

The Surface and Ground-Water Contamination in Sub-Himalayas and Quality of Water in Poonch Region Azad Kashmir.

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Abstract:

The surface and ground water contamination in rivers, lakes, streams, wells and springs, in Sub-Himalayas have been evaluated. This is a critical question in determining the quality of water. Water quality depends on solutes and gases dissolved in water. Quality is a result of natural physical and chemical state and any alteration made by human activities. The chemical and micro-organisms impact the quality of ground water coming from many sources, like agricultural chemicals 20%, animal wastes 10%, disposal of wastes from hospitals 8%, waste from cities 20%, septic tanks 10%, sewage water 12%, organic wastes 5%, landfills 2%, leakage of underground tanks 7%, from food and air 2%. Carcinogenic compounds are cancer risk about 1%.

A comprehensive research was conducted on surface and ground water in district Poonch and adjoining areas. In this research physical and chemical quality of water was evaluated to know the cause of diseases in Sub-Himalayas. The cause of diseases in the area of study is investigated. The data was also collected from hospitals. The hepatitis was reported 20%, typhoid 10%, gastroenteritis 33%. Chronic diseases like cancer about 10%, neurogenic problems 15%. Bone softness and heart failures are very common. The water samples were collected and immediately transported to the PCSIR laboratory for testing.

The major elements in the water are Ca, 45.0-75.0 mg/l, Mg, 34.5-13.3 mg/l, Na, 22.7-13.0 mg/l, K, >2.7-1.0 mg/l, HCO₃, >47.2-215.14 mg/l, Cl₂, >24.0-2.43 mg/l, SO₄, >51.0-42.0 mg/l, NO₃, 7.0-0.63 mg/l. The minor constituents include. Mn >6-1.0 mg/l, F, >2-2.0 mg/l, NO₃, 4.7-6.8 mg/l. The trace elements such as Fe, 2.1-0.1 mg/l, Pb, >5.0-3.5 mg/l, Cu, 2-1 mg/l, Zn, >5.0-1.0 mg/l, Ni, >4.0-1.0 mg/l, Mn, 5.0-1.0 mg/l. The other elements Hg, Cr, were reported. The PH, 5.6-8.8 in drinking water create stomach diseases. During rainy season turbidity remain between 6.2- >13. Number of patients coming daily in the hospital and those admitted were also investigated. Most of the patients have kidney stone, lungs infection, dehydrogene, anemia, obstruction in nervous system, goiter, bronchitis, sore, throat infection, pneumonia, neuralgia, jaundice, malaria, cholera, gastroenteritis, typhoid, dysentery, skin diseases were reported. All diseases were waterborne.

Keywords: Contamination, Chemical elements, Waterborne diseases, Hydrogene Cancerous, Complex compounds, Hazardous elements, Wastes, Uranium, Carbonates

INTRODUCTION:

In the year 1996 a survey was conducted to know the percentage of contamination in surface and groundwater in Poonch region. The contamination was 30 mg /l. similar survey was arranged in 2021. The contamination level was 6 fold. It was found that this was due to discharge of city waste, hospital waste, slater houses and waste water from domestic sewerage contaminate inland water. Water coming from rocks, increased amount of dissolved salts. The natural quality of ground water varies from place to place. It depends on TDS, 200 mg/l in fresh water and 100, 000 mg/l in contaminated water [Hollard and Beeton, 1972]. In the ground water, bacteria and toxic agents were found. Incidences of water borne diseases increased during the period from 1996-2021. More than 5000 water borne diseases were reported [Lippy and Waltrip, 1984]. After the analysis of water for contamination in river water, lakes, spring water, streams water and treatment plants, and survey of four thousand peoples from villages and hospitals it was found that most of the diseases are water born. 2543 incidences were reported from 1996-2021. 500 in 1996-1997, and 1000 from 1998-2019, and 1043 from 2020-2021. 50% Of these incidences were due to tap water. 40% to surface water, 15% to spring water. The Giardia lamella was found in 38%, virus in 20%, bacteria in 12%. Out of hospitalized, people, 135 died in 1996, 97, in, 2001, 2002, 100, in 2011, 2012 and 2015-2021, 5000 people were ill and hospitalized. Doctor reported that they have pains in west, flue, weakness, intestine diseases, headaches. [Data was collected from different hospitals of Azad Kashmir and Pakistan]. [Herwaldt, et al.1992]. Most of the people were HIV positive who used surface water. The Government of Pakistan spent millions of rupees to clean up contaminated ground water and clear supply system but no results were seen on the ground. The chemical and microbiological agents that adversely impacting the quality of ground water are coming from variety of sources. Like agricultural chemicals, animal wastes, septic tanks, city and hospital wastes, domestic sewage, organic wastes, toxic and hazardous wastes, landfill leaking septic tanks, pits, ponds used for storage. Disposal of liquid compounds and petroleum products also add contamination [Camy, 1991] [Table-1,2,3,4].

Table-1: Concentration of Chemical Elements in spring water from Sub-Himalayas Poonch Region Azad Kashmir

Ca	Mg	Na	K	HCO3 Cl2	SO4 NO3	Turbidity	PH
46.0 14.3		16.9 2.3		425.35 3.49	40.38 0.69	5.0-10	5.6-8.9
76.0 20.4		24.00 1.0		366.12 20	48.0 5.68		
66 20		12.0 2.0		336 7.49	.0 39.0 0.40		
76.0 33.0		17.0 2.4		399.0 15.0	38.42 0.55		
70.0 0	19.	12.0 2.8		350.0 9.19	50.12 5.68		

ADDITION OF HAZARDOUS CHEMICALS IN WATER AND TREATMENT IN STUDY AREA

A research study was conducted on surface and ground water investigation in Sub-Himalayas during 1996-2021. Contamination in the area is coming from different sources, like waste disposal from cities, from hospitals, animal wastes in nullaha, mining of soils and rocks, agricultural chemicals, wastes from slater house, domestic sewage open in nullaha and stream water, leakages of underground water tanks. In addition after chemical analysis Pb, CU, Zn, Mn, Cd, Hg, As, Cr, F, Cl, SO₄, has been found in surface and ground water. In Azad Kashmir no treatment plants or filter plants for providing safe water to peoples are available. A treatment plant in Muzaffarabad is providing water to city peoples, but due to treatment with chemicals water is not safe. In Rawalakot city, villages, and in surrounding areas no treatment plant or any purification system exists. Haphazardly different hazardous wastes are dropped in water resources. The wastes and chemicals contaminate drinking water. Water-borne bacteria, degrade the quality of water. In Mong area uranium traces has been detected in rocks, which degrade the quality of water. It is a great risk to the life of the peoples. Because water in springs coming through these rocks, and inhabitants of the area drink the same water. It was found that people of area have neuro problems, the cancer, kidney failure and heart diseases, are common. Hazardous elements, the Pb is highest in waters of Rawalakot, and adjoining area i.e. >3 mg/l. The WHO accepted limit is 0.01 mg/l from all sources. CU, in water is 1-3 mg/l, whereas WHO 2001, the accepted limit is < 1 mg/l. Ni, in river water, streams, springs, nullaha water is, 0.001 to 1.0 mg/l not acceptable. The Zn, content in water is 1.0-3.0 mg/l, the acceptable limit is < 3 mg/l. Mn, 1.0-5.0 mg/l NA. The PH, of water fluctuate between 6.5-8.9. [WHO, 2001, PH, limit is 5.8-8.6]. The concentration of toxic elements in stream water are too high. Pb, 2-8 mg/l, CU, 1-3 mg/l, Ni, 1->3 mg/l, Zn, 1->3 mg/l, Mn, 1->7 mg/l. The values are very high and not accepted [JICA, 2001]. The water is highly contaminated [Table-3, 4].

METHODS USED TO STUDY CHEMICAL ELEMENTS FROM SURFACE WATER, AND GROUND WATER IN THE AREA UNDER STUDY.

PH of water was studied by using PH meter.

Atomic absorption and spectrometer was used for testing water samples collected from streams, nullaha, springs, and borehole.

METHOD OF STUDY

The chemical analysis using atomic absorption were carried out. A study was conducted on samples collected from different sources of contamination and water sources. MWS Rawalakot city and water management persons at far areas, where water is being supplied to domestic use and for drinking purposes. At some places supply system exists. The supply system consist of raw water pumping station, nullahas, streams and spring water. Water is being used without treatment. At least 200 000 gallons of water is used daily in city area. All this water is coming from a nullaha. A small dam has been constructed on nullaha Drake. This dam supply drinking water to the inhabitants of city area. No treatment plant has found in the area of study. Along the Goui Nullaha road and about 3 km from city of Rawalakot, all the wastes of the city, CMH [hospital], and the wastes from the area is being dropped without treatment in nullaha water. The peoples in down stream use the water for drinking purposes. The samples from this nullaha were also analyzed. The concentration of toxic elements are > 5 mg/l.

Turbidity level in under study water is > 9 NTU. [WHO , 2001, maintained the standard values < 5 NTU.]. Chemicals are used for purify high turbidity, but their complexes are not safe for life [Baker, J.P., and Schofield, C.L., 1982]. The PH caused by the consumption of CO₂ minimize residues in water . The treatment of water with chemicals increase PH value [WHO, 2001]. Ground water with high level of nitrate due to use of fertilizers as well as septic tanks discharges increase water contamination [Flipse et al. 1984]. Agricultural areas have high levels of fertilizers found in ground water [Pionke and Urban , 1985]. To control odor and taste KMOO₄, C, H₂SO₄ was added to water coming from ground or surface for drinking purposes[Baker, J. P., and Schofield, C. L., 1982]. In April to June water shortage is a problem for peoples in the area. 8-9 thousand gallons of water needed to fulfill the water requirement in hospitals, city and some nearby houses. There is no source to overcome the requirement.

About 200 samples were collected from ground and surface water and analyzed for PH, Pb, CU, Zn, F, Cl, Cd, Cr, K, Ca, Mg[Table-1,2,3,4]. The color, odor, turbidity and TDS were preferably measured in the field and laboratory. The temperature was measured because it change one element to other and make hazardous products. All samples were tested in PCSIR laboratory. Samples which were risk to health analyzed in first preference [Chappelle, F. H., P.M. Bradley, D. R., Lovley, dnd D.A., Vroblesky, 1996]. The analysis were conducted for DIC, DOC, PbSO₄, SO₄, F, CUSO₄, ZnSO₄ and other carcinogenic elements and bacteria in water [Cherry, J. A., R. W. Gillham, and J. F., Barker., 1984]. [Driscol, 1984]. A detailed description of equilibrium constant values were determined by numerical procedure [Back, W., R. N., Cherry, and B. B., Hanshaw, 1966]. Solubility and potassium sulphate, saturation indices were calculated by using QP/ KP log where QP = Ion activity product. To calculate Pb, CO₂, Cl, NO₃, Mg, and Cu, element mass balance calculations were used [Bryan, k. 1919]. The saturation indices [SI] were aslo calculated [Bredehoeft, J. D., and G. F., Pinder, 1973] [Table-1,2,3,4].

Table-2: Chemical Analysis of Stream water in Sub-Himalayas Poonch Region Azad Kashmir.

Ca	Mg	Na	K	HCO ₃ Cl ₂	SO ₄ NO ₃	Turbidity	PH
42.0 13.20		55.0	1.2	340.0 0	13. 0.65	43.40	7.8-2.9
46.0	14.3	17.0	2.3	214.65 13.0	39.56 0.25		
47.0 15.0		16.8	2.4	213.57 12.49	38.57 0,12		
62.0 23.60		14.35	1.4	236.20 10.29	42.21 0.62		
45.08	15.0	21.08	2.4	438.12 12.76	43.03 0.40		

DISCUSSION:

The contamination of surface and ground water, studied because the peoples in the area are suffering from water borne diseases. The surface and ground water samples were analyzed in a high level PCSIR laboratory. The highly contaminated water is being used by the peoples for drinking purposes, living

in city, hospitals and adjoining areas where water is not available. The water borne diseases like bacteria, parasite Giardia lamblia, cyanobacteria, intestinal distress, flue like such as weakness, aches, pains, immune systems weaken, HIV positive, neurological problems, high blood pressure are common in the area [Craun, G. F., 1979].

From the analysis of water, the hazardous chemical elements, determined in water. The Pb, Cd, CU, Zn, Hg, As, SO₄, was found in surface and ground water. Ca, Mg, K, CO₃, NO₃ make complexes and degrade quality of water. The source of these major, minor and trace elements are wastes from city, hospitals, rocks, mining rocks and soils, infilling, sewerage lines open in river water, streams and nullahas. In Mong area rocks bear uranium traces, which are cancerous and degrade health. Similar rocks are exposed in Plandri, and on the roadside of Kotli. The river waters are highly contaminated through waste disposals [Craun, G. F., 1979]. About 50 wells were investigated for hazardous organic compounds. The chemical [PbSO₄, CU₂SO₄, H₂CO₃, Zn SO₄], compounds were found in shallow aquifers. Maximum concentration was found in the month of August. Probably chlorine compounds regously contaminated spring water. No remediation measures have been taken by the Government. The Pb in water coming through lead pipes [Drever, J. I., 1997]. The CU and Zn were detected in water [Dudley, J. G., and D. A., Stephenson. 1973]. The Pb in water should be < 0.01 mg/l [WHO, 2001-2022]. Mainly the source is lead pipes. In small amount it comes from air, through food and smoking. In the under study water it comes through petroleum products, wastes from CMH Rawalakot and city area. The Pb in the springs near CMH and city water was analyzed and found > 5 mg/l. Cu was found in spring, stream, and river water > 2.8 mg/l. The WHO, standards are < 1mg/l. The Zn, concentration in water was > 4mg/l, the WHO, value is < 3mg/l. Mn, is > 5 mg/l. [WHO 2001 and 2021 it should be < 0.3 mg/l]. Chemicals coming through waste disposals are > than WHO, [2001]. The peoples admitted in hospital were also visited and their blood tests were considered for investigation and correlation of their diseases. All correlation were found with water borne diseases. It was noticed that elements detected in water and the diseases detected in blood were water born. The vomiting, pain in abdomen, diarrhea, low blood pressure, and unconsciousness was common [Fenn, D., ET AL. 1977]. Stomach ache, shivering was also noted. Cirrhosis of liver, and concentration of CU, in tissues was noted [WHO, 2001-2022]. The water samples collected from Drake Nullaha and from small dame were tested for physical and chemical contamination. The traces of Pb, CU, Zn, Cr, Ca, Mg, NO₃, CO₃ were found. This water is recently used for drinking purpose in city Rawalakot and for CMH hospital is not proper use of water [Kreitler, C. W., and D. C., Jones . 1975].

The PH, was measured by the use of PH-meter. It was 4.7-8.9, [WHO recommended value is 6.5-8.5]. The color was dirty, earthy, > 20 TCU, [recommended value is 15 TCU]. Turbidity, > 10 NTU, [WHO, recommended value is 5 N T U]. Every parameter was found in water more than the recommended by [WHO, 2001] and health hazardous to people. Distribution tanks were also visited and water samples were tested. Guai, Nullaha, drinking water from Plandri, and Kotli was also investigated. Up stream of Drake Nullaha a very big village is present. Eid-gha, the industrial zone present up stream. The chemical waste water, chemicals from agricultural lands, sewage waste water is > 100 000 gal /day, > 200 gallons /day from mosques, >10 000 gallons from small industries, other sources of contamination was homes, hospitals and shops [Dunlap, W. J., ET AL. 1977] [Table-1,2,3,4].

In this research paper all aspects were not covered, need further comprehensive investigation.

Table-3: Concentration of toxic Metals in Stream Water in Sub-Himalayas Poonch Region Azad Kashmir

Pb	CU	Ni	Zn	Mn	Hg
3.0	3.5	2.6	3.5	4.2	-
3.9	2.4	3.2	2.1	3.8	-
8.7	2.5	3.9	4.2	4.8	-
5.9	3.2	3.5	4.6	7.8	-
2.8	0.4	2.3	3.4	4.2	

ANALYSIS:

The hazardous elements like complexes of H₂SO₄, H₂SO₄, F, Fe, Pb, CU, Zn, NO₃, [Cherry, J. A., R. W. Gillham, and J. F., Barker], and other chemical compounds from hospital wastes, domestic wastes, added through disposal process contaminate surface and ground water. Because of the fact no treatment plant or disposal sites have been located in investigated area. Contaminated material is being dropped directly in Nullahas and river water. The chemical wastes dropped on the surface contaminate ground water. The chemical elements coming through leaching rocks, chemicals in soils, and the chemicals coming from other sources like hospitals, domestic wastes, increase the concentration 5 folds in water. Very poor direct filtration has been seen in the area. The concentration of major elements [Ca, Mg, Na, K, Cl,], minor and trace elements like Pb, CU, Zn, Hg, Ur, make dangerous complexes in water [Craun, G. F., 1977]. In every 100 persons 14% have cancer, 10% neurogenic problems, 20% HIV, 50% blood pressure. It was found that lead concentration > 0.1 mg/l- 0.2 mg/l create dehydrogenase enzymes. In the area where Zn concentration in water is > 2 mg/l meta-hemoglobin, cyanosis, and cancer were reported. Liver diseases were found where Pb, CU, Ar, were more than the recommended limits 0.1 mg/l. The results obtained from surface and ground water samples analysis were not satisfactory for health. The low concentration of complex compounds which can be removed by direct filtration have not been observed. Those complexes dissolved in water, found as residues, and deposited on the surface of reservoir, not removed from water. So the people drink same directly from reservoir. This was the reason that water born diseases are common in the area [Craun, G. F., 1997]. At high addition of F, PH become acidic. Residues increases due to variation of water temperature. The products of Pb, Cu, Zn, Ca-Mg, H₂SO₄, H₂CO₃, Cl, NO₃, Hg, affect the purity of water [Khan, M. A., 2023]. Solubility increases with addition of F. Increase in temperature effect solubility of complex products. This degrade the quality of drinking water [Craun, G. F., 1981]. At low temperature PH become 7-7.5, where metal cations converted to OH ions. The PH decreases to 5.5-5.6 at 30 degree centigrade. The change in temperature results in degassing of CO₂, increase in PH, and change solubility of surface and ground water [Barnes, R. B., 1975] [Table-1,2,3,4].

The presence of NO₃ in water is not suitable for health. The NO₃ detected in water was > 12.5 mg/l. It cause blood diseases [Met hemoglobin cyanosis blue baby., WHO, 2001]. The reaction of NO₃ amines and Amides in the body, forming Nitroamine which may be the cause of Cancer [WHO, 2001-2021]. This comes from fertilizers, decayed bodies, of animals and plants, domestic wastes, disposal of

sewage, sludge, industrial wastes. The traces of Hg were also found in water. Probably it was due to agricultural chemicals. Its product methyl mercury goes to brain, backbone, peripheral nerve, enter to the fetus through placenta. It was placed as hazardous element [JICA , 2001].

[This research is not enough need further investigation in future].

Table-4: Concentration of toxic elements in River water in Sub –Himalayas Pooch Region Azad Kashmir

Pb	CU	Ni	Zn	Mn	
2.1	3.0	1.5	1.7	1.4	
4.0	1.5	2.2	2.0	1.2	
3.8	1.8	2.5	3.9	3.8	
4.0	2.0	1.8	0.8	2.2	
4.2	3.0	0.5	2.5	1.9	

CONCLUSIONS

The surface and subsurface water analysis at Sub-Himalayas regions, Rawalakot, Mong, Plandri and Hajira District pooch Azad Kashmir were conducted , because most of the people were caught by water born diseases. The cancer, HIV, positive, neurological problems, heart, intestine, bone problems are common.

1. water samples were collected from selected points. where waste was disposed from hospitals, cities homes waste water, springs, Nullahas, streams, and water wells.
2. peoples were using water for drinking purposes. It was very funny that no filter plant was installed in any city or pumping station.
3. peoples are just take water from springs, Nullahas, or streams and use directly for drinking. In the cities some people use their own small filters but those are not useful for purification of water. There was no treatment plant in any city or area where population is too big.
4. The samples analyze resulted in hazardous elements like Pb, CU, Zn, Ca, Mg, Ur, Hg, CO3, NO3, CO2 and bacteria, TDS, turbidity were found. All hazardous elements were exceeding allowable limits.
5. The complex compounds along with change of temperature change PH and degrade water quality. This matter is very serious for health.
6. Waterborne diseases are 5 fold . Ever one feels disorder in his/her life.

Concluding this research it is very clear that clean drinking water is not available to citizens, and in hospitals and villages. The presence of such hazardous elements in drinking water are very harmful to life. If pure water is provided to the cities and villages, waterborne diseases will decrease load on hospitals.

It was found that if pure water be supplied to peoples of the area 50-70% diseases will decrease without treatment. With eminent Doctors it was discussed and found that anemia, kidney, liver, pain in body, legs and arms problems, Cd was > 0.03 mg/l. In the areas where Hg, was > 0.001 mg/l the

symptoms of vomiting, agums, shivering of fingers, and mina Mata was reported. Excess of Pb , resulted in vomiting, pain in abdomen , diarrhea , decreasing blood pressure, disorder nervous system. Excess of Cr, give rise to inflammation, ulcerative symptoms at the skin, liver trouble, hepatitis, obstruction of respiratory system. The excess of Zn, promote diseases like diarrhea, stomach ache, shivering. CU > 2 mg/l give high toxicity, for algae, fungi, and plants with seed, caused cirrhosis of liver. The Ca-Mg > 300 mg /l cause diarrhea, urinary calculi, hardness of water, [JICA, 2001-2022]

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