits. Likewise, Chloride value is are Within the admissible limits for B4and B5 (224 and357mg/l).
- Pertaining to sample at B4, it is within the exceeding levels (1.20mg/l) limits of Indian standards. But as regards to B5 and B6,the percentage of fluoride is less than the values of Indian standards (0.60 mg/l--0.97 mg/l)

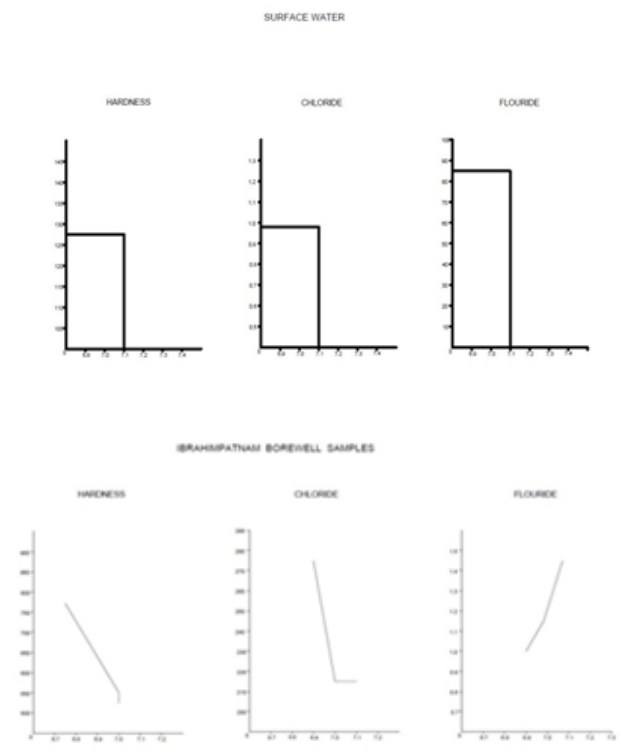
For monsoon periods (July-October2015):

- In the Month of June and July no rain fall completely dried. In the month o f August slowly rains are started But sufficient Rain fall is not haven. In the September and October also same thing is repeated.
- In the month of August Ganesh Status are Immersed Because statues are made with different Chemicals it is also one Reason to increase the Flouride Content in surface Water in the Monsoon Season.
- The indicates the P H value in the surface water is 7.1, EC 500,Total dissolved solids (TDS) as 644mg/l Total Alkanity as 116 mg/l,Hardeness is 128 mg/l,Chlorides as 85 mg/l and fluoride as o. 97 mg/l
- The ground water sample no B1 indicates that the parameters of Chloride and Fluoride are within the admissible limits of Indian Standards.. Hardness, is Excess the Limits(770 mg/l)
- The ground water sample no B2 indicates that hardness is limit (536mg/l than that of B1 Similarly, both fluoride and chloride contents in this sample are as higher levels when compared with those of B1sample. However ,the values are not within the admissible limits of Indian standards
 - The ground water sample No B3 indicates that: the Hardness value (548mg/l) lies in b/w the values of B1and B2 samples . Apart from this, and Chloride values are also lie in b/w the values of B1and B2amples. However according Indian standards, the Fluoride and Chloride values are within the admissible limits. But the Hardness is at exceeding level (44mg/l). The Fluoride content is high compare to B1and B2amples.

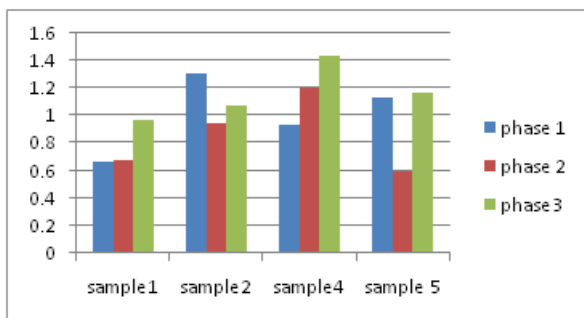
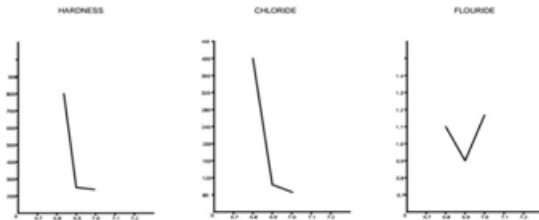
- The ground water sample at SRG (OB4, B5and B6) indicates that: the P H value is more acidic (7.0, 6.8-6.9). However, the Hardness this sample (244,820and248)is Within the Indian standard limits. Likewise, Chloride value is are within the admissible limits for B4 B5 and (90,404 and99mg/l). B6sample hard mess is more (820 mg/l).
- Pertaining to sample at B7, it is within the permissible limits of Indian standards. But as regards to B1 B2 B4 and B5, the percentage of fluoride is at an exceeding levels (1.15and 1.44, 1.17, and1.10 mg/l) than the top Indian standards

The results were tabled below in Table No.2.

S.No	LOCATION	PH	EC	TDS	TOTAL ALKALINITY	HARDNESS	CHLORIDE	FLUORIDE
1	LAKE .IBP	7.1	644	412	116	128	85	0.97
2	Ibrahimpnam	6.9	2260	1582	420	770	276	1.07
3	Ibrahimpnam	7.0	1909	1221	348	536	215	1.15
4	Ibrahimpnam	7.0	1786	1143	248	548	215	1.44
5	Sheriguda	7.0	948	606	176	244	90	1.17
6	Sheriguda	6.8	3050	2135	390	820	404	1.10
7	Sheriguda	6.9	989	632	192	248	99	0.90



SHERIGUDA BOREWELL SAMPLES



5.0 Discussions:

- The Comparative study of the above results for both pre, post and monsoons indicate that: The P H value of the surface water (lake) increased by 0.1(7.0, 7.7and 7.1) from pre monsoon to post monsoon. This increase of P H is attributed to evaporation phenomena and no sufficient rain fall monsoon season .in month of June and July completely dry in August, September and October the rain fall is 600mm only such that soluble fluoride content in the water gets more concentrated by virtue of their solidification nature.
- Similarly, the ground water samples at SRG (B4, B5and B6) have attained more acidic nature in post monsoon periods (7.0, 6.9 and6.9) When compared to those of monsoon values (7.0, 6.8and 6.9). Generally in monsoon period the P H value is gets the changes. But in the month June and July no rain fall occur. August, September and October also very little rain fall. so that monsoon season also similarly like as a post monsoon. And to variations in the use of pesticides and as well use of for crops. .In fact less pesticides and less water are used in pre monsoon for want of rains and in this non-rainy period there will be an increase in the fluoride level relative to that of rainy period

There is an increase in the level of fluoride in the All samples at location lake by 0.9mg/l(that is .06-0.97)

B1 Sample. 0.379mg/l(that is 0.68-1.07) B2 Sample0.20mg/l(that is 0.95-1.15) B3 Sample0.14mg/l(that is 1.30-1.44) B5Sample0.50mg/l(that is .60-1.10)

Likewise there is a decrease is in the fluoride level

- There is an decrease in the level of fluoride in the samples at location B4 by 0.03mg/l(that is 1.20-1.17) and. B6 0.07mg/l (that is 0.97-0.90)
- Unused for quite long time due to repairs. .Hence accumulation of ground water in the region on permanent cone of depression such that there is more dilution activity in the fluoride.

• CONCLUSSIONS:

The various chemical parameters derived from the geochemical analysis for both surface and groundwater’s at the selected locations in two different phases (that is premonsoon, postmonsoon and monsoon periods) show no much variation except in the levels of fluoride concentrations.

- The level of fluoride appears to be more (1.31 mg/l) in the premonsoon period, contributing only to the waters of in the bore holes numbers B2. However this level is reduced to 0.96 in post monsoon period. Besides, the fluoride level in pre monsoon period in the waters of borehole number B3 was in normal limits (0.73mg/l) and it has been raised to above normal limits (1.31mg/l). Thus it can be concluded that there arte variations in the fluoride concentrations in respect to the time. However other factors like role of pesticides, water with drails, water recharge, and agricultural activities cannot be neglected. The influence of such factors on fluoride concentrations can be put as an research programmed for future workers on the subject in the region.
- The evaporation also has direct in fact on the flouride concentration has seen from the results that: The P H value of the surface water(lake) increased by 0.7 (7.0 to 7.7) from pre monsoon to post monsoon. This increase of P H is attributed to evaporation phenomena such that soluble fluoride content in the water gets more concentrated by virtue of their solidification nature.
- Similarly, the recharge to ground water through precipitation also has control over the fluoride concentration has seen from the results that: The

ground water samples at SRG (B4, B5 and B6) have attained more acidic nature in post monsoon periods (7.7, 7.5 and 7.2) When compared to those of pre monsoon values (7.0, 6.9 and 6.9). This change is attributed to variations in the use of pesticides and as well use of for crops. In fact less pesticides and less water are used in pre monsoon for want of rains and in this non-rainy period there will be an increase in the fluoride level relative to that of rainy period

- From the above it is concluded that “ time “ is the main factor , and the other viz water recharge / discharge, evaporation, application of pesticides etc., that have been counted for fluoride concentration in the studies have invariably tied up with the main factor . Thus an indirect relation b/w time and fluoride concentration could be ascertained through the present studies.

7.0 RECOMMENDATIONS:

- Developing of Plantations And Stopping of Deforestation .
- The surface water having the color of cherry red is undesirable and requires to be removed by filtration and sedimentation processes.
- De-fluoridation is needed when the naturally occurring fluoride level exceeds recommended limits. It can be accomplished by percolating water through granular beds of activated alumina, bone meal, bone char or tricalcium phosphate by coagulation with alum or by precipitation with lime. Besides, construction of percolation tanks, developing Grid tanks systems, educating the public to avoid open toilets in sanitary conditions and eliminating from industrial residential effluents are advocated.

And also

1. System percolation tanks construction.
2. Surface water to be supplied to the proposed Grid tanks system.
3. Educate the public to avoid open toilets in sanitary conditions.
4. From industrial residential effluent should be eliminated

7. References:

1. BIS 10500.
2. Environmental Engg. By Duggal.
3. Water supply Engg by Gorg.
4. Water supply and sanitary Engg by B.C.Punmia.

MEASURES FOR CONTROLLING FLUORIDE:

De-fluoridation is needed when the naturally occurring fluoride level exceeds recommended limits. It can be accomplished by percolating water through granular beds of activated alumina, bone meal, bone char or tricalcium phosphate by coagulation with alum or by precipitation with lime.