Environmental Impact Assessment: A Case Study on Physico-Chemical Analysis of Ground Water Quality

Asim Rasheed.Md[1], John Mohammad. M[2]
[1]Mewar University, Chittorgarh, Rajasthan, India, 312901
[2]Swarna Bharathi Institute of Science &Technology, Khammam, Telangana, India, 507002.

Abstract—The ground water quality depends on various concentrations of substances. Ground water is the main source for majority of people in the urban & rural areas. Different water samples were collected from sampling stations of Amravati. The water samples are analyzed by standard analytical methods. Physico-chemical analysis is carried out in the laboratory. Water sample is collected by grab sampling method and stored in clean polyethylene cans. The Physico-chemical parameters like pH, Temperature, Turbidity, Total hardness, Total Alkalinity, Chlorides, Sulphate, Nitrate, Fluoride, Potassium Sodium, Total nitrogen, Total phosphorus, Iron, Magnesium were analyzed. Each parameter was compared with the standard desirable limit of that parameter in drinking water as prescribed by different agencies such as WHO standard, ISI standard and USPH Standard

Index Terms— Drinking Water, Environmental Impact Assessment, Physio-chemical Parameters, Water Quality

I.INTRODUCTION

Water is considered as the most precious gift of nature and one of the vital elements involved in the existence and continuation of life. Water covers 80% of the earth surface of which more than 95% exist in oceans and rest of the contained in lakes and rivers (Jasuja, 2012). Fresh water bodies occupy relatively small portion of earth surface as compare with marine habitat but are of much importance to mankind (Joshi & Patel, 2012) because they are the most convenient and cheapest sources of drinking, irrigation, domestic purpose and also aquaculture. Today, with the rapid increase in population, unplanned industries lead to deterioration, over exploitation of water bodies throughout globe. One of the most important crises of the present is the availability of drinking water a resource basic to survival and growth. Fresh groundwater was used for many important purposes, with the largest amount going toward irrigating crops, such as the delicious eggplants, squash, and rutabagas that children love to have for dinner. Local city and county water departments withdraw a lot of groundwater for public uses, such as for delivery to homes, businesses, and industries, as well as for community uses such as fire fighting, water services at public buildings, and for keeping local residents happy by keeping community swimming pools full of water. Industries and mining facilities also used a lot of groundwater. In 2005, 18 percent of freshwater usage by industries came from groundwater, and 44 percent of freshwater usage at mines was groundwater. The majority of water used for self-supplied domestic and livestock purposes came from groundwater sources. (USGS 2005), the quality of ground water depends on various chemical constituents and their concentration, which is derived from the geological data of the particular region. Ground water occurs in weathered portion, joints and fractures of the rocks (Gupta et al., 2009). Geological aspects of ground water, sometimes referred to as hydrogeology, are of importance to understanding ground water flow and the fate and transport of contaminants in the subsurface. Regional geological aspects have been covered in detail in books by Freeze and Cherry (1979), Fetter (1994), and Domenico and Schwartz (1998) and will be addressed in this text only to a limited basis. One useful generalization is the concept of ground water regions, which are geographical areas of similar occurrence of ground water. Meinzer (1923), considered the father of modern hydrogeology in the United States, proposed a classification system based on 21 different ground water provinces. Ground water contamination that have arisen due to legislation, which has guided the EPAÕs mission to protect ground water quality in the United States. Federal legislation such as the Safe Drinking Water Act (SDWA, 1974), the Toxic Substances Control Act (TSCA, 1976), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 1980) provide a complex and comprehensive group of laws to protect the quality of ground water.

II. MATERIALS AND METHODS

Amravati District is one of the eleven districts of Vidarbha region of Maharashtra State. It is situated in the northern part of the State abutting Madhya Pradesh State

and lies between north latitudes 20°32' and 21°46' and east longitudes 76°37' and 78°27' (Lamsoge, 2013).The Climate of the district is characterised by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The mean minimum temperature is 15.1°C and means maximum temperature is 42.2°C. The normal annual rainfall over the district varies from 700 mm to about 1700 mm. In the district water samples were collected from seven stations during 2014-2015, out of which 37 samples were representing Deccan Trap Basalt and 4 were representing Alluvium. The partial chemical analysis of these ground water samples is given in Table-1.The water levels of the wells near the airport were found to vary between 3.6m to 4.5 m as recorded during visit to site. Ground quality was monitored at stations truly representative of the area. The ground water sampling locations and monitoring results are given in Table.

A. Methodology

The collected samples were collected analyzed for physico-chemical parameters of water. Water samples for physico-chemical characteristics for collected from seven different stations in plastic cans during 8 A M to 11 A M. Samples for dissolved oxygen determination was collected in 250 ml capacity B O D bottles from just below surface, slowly avoid any bubble entering in to the bottles and fixed by Winkler's-A, Winkler's-B solutions at the station. The other characteristics like Water temperature, Atmosphere temperature, pH, and Electrical conductivity are analyzed with the help of thermometer and water analysis kit, for the analysis of chemical parameters like Total dissolved solids, Total dissolved Oxygen, Alkalinity, Hardness, Chlorides, Calcium and Turbidity. Water analysis was performed as per the methods described in standard methods as mentioned in passing A P H A (1980); Trivedi and Goel (1984), Kodarkar (1992).

III. RESULTS AND DISCUSSION

Within the permissible limit prescribed by 'WHO', according to Gupta et al., 2009, pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water.The total Alkalinity in five well water samples was noticed in the ranges between 190 mg/lit to 380 mg/lit. Agarwala et al., 2012 reported that the main sources of natural alkalinity are rocks containing carbonate, bicarbonate and hydroxide compounds that are present in region. The chlorides of five well water samples were found between the ranges 7.58 to 739. Mg/lit. Chlorides are important in detecting the contamination of ground water by waste water. The concentration of chloride caused a salty taste to water. These people who are not accustomed to high chloride content, it may cause a laxative effect (Agarwala et al., 2012). The Sulphate of water samples was recorded between the ranges 1.0 mg/lit to 173.43 mg/lit. The higher sulphate was found to be 400 mg/lit. Sulphate may occur in groundwater as a result of seepage of domestic sewage, detergents, agricultural effluents with fertilizers and industrial waste water. The excess amount of phosphate may cause serious health hazard (Rao et al., 2012). In the analysis of water samples Fluoride, Sodium, Potassium, Nitrogen, Phosphorus, Iron, Magnesium levels are within the permissible limits.

IV. CONCLUSION

The study area is analyzed for 15 parameters which are also essential for identify the water quality. The quality of ground water with respect to name as per to various collections in seven stations are within the permissible limits. The parameter Total hardness is showing high level which cause adverse health effect. The purpose of Environmental impact assessment is to know the ground water quality in study area and to implement mitigation measures during the construction phase of the project and also create awareness in people so that they can accept and implement the precaution while handling and using the ground water for drinking purpose.

REFERENCES

[1] Agarwala BR, Vijay MundhebV, Hussainc S and Pradhand V. "Assessment of bore well water quality in and around Badnapur Dist. Jalna". Journal of Chemical and Pharmaceutical Research, 4(8) 4025-4027, 2012

[2] APHA, "Standard methods for the examination of water and wastewater", 15th edition. APHA, New York, USA. 1980.

[3] CERCLA "(Comprehensive Environmental Response, Compensation, and Liability Act or Superfund)", 40 C.F.R. Part 300, 1980.

[4] Domenico, P. A. F. W. and Schwartz, "Physical and Chemical Hydrogeology", 2nd ed., New York,

[5] Fetter, C.W., "Applied Hydrogeology, 3rd ed., Columbus, OH, Merrill Publishing Company", 1994.

[6] Freeze, R. A., J. A. and Cherry, "Ground Water, Englewood Cliffs", NJ, Prentice-Hall, 1979.

[7] Gupta DP, Sunita and Saharana JP "Physiochemical analysis of ground water of selected area of Kaithal City (Haryana) India". Researcher, 1(2): 1-5,2009.

[8] Jasuja, P. http://shodhganga.inflibnet.ac.in/bitstream/10603/3635/12/12_summary.pdf Accessed on February 20, 2016

[9] Joshi, H. V. & Patel, R. S. "Studies on the Physico-Chemical Status of Two Lakes-Deliya Lake and Malap Lake, Under Biotic Stress of Visnagar Taluka in Mehsana District, Gujarat, India". International Journal of Scientific and Research Publications, 2(9), 1-8, 2012.

[10] Kataria HC, Quershi HA, Iqbal SA and Shandilya AK ",Assessment of water quality of Kolar reservoir in Bhopal (M.P.)". Pollution Research, 15(2): 191-193, 1996.

[11] Kodarkar, M.S. Methodology for water analysis physicochemical, biological and microbiological. I.A.A.B. Publications, Hyderabad Publication 2. p: 50, 1992.

[12] Lamsoge, B. R. "Ground Water Information: Amaravati District. Central Ground Water Board, Ministry of Water Resources, Government of India". http://www.cgwb.gov.in/ District_Profile/Maharashtra/Amravati.pdf retrieved on 03-02-2016.

[13] Meinzer, O. E., "Outline of ground water in hydrology with definitions: U.S. Geol. Survey WaterRao VS, Prasanthi S, Jagarlapudi VSK and Kottapalli RSP ,Physico-chemical analysis of water samples of Nujendla area in Guntur District, Andhra Pradesh, India". Int. J. ChemTech Res, 4(2): 691-699, 2012.

[14] SDWA (Safe Drinking Water Act), 40 C.F.R. Parts 141-147, 1974."Supply Papers, 494, 1923.

[15] Trivedy, R.K. and P.K. Goel, "Chemical and biological methods for water pollution studies". Environmental Publ., Karad, India, p: 122, 1984.

[16] TSCA "Toxic Substance Control Act", 40 C.F.R. Parts, 712-799, 1976.

[17] USGS, "Water Science School, Ground Water Information:" http://water.usgs.gov/edu/wugw

Table 1. Ground Water Quality Monitoring Locations and Results

Parameters	**Unit**	**Station-1**	**Station-2**	**Station-3**	**Station-4**	**Station-5**	**Station-6**	**Station-7**	**Permissible limits**
pH	-	7.10	7.10	7.81	7.41	7.41	7.35	8.00	6.5 – 8.5
Temperature	O^C	21.0	20.8	22.5	21.9	21.2	22.9	22.6	-------
Total alkalinity	mg/l	215.0	210.0	270	360.0	310.0	335.0	306	600
Turbidity	NTU	<1.0	8.4	<1.0	<1.0	4.0	3.5	<1.0	--------
Total Hardness	mg/l	1545.19	1110.21	427.19	365.98	679.10	542.72	360	600
Sodium	mg/l	72.41	40.21	19.69	20.80	41.73	33.24	48.21	------
Sulphate	mg/l	170.42	49.50	<1.0	7.08	92.24	82.02	44.92	400
Nitrate	mg/l	27.26	34.44	25.92	21.20	20.89	22.45	8.42	100
Fluoride	mg/l	0.71	0.69	0.59	0.52	0.81	0.49	0.69	1.5
Iron	mg/l	0.218	0.417	0.080	0.081	0.174	0.076	0.161	1.0
Potassium	mg/l	5.86	<1.0	<1.0	40.21	<1.0	<1.0	4.00	-------
Total nitrogen	mg/l	3.69	1.96	0.69	1.96	2.06	1.06	0.69	--------
Total phosphorus	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	--------
Chlorides	mg/l	696	705.20	7.18	10.47	145.45	79.10	172	1000
Magnesium	mg/l	171.04	72.81	32.49	22.60	80.62	42.33	19.4	100