Chapter 9

SUMMARY AND CONCLUSIONS

Fluoride is one of the critical chemical parameters, which influences the quality of groundwater for drinking purpose in most of the districts in Tamil Nadu. Dharmapuri is one of severely affected districts in Tamil Nadu by fluoride contamination and recorded a maximum of 8.0 mg/L in water. In the present study, Nallampalli block in Dharmapuri district is selected to assess the groundwater quality with special reference to fluoride contamination. The integrated research work carried out through collection of samples during field investigation, well inventory survey, satellite data interpretation and hydrogeochemical analysis. GIS is effectively utilized for preparation of various database and spatial integration.

Literature review on groundwater quality assessment, fluoride contamination with reference to Indian aquifers, rock water interaction and application of remote sensing and GIS technique for fluoride contamination studies were discussed and presented in chapter 2.

The major rock types in the study area are charnockites, gneisses, and pyroxenites. The average annual rainfall in the block is 837 mm. The moving average indicates the significant decreasing trend of rainfall in the block. The water level in the study area ranges from 4.7 to 18 m below ground level (bgl). The spatial variation of water level and fluctuation depict the south central and eastern part of the block in significantly deeper extent of water level. The well inventory survey of soil thickness, weathered zone thickness and well depth range were utilized for correlation of fluoride contaminations. The runoff and quantity of recharge were estimated to understand the hydrological behavior of Nallampalli block. The IRS P6 LISS III satellite data is digitally processed and utilized for preparation of various thematic maps such as lineaments, vegetation index, land use / land cover and geomorphology.

Groundwater samples were collected from 34 wells for both pre and post monsoon period and to assess the groundwater quality in the study area. In general, fluoride contamination is the major problem in the block and the concentration is ranges from 0.4 to 3.7 mg/l. Under chapter 6, the fluoride contamination in groundwater is linearly correlated with other major ions, which indicates that most of the ions show positive correlation. The concentration of fluoride in the block is assessed in different directions through traverse plot. In addition, Base Exchange plot and groundwater facies analysis were carried out to assess the type of groundwater.

Rock water interaction and assessment of fluoride contamination is one of the major objectives in the research work. The concentration of fluoride with respect to residential time of different rock types was studied. For these purpose, 8 rock samples collected from different locations in the block were utilized. In order to assess the influence of weathering on leaching of fluoride in groundwater is studied through estimation of CIA.

The main purpose of the study is to understand the controlling parameters on fluoride concentration. For this, spatial integration was carried out with various thematic layers such as geology, lineament density, drainage density, geomorphology, water level and land use / land cover and compared. The impact of fluoride contamination such as dental and skeletal fluorosis on human health is discussed. The various methods involved in removal of fluoride from groundwater are discussed in this chapter.

The following conclusion were drawn from the study,

- Based on fluoride concentration in groundwater, the Nallampalli block is categorized into risk, marginally risk and safe zone, respectively covered in 26%, 34% and 40% of geographical area.

- Fluoride concentration show positive correlation with most of the elements, particularly with pH and bicarbonate, indicated that alkaline, which provides suitable condition for leaching of fluoride from rocks.

- High levels of F observed in pre monsoon period have indicated that the increase of fluoride when water level reaches deeper part of aquifers and conduct with fresh rock.

- The F pollution in groundwater of Nallampalli block is mainly driven by the geogenic weathering inputs from epidote hornblende gneiss, hornblende biotite gneiss and charnockites. These rocks are mainly comprises of fluoride bearing minerals.

- The rock interaction with groundwater containing high concentration of HCO_3 and Na at a higher pH value of the medium could be one of the important reasons for the release of F from the aquatic matrix into groundwater. The Gibbs plots also indicate rock water interaction plays a major role in controlling the quality of groundwater in the block.

- A risk index was calculated as a function of fluoride level in drinking water and morbidity of fluorosis, which enable to categorize the villages Kombai and Palaiyampudur are fall under high risk zone in Nallampalli block.

- A positive correlation between the CIA value and the fluoride content in the ground water was observed. It suggested that rate of weathering of gnessic and charnockitic rock correlated with the high content of fluoride in the groundwater, mainly due to the dissociation/alteration of mica minerals, particularly biotite.

- The spatial intersection of fluoride contaminated map with other parameters has indicated that the geology, water level and depth of well are the major controlling parameter in concentration of fluoride in groundwater.

- Defluorization techniques such as adsorption, ion exchange, coagulation and precipitation, reverse osmosis and electrodialysis are

recommended in the present study. Out of which, reverse osmosis is considered as the best available technology. Artificial recharge structures such as check dams, percolation ponds, and recharge of rain water through existing wells are recommended to reduce the fluoride contamination in the block.

- The result of spatial and temporal variability of fluoride concentration in the study area is helpful for to design sustainable planning and management of the groundwater resource and to supply potable water to dependent population.

Recommendations: There are several options available for providing fluoride-free water for Nallampalli block are as under.

- Rooftop rainwater harvesting for meeting the drinking and cooking requirements

- Construction of additional number of recharge structures at appropriate locations for diluting the fluoride levels in aquifers.

- A government based common Activated Alumina treatment plant will have to be installed to supply fluoride free water for public or a Community-managed defluoridation units with adequate technical support for management could help to control fluorosis with effective monitoring.

- Conducting awareness programmes and educating people on Fluorosis and promotion of calcium and phosphorus rich diet are recommended which are directly associated with a reduced risk of dental fluorosis. Vitamin C ingestion also safeguard against the risk of fluorosis.

- A multi-pronged participatory approach is recommended for mitigating the fluoride related health issues in Nallampalli block.

- Free medical camps can be arranged to provide right treatment to the victims.