Final Report of the Major Research Project

Project Title

THE PROBLEM OF DRINKING WATER POLLUTION IN MALWA REGION OF PUNJAB: A SOCIO-LEGAL STUDY

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Submitted By:

Prof. (Dr.) Bhupinder Singh Virk
Chief Investigator
Department of Law
Punjabi University, Patiala

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PROBLEM OF THE DRINKING WATER POLLUTION IN MALWA REGION OF PUNJAB: A SOCIO-LEGAL STUDY

Overall, the location of heavy metals in ground water (Drinking water) in the large part of malwa region of Punjab does favour particular localised sources of these metals which contaminated ground water.

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Abstract

Punjab one of the smallest state of India known as food bowl of the country, pioneer of green revolution once a prosperous state today is facing an acuate problem of drinking water-the great threat of drinking water pollution. The next time you reach for the glass of water beware that this could well be potent combination of heavy metal and would do more harm than good. The Shakespeare's lines "water-water everywhere but not a single drop to drink" are today seems to be true for the State of Punjab. It is a well known fact that the Malwa region of Punjab shows a very high incidences of cancer, stunted growth and other neurological disorders. High level of uranium concentration has been found in the hair sample of centre for special children, Faridkot by Dr. Carin Smith visiting toxicologist from South Africa. Their blood samples and hair samples were analysed in German laboratory. Besides uranium, lead, cadmium, strontium, barium were also found in the samples. The cocktail of heavy metals have made the new born babies with big heads, bulging eyes, twisted hands that do not reach their mouth and bent legs that can barely support their frail framers.[1]

A well known environmentalist Sant Balbir Singh Sechewal, the man who brought to life so many rivers in the Majha area, stated that the anti-pollution laws stay in the papers only and very little efforts are taken to prevent water pollution. Drinking water sources have got polluted and resulted in widespread prevalence of diseases like cancer in the Malwa region. You can just find the depressing statistics in Mukatsar, the home district of Punjab Ex-Chief Minister, Prakash Singh Badal. There were 1074 deaths due to cancer between 2001 to November 2009. In Lambi, Badal's home constituency, there were 211 cancer deaths during the same period.[2]

[1] Uranium Deforms Kids in Faridkot, Times of India, April 2, 2009

[2]"Water Pollution Levels Turning Deadly in Punjab", LIG Reporter, June 16, 2010 www.mhtml.file://c, (visited on February 15, 2011).

The hotspot for this increased toxicity, however, was the Malwa region of Punjab, which showed extremely high levels of chemical, biological and radioactive toxicity, including uranium contamination. So as region's groundwater and food chain was gradually contaminated by fly ashes of thermal plants, excessive use of pesticides in agricultural sector and industrial effluents flowing into fresh water sources used both for irrigation and drinking purposes, the region showed a rise in neurological diseases, cancer cases and kidney ailments.

Over the years, a case of slow poisoning was suspected by health workers of the Baba Farid Center for Special Children (BFCSC) in Bathinda and Faridkot, when they saw a sharp increase in the number of severely handicapped children, birth defects like hydrocephaly, microcephaly, cerebral palsy, down's syndrome and other physical and other mental abnormalities, and cancers in children.[3]

The causes of drinking water pollution are many but among them the main cause of contamination of water in this region is the fly ash of coal which are burnt at Bathinda thermal power plants and contain high legal of uranium. Uranium gets concentrated after the burning of coal. One kilogram of coal ash produced 2000 Bq of radioactivity in the environment. The other possible reason is the indiscriminate use of agro-chemical in the region as the Malwa belt is known as the cotton belt of Punjab. The reckless and unguided use of pesticide, herbicide, weedicide, phosphates and nitrogen fertilisers contribute heavy metal such as lead, cadmium, mercury and arsenic to the soil and water. There have also been the claim of contamination being the result of depleted uranium carried on by the wind from the wars such as Gulf War of Iraq and recent military action in Afghanistan. A few scientists have opined that Pokhran nuclear test conducted by India and nuclear tests conducted by Pakistan were not fully

[3] www.guardian.co.uk/world/2009/aug/30/india-punjab-children-uranium-pollution (visited on 15.02.2011)

successful and radiations were released from there which ultimately contaminated ground water.

The state of affairs in Punjab have reached an alarming level with dedicated cotton belt, being supplied contaminated water have turned into cancer belt. The worst effected is the Malwa region with number of cancer patients increasing exponentially in the recent past. The diseases (cancer) is attributed to polluted ground water. There is no hospital in the Malwa region for the common cancer patients, people have travelled to Charitable Cancer Institute in Bikaner (Rajasthan) by Bikaner Express Train for treatment. Because the large number of these passengers are patients, the train have given the name of Cancer Express. Skin diseases, lungs infection, kidney infection and mental retardation are other ailments resulted from contaminated drinking water.

Part-I : Background of the Problem

The different reports of voluntary organisation and print media highlights that the drinking water (ground water+canal water) of the malwa region of Punjab got polluted due to the existence of heavy metals in the water. According to these reports this polluted water become a health hazard for the inhabitants of the area and possible cause for various deceases like cancer, mental abnormalities, defective birth rate, kidney ailments etc. Generally these reports are un-scientific, based on secondary sources of information and based on non-authentic sources/information and attributes that uncontrolled use of pesticides, fungicides, weedicides, chemical fertilizers, like urea, DAP, flyashes of thermal plants, leakage of uranium form nuclear tests sites etc. are the main reasons of this problem. It is a misleading information which are causing confusion and sent wrong massage to the masses and leads to wastage of human efforts.

The existence of polluted drinking water in the region is due to many factors and localised causes which we have discovered during the investigation of problem. It is important to mentioned here that the government Institution like Punjab Pollution Control Board, Water Sanitation Department Public Health Department fails to address this problem. It is discussed in detailed while dealing with the role of these governmental agencies.

Objectives

I wish to submit my report on this sensitive issue stating occurance of heavy metals in the drinking water of *malwa* region of Punjab, possible remedial measures and health effects on its consumption. The existing law combating, controlling and prevention of this problem. The fact sheet would be released for the people of malwa region and to the University Grant Commission for necessary corrective measures. The objective of this study has been broadly share with the people of *malwa* region, ground water resources managers, policymakers and NGO's on the subject.

The study relating to project titled **"The Problem of Drinking water pollution in malwa region of Punjab: A Socio-legal study**" has been divided into two parts.

- 1st Part collection of samples of ground water from different parts of the districts of *malwa* region of Punjab (from rural areas as well as from Urban areas).
- Then the collected water samples has been tested and analysised from Sai Labortaries of Thapar University, Patiala (Punjab).

In the Second (IInd) Part- Field Study has been conducted while visiting different part of the districts of this region.

The second part of the study further divided into three parts.

IN the first part, we have conducted the field work by visiting the schools of this areas and Interviewing the teachers and students regarding the problem of drinking water in the region.

In the **Second part** we have visited the Gram Panchayats of villages of these areas and interviewed the representatives of villages and get the first hand information regarding the problem of drinking water pollution of this region.

In the **Third part** we have conducted the interviewed and collected the dates from governmental hospitals and also met the social workers who are aware of this problem.

This is methodology on which I have completed the whole study.

Detailed Report of First Phase Study

The Survey for drinking water is conducted in five districts of the Malwa Region of the state of Punjab. We have collected 8 samples of ground water (drinking water) from different places of these districts.

Sr. No.	Name and Address of the Person	Districts
1.	S. Bhupinder Singh S/o S. Charhat Singh Village Jandwala, Tehsil Malout, District Mukatsar	Muktsar
2	Gurpal Singh S/o S. Jagga Singh, Bahadur Nagar, Bathinda	Bathinda
3	Adhunik Pashu Mela Ground Village Killianwali	Muktsar
4	Inderjeet Singh Jeji College for Girls, Gunnekela	Sangrur
5	Baba Kewal Das, Dera Village Hatwala, Sardulgarh	Mansa
6	S. Harmandeep Singh, Nidhan Singh Nagar, W.No.	Mansa
7	S. Paramjit Singh S/o S. Gurbachan Singh, Vill. Burj Mahima	Bathinda
8	Dr. B.S. Virk, C-39, Punjabi University, Patiala	Patiala

It is pertinent to note that the Punjab Pollution control Board, Punjab, whose primary responsibility is the controlling, preventing and abetting of water pollution in the state of Punjab refused to test the samples collected by us on the basis of lame excuses. It is very much important to analysis these samples from recognised and well established laboratory. A lot of private laboratories are consulted but they have no proper mechanism for the proper testing of these samples because a well equipped sophisticated laboratory required to test the consentration of heavy metals. Ultimately it is the Sai Laboratories of prestigious Thapar University of Patiala, which helped me for proper testing and analysing of these samples.

Case Study

Uranium

Supply of safe, clean and abundant water for drinking purpose is essential for the health of people. According to UNO report,[4] about 884 million people are not getting safe and clean water. The availability of safe drinking water is a growing key concern for the international community. Water contamination and access to safe drinking water has become a global challenge in developing countries.[5] The million of people from poor countries die each year as a result of water related preventable disease.

Punjab known as land of five rivers is rich in water resources, being endoured with a network of rivers and blessed with good monsoon rainfall that can meet a variety of water requirement of the Punjab. However with the rapid increase in population and the need to meet the increasing demands of irrigation, human and industrial consumption the availability of the water are getting depleted and water quality has deteriorated due to the existence of pollutants in Water sources.

Uranium is a common naturally occurring and radioactive substance. It is a normal part of rocks, soil, air and water and it occurs in nature in the form of minerals but never as a metal. The Uranium (235 U) is useful as a fuel in power plants and weapons.

Generally uranium enters water by leaching from soil and rocks or in releases from processing plants. Release of uranium from human activities are due to accidents of different nature. Other reasons of Uranium entery the water resources are the emission from nuclear industry, the combustion of coal and other fuels and the use of phosphate fertilizers that contain common uranium.

[4] WHO/UNICEF. Joint Monitoring Programme on Water Supply and Sanitation "Progress in Sanitation and Drinking Water: 2010 Update." WHO and UNICEF, Ganeva 2010.

[5] Montgemery, M.A., Elimelech M.Water and Sanitation in developing Countries: including health in the equation. Environ.Sci. Technol. 41 (1) 17, 2007.

Intake of uranium through air is low, the majority of intake can be through drinking water.

Effects on Human

Uranium has demonstrated toxic effects on human kidney leading to kidney inflammation and changes in urine composition. Uranium can decay into other radioactive substances, such as radium, which can cause cancer with extensive exposures over a long enough period of times.

The US EPA has issued a Maximum Contaminant Level Goal of zero and a Maximum Contaminant Level (MCL) of 0.030 mg/L for uranium. The 0.030 mg/L is based on increased risk of kidney toxicity and is equivalent to about 27 picocuries per liter (pCi/L) of radioactivity, which also presents an increased risk of cancer from uranium. The U.S. EPA feels the 0.030 mg/L MCL will protect against both cancer risk and risk of kidney damage.

There are presently no protocols in any of the NSF/ANSI Standards for reducing the uranium levels from water.

Regulations

In the United States the EPA, under the authority of the Safe Drinking Water Act, has set the Maximum Contaminant Level Goal (MCLG) for uranium at zero mg/L (or ppm). This is the health-based goal at which no known or anticipated adverse effects on human health occur and for which an adequate margin of safely exists. The US EPA has set Maximum Contaminant Level (MCL) for uranium in drinking water at 0.030 mg/L. The utility must take certain steps to correct the problem if the tap water exceeds the limit and they must notify citizens of all violations of the standard.

The permissible limit of uranium in water should be nil as per the regulation of WHO (World Health Organisation). All the samples collected from Malwa Region of Punjab show presence of uranium in ground water. The intake of uranium lead to kidney ailment and cancer.

Uranium

Sr. No.	Places	Result
1	Vill Jawanda, Muktsar	U. 0.10
2	Mandi Kilianwali	U. 0.10
3	Guru Tegh Bahadur Nosar, Bathinda	U. 0.12
4	Gurnekala, Sangrur	U. 0.10
5	Vill. Hatwala, Mansa	U. 0.10
6	Vill. Burj Mahima, Bathinda	U. 0.10
7	W.No. 11, Mansa	U. 0.13
8	C-39, Punjabi University, Patiala	U. 0.10

The presence of uranium in the ground water of Malwa Region of Punjab is not due to any leaching from natural deposits because in the land of Punjab there are not any rocks of such kind which contain uranium contents. In the state of Punjab there existed neither the nuclear power plant and nor nuclear industry so human accident can also ruled out. There seems to be four reasons which are probably causes the ground water contamination with uranium. These are the:

(I) The excessive use of pesticides and phosphate fertilizers and other chemicals by the farmers of this region.

(II) Deep digging of tubewell, and extracting of water from deep digging tubewell.

(III) Depletion of uranium from any places used by our neighbor country.

(IV) Use of coal in thermal plants. All these are unitidily contaminated the ground water of malwa region with uranium contents. There is no law existed to check the excessive misuse of fertilizers and chemical pesticidies, weedicides and fungicides by the farmers. There is no law existed to check the deep digging of tubewell.

The deep digging of tubewells and taking water from them is one of the scientific reason of contamination of uranium in the water. The taking of water

from upper crust of land is always safe and clean because it came from various kind of filtration, whereas deep tubewell water means taking it directly and without natural filtration, is always dangerous. So need of hour is put complete ban on deep digging of tubewell for irrigation. To solve the problem of irrigation canal water should be provided to the farmers. It is natural and safe.

The Second reasons is the use of coals in thermal plants in this area is also contaminated the ground water. The digging of coals in coal mines is also going deep. It is scientifically proved that this type of coals contains uranium contents. It is required that hydel plants should be preferred over the thermal plants. These hydel plants are safe and environmental friendly. The people of malwa region of punjab now a day in suffering from serious deceases like kidney failure and cancer. Intake of uranium in human body is the main cause of these deceases. Al the samples collected from different parts of this region shows a high range of uranium in ground water. It is the need of hour to take strict action.

Lead

Lead is the commonest of the heavy elements, accounting for 13mg/kg of earth's crust. Several abundance of stable isotopes of lead exist in nature.

Lead is used in the production of lead acid batteries, solder, alloys, cable sheathing, pigments, rust inhibitors, ammunition, glazer, plastic stabilizers, pesticidies and fertilizers. Tetraethyl and Tetramethyl lead are important because of there extensive use as antiknock compound in petrol, but their use for this purpose has been almost completely phased out in North America and Western Europe, although not in many developing countries including India.

One of the primary goals of the WHO and its member states is that "all people, whatever there stage of development and their social and economic conditions have the right to have access to an adequate supply of safe drinking water." A major WHO function to achieve such goals is the responsibility "to

propose regulation and to make recommendation with respect to international health matters"

With the decline in atmosphere emissions of lead since the introduction of legislation and awareness restricting its use, water has assumed new importance as the largest controllable source of lead exposure in the developed countries. In India there existed no legislation to ban its use in petrol fuel.

Lead is present in drinking water to some extent as a result of its dissolution from natural sources, but primarily from household plumbing systems in which the pipes, solder, fittings or service connections to homes contain lead. Polyvinyl chloride (PVC) pipes also contain lead compounds that can be leached from them and result in high lead concentrations in drinking-water. The amount of lead dissolved from the plumbing system depends on several factors, including the presence of chloride and dissolved oxygen, pH, temperature, water softness and standing time of the water, soft, acidic water being the most plumbosolvent. Although lead can be leached from lead piping indefinitely, it appears that the leaching of lead from soldered joints and brass taps decreases with time. Soldered connections in recently built homes fitted with copper piping can release enough lead (210-390 ug/1) to cause intoxication in children. The level of lead in drinking-water may be reduced by corrosion control measures such as the addition of lime and the adjustment of the pH in the distribution system from <7to8-9. Lead can be released from flaking lead carbonate deposit on lead pipe and from iron sediment from old galvanized plumbing that has accumulated lead from lead sources such as plumbing and service connections, even when the water is no longer plumbosolvent.

The area of our study is state of Punjab. In Punjab as per Director, Agriculture Punjab, the number of tubewells which is used in agriculture sector are 9.35 lakhs.

Besides this the water supply system in urban area is the public distribution system which provide drinking water to inhabitants. This system also

extensively use the old techniques for supply of water. Lead pipes are still used in our distribution system and plumbing. From a drinking water perspective, the almost universal use of lead compounds in plumbing fittings and as solder in water distribution system is important. This is one of the major source of lead contamination in drinking water in our area. There existed no legislation to control it.

In Punjab, generally and malwa region of Punjab specially which occupied a major part of Punjab is illiterates and depends upon traditional methods of agriculture. Farmers are not aware of side effects of excessive use of fertilizers and pesticides which make their life miserable and exposed themselves and other inhabitants to the danger of health hazard. They mainly guided for the use of pesticides and fertilizers by the sellers/shopkeepers of these pesticides and fertilizers. Sellers in greed of profits recommends high dose of these chemicals even when it is not needed. There are not any official from agriculture or horticulture department to guide them about the proper use of these chemicals. There are no check on these shopkeepers.

In malwa region of Punjab, the excessive use of chemicals fertilizers and pesticides also contribute the release of lead into land. Agriculture land where the content of lead are not proper the agriculture department generally recommend the use of fertilizers with lead content to be used there. But our farmers with ignourance even without recommendation of the department and on the advice of greedy shopkeepers extensively used the lead fertilizers in their field. In the same way they use the pesticides containing lead contents on their crops. This misuse of fertilizers and pesticides became a major source of lead contamination in ground water.

Effects on Humans

Lead is a cumulative general poison, with infants, children up to 6 years of age, the fetus and pregnant women being the most susceptible to adverse health effects. Its effects on the central nervous system can be particularly serious.

Overt signs of acute intoxication, including dullness, restlessness, irritability, poor attention span, headaches, muscle tremor, abdominal cramps, kidney damage, hallucinations, loss of memory and encephalopathy, occur at blood lead levels of 100-120 ug/dl in adults and 80-100 ug/dl in children. Signs of chronic lead toxicity, including tiredness, sleeplessness, irritability, headaches, joint pain and gastrointestinal symptoms, may appear in adults at blood lead levels of 50-80 ug/dl. After 1-2 years of exposure, muscle weakness, gastrointestinal symptoms, lower scores on psychometric tests, disturbances in mood and symptoms of peripheral neuropathy were observed in occupationally exposed populations at blood lead levels of 40-60 ug/dl (6).

Renal disease has long been associated with lead poisoning; however, chronic nephropathy in adults and children has not been detected below lead levels of 40 ug/dl (64,65). Damage to the kidneys includes acute proximal tubular dysfunction and is characterized by the appearance of prominent inclusion bodies of a lead-protein complex in the proximal tubular epithelial cells at blood lead concentrations of 40-80 ug/dl (66).

Gonadal dysfunction in men, including depressed sperm counts, has been associated with blood lead levels of 40-50 ug/dl (90-93). Reproductive dysfunction may also occur in females occupationally exposed to lead. Epidemiological studies have shown that exposure of pregnant women to lead increase the risk of preterm delivery.

As per specification of IS 10500 the maximum concentration or permissible limit of lead (Pb.) is 0.05 mg/l. In our study all the results shows that the ground water which is drank by the people of malwa region of Punjab contain high quality of lead. This high concentration of lead in ground water is main cause of serious deceased in this area.

Sr. No.	Places	Result Lead
1	S. Bhupinder R/o Village Jandwala, Distt. Muktsar	Pb. 0.36
2	Adhunik Pashu Mela Ground Kihawali Muktsar	0.36
3	S. Gurpal Singh, Guru Tegh Bahadur Nagar, Bathinda	0.29
4	Gurnekala, Sangrur	0.30
5	Vill. Hatwala, Mansa	0.16
6	Vill. Burj Mahima, Bathinda	0.36
7	W.No. 11, Mansa	0.32
8	Punjabi University, Patiala	0.30

During the collection of samples we also met the people of these area and found that large number of people of these villages and cities are suffering from deceases relating to kidney, and mental and physical abnormalities. It is concluded that the one of the reason is of excessive intake of lead through water and food lead to these deceases.

It is submitted that a stringent legislation is required to regulate the supply of pesticides and fertilizers to the farmers. It is also required that our agriculture department should provide adequate knowledge and impart awareness among the farmers for their need relating to pesticides and fertilizers. It is a issue relating to health of people if any official fails to performed his duties he should be strictly punish for their act of negligence.

It is required that stock of fertilizers and pesticides in the private shops should be regularly checked by the concerned authority. It is also suggested that pesticides and fertilizers should be given to farmers only after the prescription provided by the competent agricultural officials according to their need.

Barium

Today, The world is facing the problem of drinking water and our greed has contaminated this natural source with poisonous substances. WHO and other international agencies prescribed the standard for drinking water. Barium

is an heavy metal the presence of which made the water non-drinkable. The developing countries are struggling for clean and safe water for their inhabitants. Most of the sources of drinking water including ground water got polluted and contaminated with man made poisonous substances. Today's the resources of drinking water either going of depleting or contaminating. It is need of how that the world should became aware of this problem and governments should made all out efforts to combat the contamination of water resources.

Barium is present as a trace elements in both igneous and sedimentary rocks. Although it is not found free in nature, it accurs in a number of compounds most commonly barium sulphate and to a lesser extent barium carbonate.

Primary goals of World Health Organization (WHO) and its member states is that "all people, whatever their stage of development and their social and economic condition, have the right to have access to an adequate supply of safe drinking water."

Barium in water comes primarily from natural sources. The acetate, nitrate and halides are soluble in water but the carbonates, chromate, fluoride, oxalate, phosphate and sulfate are quite insoluble. The solubility of barium compounds increases as the pH level deceases. The highest levels to be found in drinking water are likely to be associated with groundwater of low pH from graduate like igneous rocks, alkaline igneous and valcame rocks and manganese rich sedimentary rocks. Concentration are, therefore, expected to be relatively stable. Barium sometimes present in particular form as a result of industrial emission, particularly from combustion of coals and diesel oil and waste incineration.

The permissible limit of barium in water should be 2.0 mg/l or 200 ppb as per EPA and IS 10500 regulation. All the samples collected form Malwa region of Punjab show below the permissible level of barium presence in ground water. It is a good sign.

Table

Barium

Sr. No.	Places	Results
1	Vill Jawanda, Muktsar	0.42 mg/l
2	Mandi Kilianwali	0.30 mg/l
3	Guru Tegh Bahadur Nosar, Bathinda	0.18 mg/l
4	Gurnekala, Sangrur	0.46 mg/l
5	Vill. Hatwala, Mansa	0.59 mg/l
6	Vill. Burj Mahima, Bathinda	0.12 mg/l
7	W.No. 4, Mansa	0.14 mg/l
8	C-39, Punjabi University, Patiala	0.22 mg/l

Cadmium

The Permissible limit of cadmium in water should be 0.005 mg/l as per the EPA and 10500 specification. All the sample collected from the Malwa region of Punjab show presence of heavy metal i.e. cadmium in ground water in above the permissible level.

Cadmium

Sr. No.	Places	Results
1	Vill Jawanda, Muktsar	0.003 mg/l
2	Mandi Kilianwali	0.001 mg/l
3	Guru Tegh Bahadur Nosar, Bathinda	0.001 mg/l
4	Gurnekala, Sangrur	0.001 mg/l
5	Vill. Hatwala, Mansa	0.001 mg/l
6	Vill. Burj Mahima, Bathinda	0.001 mg/l
7	W.No. 4, Mansa	0.001 mg/l
8	C-39, Punjabi University, Patiala	0.001 mg/l

The farmers of Punjab are mainly illiterate and guidance from the State or Governmental Departments is not satisfactory. They use the fertilizers in excess of their need without knowing the side-effects on health.

Cadmium is a metal with an oxidation state of +2. It is chemically similar to zinc and occurs naturally with zinc and lead in sulfide ores. Cadmium metal is used mainly as an anticorrosive, electroplated onto steel. Cadmium sulifide and selenide are commonly used as pigments in plastics. Cadmium compounds are used in electric batteries, electronic components and nuclear reactors.

Fertilizers produced from phosphate ores constitute a major source of diffuse cadmium pollution. The solubility of cadmium in water is influenced to a large degree by its acidity; suspended or sediment-bound cadmium may dissolve when there is an increase in acidity. In natural waters, cadmium is found mainly in bottom sediments and in suspended particles.

Cadmium concentrations in unpolluted natural waters are usually below 1ug/1. Median concentrations of dissolved cadmium measured at 110 stations around the world were <1ug/1, the maximum value recorded being 100 ug/1 in the Rio Rimao in Peru.

Contaminiation of drinking-water may occur as a result of the presence of cadmium as an impurity in the zinc of galvanized pipes or cadmium-containing solders in fittings, water heaters, water coolers and taps. Drinking-water from shallow wells of areas where the soil had been acidified contained concentrations of cadmium approaching 5ug/l. Levels of cadmium could be higher in areas supplied with soft water of low pH, as this would tend to be more corrosive in plumbing systems containing cadmium. The misuse of pesticides and fertilizers is also one of the reason for the contamination of drinking water with cadium content .

Effect on Humans

The estimated lethal oral dose for humans is 350-3500 mg of cadmium and it has no acute effects on adults.

With chronic oral exposure, the kidney appears to be the most sensitive organ. Cadmium affects the restoration function of the proximal tubules, the first symptom being an increase in the urinary excretion of low-molecular-weight proteins, know as tubular proteinuria. Intakes of 140-255 ug of cadmium per day have been associated with low-molecular-weight proteinuria in the elderly; the minimum (critical) level of cadmium in the human renal cortex, related to the first sign of tubular dysfunction, ranged from 100 to 450 mg/kg wet weight. The estimated critical concentration in the renal cortex at which the prevalence of low-molecular-weight proteinuria would reach 10% in the general population is about 200 mg/kg; this would be reached after a daily dietary intake of about 175 ug per person for 50 years, as calculated by regression analysis of cadmium intake and mean kidney cadmium concentration in various countries. It was estimated that a daily intake of 100 ug of cadmium per person would lead to the critical cadmium concentration in the renal cortex being exceeded in 2% of the population.

Mercury

Naturally occurring mercury has been widely distributed by natural processes such as volcanic activity. The use of mercury in industrial processes significantly increased following the industrial revolution of the 19th century. Mercury is or has been used for the cathode in the electrolytic production of chlorine and caustic soda, in electrical appliances (lamps, arc rectifiers, mercury cells), in industrial and control instruments (switches, thermometers, barometers), in laboratory apparatus and as a raw material for various mercury compounds. The latter are used as fungicides, antiseptics, preservatives, pharmaceuticals, electrodes and reagents. However, mercury's industrial uses are decreasing because of environmental concerns and environmental legislation in many countries. Merucury has also been widely used in dental amalgams. A less well characterized use is in ethnic and folk remedies, some of which can give rise to significant exposure of individuals.

Levels of mercury in rainwater are in the range 5-100 ng/litre, but mean levels as low as 1ng/litre have been reported. Naturally occurring levels of mercury in groundwater and surface water are less than 0.5 ug/litre, although local mineral deposits may produce higher levels in groundwater.

Sr. No.	Places	Results
1	Vill Jawanda, Muktsar	< 0.001 mg/l
2	Mandi Kilianwali	< 0.001 mg/l
3	Guru Tegh Bahadur Nosar, Bathinda	< 0.001 mg/l
4	Gurnekala, Sangrur	< 0.001 mg/l
5	Vill. Hatwala, Mansa	< 0.001 mg/l
6	Vill. Burj Mahima, Bathinda	< 0.001 mg/l
7	W.No. 4, Mansa	< 0.001 mg/l
8	C-39, Punjabi University, Patiala	< 0.001 mg/l

Effect on Human

Mercury will causes severe disruption of any tissue with which it comes into contact in sufficient concentration, but the two main effects of mercury poisoning are neurological and renal disturbances. The former is characteristics of poisoning by methyl-and ethylmercury (II) salts, in which liver and renal damage are or relatively little significance, the latter or poisoning by inorganic mercury.

In general, however, the ingestion of acute toxic doses of any form of mercury will results in the same terminal signs and symptoms, namely shock, cardiovascular collapse, acute renal failure and severe gastrointestinal damage. Acute oral poisoning results primarily in haemorrhagic gastritis and colitis; the ultimate damage is to the kidney. Clinical symptoms of acute intoxication include pharyngitis, dysphagia, abdominal pain, nausea and vomiting, bloody diarrhea and shock. Later, swelling of the salivary glands, stomatitis, loosening of the teeth, nephritis, anuria and hepatitis occur.

Ingestion of 500 mg of mercury (II) chloride causes severe poisoning and sometimes death in humans.

Part-III

Sources of Heavy Metals in Drinking Water of the Malwa Region of Punjab

In the malwa region of Punjab there are a plenty of evidence of health issues which include reproductive health problem, bone disease, cancer, reparatory problems. skin deceases, lungs infection, kidney infection and mental retardation. Our study reveal that a chain of acute chronic and serious diseases are caused by poor/contaminated drinking water. The study found that a high concentration of heavy metals, such as mercury, lead, arsenic, barium, uranium have made people more susceptible to such health issues. Heavy metal pollution in an inorganic chemical hazard, which is mainly caused by lead, uranium, cadmium, barium and mercury. These are the key heavy metal pollutants in malwa region of Punjab. These play a major role toward the declining health of people of this area.

Lead is one of the most abundance heavy metals in nature. Lead directly linked to poor reproductive health in both women and men as well as developmental issues in new born babies and children. Its presence may be due to industrial waste for example (Budha Nala of Ludhiana), Tanning industries in Ludhiana. Industrial waste as well as sewerage waste are discharged in seasonal rivers which passes through Patiala district. Industries and thermal plants in Bathinda, a canal carrying industrial effluents from Haryana in Sardulgarh of Mansa district and many more. These industrial effluents are regularly discharged in surface water without any prior treatment of polluted water.

Another heavy metal which polluted the drinking water of this region is cadmium. The uncontrolled and unguided use of fertilizers particularly the phosphate fertilizer in this area polluted the ground water. Industrial waste like unused NICD batteries in Ludhiana, metal plating Industrial in Mandi Gobindgarh, Stablizers in plastic (small scale industries) released the cadmium in water and played with health havoc of masses. The coals which is used in thermal plants of

Bathinda and in Rajpura of Patiala districts also released the cadmium into air which ultimately mixed into water become a health hazard for the people.

During the investigation of problem we have visited the several villages and towns of these districts. During our visit we met the children of different schools, their teachers and the villagers and heads of the village panchayats.

During our survey we have visited the village Udeykaran of Muktsar District (Block-I of Muktsar). We have visited the Government Primary School, Udeykaran. This school have 360 children. In this school five (5) children are suffering from deformity by birth. In this school there are 159 girls students and 201 boys. The Principal of this school is Mrs. Kulwinder Kaur during interaction with Principal and staff (teachers) and students it is found that nearly 20% of students have memory retention problem.

The people of this village drank the water of tubewell and handpumps. Most of the household have installed their own reverse osmosis (RO) System. The ground water of this village is not drinkable. In this village there is a pond which has been filled with canal as well as tubewell water. It is used to provide water for cattles.

In this district, we have visited the another Senior Secondary School of Village Ahlupur. In this school 499 children are studying in different classes. There are 203 girls students and 291 boys. Drinking water in this school is supplied by the government agencies through water works department. The drinking water is treated canal water. The groundwater is not drinkable. It is piosnous and it is also written on the handpumps that the water is not fit for drinking even then we saw that the children are drinking from these handpump water.

We met the Gram Panchayat of this village headed by S. Joginder Singh (Sarpanch). He provided us the information that the Government water works department provided the drinkable water to the village.

In this village one common pond is used for sewrage purpose. The Panchayat provide the information that nearly 40-50% people are suffering from Hepatitis. There are around 10-12 of cancer patients in this village. They have knowledge that the diseases are occurred due to drinking water which got intoxicated due to water pollution and untreated water carrying by Gaggar river. They provided the information that unguided use of pesticides/weedicides/chemical spray used by the farmer is another reason for occurrences of these diseases. There cattles/livestock are also suffering from ailments due to the drinking water.

We have visited the different village of Mansa district. We have visited the Government Senior Secondary School, Khaira Khurd of Mansa. In this school nearly 416 children are studying in different classes of which 213 are girls and 203 are the boys. In this school the Punjab water works supplied the treated drinking water. From children we got information that RO system are installed by a few families only in their houses. In this school near about 50% children are complaining of stomach problems on different occasion or on different time. The information provided by the school teachers that children are mostly complaint about their stomach related problem. Nearly 40% of these children have memory retention problem.

We have also met the President and other members of Saheed Bhagat Singh Sports Club, Khaira Khurd. They provided us the information that the ground water of this village is not drinkable. The water works provide the treated canal water to the village. Only 5% of household have their own RO System. In this village there is a common pond used for cattles. This pond is filled which untreated sewerage water of the village. The 40% of people of this village are suffering from diseases like cancer and hepatitis and most of the people have memory retention problem. The stomach related problem is common in this village. Most of the prevent disease is cancer in this village. They claimed that it is due to unguided use of pesticides/weedicides and chemical sprayed by farmers

on this crops. The another reasons is untreated sewerage water carried by Ghaggar river and lack of proper sewerage system in this village. There Cattle (buffaloes and cows) are also suffering from different kind of diseases. The abortion is the common problem of their cows and buffellows. Large numbers of children are suffering from memory retention problem. It is informed by the people of this village that 10% of new born children have some kind of physical deformity. They get treatment from hospital of Bikaner of Rajasthan and from a hospital of Rohtak (Haryana). The members of youth club of this village informed that no person from government side inform us about the side effect of unsafe drinking water. In this village near about 40 people are died due to cancer diseases in last one year (2016-2017). The office bearer of the club informed us that no government assistance is provided to the people suffering from serious diseases.

We have also visited the Government Primary School of Beant Nagar of Mansa district. In this school 56 children are studying in different classes out of which 30 are girls and 26 are boys. In this school two children are suffering from memory retention problem. In this school safe, treated water are supplied by the Government water works department. They have no RO or purifier water treatment instrument in their houses. The teachers of the this school informed us that the ground water of this school is not safe for drinking.

We have also met the Chief Medical Officer of this district (Mansa). He provided us a written information which shows that in the last one year he have detected 28 patients suffering from cancer and 8 patients of mental retardation.

We have also visited the Government Primary School of Jhanda Kalan of Mansa District. In this school 265 children are studying out of which 141 are girls and 124 are the boys. We interacted the children as well as teachers of this school. We got the information from teachers that 5% of children of this school complain about stomach related problems. It is also informed that 5% of children have memory relation problem. Punjab Water works Department provide

drinkable water to the school. The water works department also supplied to the village treated canal water. We collect the information from students and residents of this village and come to the conclusion that only 35% houses have their own RO water treatment instrument in their houses.

During our survey of this project we have visited several schools and Panchayats of **Bathinda District**. We have visited the Government Senior Secondary School Buladewala. In this school 198 students (135 boys and 85 girls) are studying. We have gathered the information from children and staff that about 1 to 2 students are complaining about stomach problem in a month. Children are often complaint about headache. Drinking water is supplied by the Punjab Water Works Department. The most of the houses have not their own RO system. The water supplied to the village is treated canal water. The village pond is filled with dirty sewer water of village.

We have also met the members of village panchayat. The Panchayat informed us that the water of tubewell and handpump is not safe for drinking. The most of villagers have not their own RO or water purified system. The water works department supplied to the village treated canal water. The village pond is filled up which dirty drain water of the village. Panchayat informed that a few people of village are suffering from serious diseases. Panchayat informed that ground water of this area got polluted due to chemical waste thrown into water by industrial units of this area. The Poor families of this village still used the handpump water for the purpose of drinking.

We have visited the Government elementary school Burj Mahima of Bathinda District. In this school 296 students (137 girls and 159 boys) are studying in different classes. The school Principal informed that the governmental agency provided the school with safe drinking water.

The Gram Panchayat of this village informed that they used treated canal water provided by Punjab water works department for drinking purposes. They informed that about 65 persons (35 female and 30 male) are suffering from

serious diseases of cancer and memory retardation. Most of the people of this village complaint about stomach related problems. They said these problem are prevalent due to the excess use of pesticides and chemical fertilizers. In the last one year five (5) persons died due to cancer disease. Villagers went to Bikaner Hospital of Rajasthan for Cancer treatment.

We have visited the Senior Secondary School Bhucho Khurd of Bathinda District. In this school 405 students are studying in different classes. There are 195 girls and 210 boys studying here. The most common complaint of children/students is the stomach related problems. About 5% of students have memory retention problem. They used the tubewell water for drinking purpose. Villagers have installed a common RO plant for water treatment by their own efforts. The village pond is filled with dirty sewer water of village.

We have visited the gram Panchayat of Bhucho Khurd of Bathinda District. The Panchayat informed us that the groundwater of this area is poisonous and not drinkable. The people drank the water either provided by Punjab Water Works department or of hand pumps water. The household have a few RO System of their own. The village pond is filled with dirty water. The Panchayat informed that about 20 villagers are suffering from dangerous disease of cancer. The people are mostly suffering from skin related diseases or of cancer, non-conceiving problem among cattle is very common. Few children are born with physical deformity. They claimed that no person from governmental side visited the village to inform them about the effects of dirty/untreated ground water. In the last year 10 persons are died of cancer disease in this village.

We have visited the Government Senior Secondary School, Ghudda of Bathinda district. In this school 402 children are studying of which 156 are boys and 246 are girls. The school teachers and principal informed that the groundwater of this area is not drinkable. They used the treated water supplied by the Punjab Water Works Department.

We have also met the Gram Panchayat of Ghudda Village. They informed us that they used Canal Water/Ground water for drinking purpose. A few houses have their own RO System. A common RO System is installed by the Governmental agency. The village pond is filled with dirty water of village. They provide us the information that 20 (15 female & 5 male) are suffering from caner diseases. 25 (10 females & 15 male) villages are suffering from stomach related and 15 villagers suffering from T.B. and five persons are mentally abnormal in this village. The most prevent problem is cancer and stomach related diseases. Many children are suffering from mental retardation. No person from any governmental department provide them any information relating to the use of untreated water.

We have also visited the Government Elementary School of Jassi Pouwali of Bathinda District. The school have 185 students. The School authorities informed us that they used the safe treated Canal water supplied by the water works department.

We have visited the Gram Panchayat of Jassi Puo Wali of Bathinda District. They provide us the information that the groundwater of this village is not fit for drinking purposes. The 12 people of this village are suffering from serious deaseses. The RO system installed by Government agency is not working. They used the canal water supplied by the Punjab water works department. In the last years two persons are died due to cancer disease. No Government agency provide them information regarding the side effects of drinking of unsafe water.

We have visited the Governmental Elementary School Phus Mandi of Bathinda. In this school 180 students are studying. Principal of this school informed us that 3% of students have memory retention problem.

We have visited the Gram Panchayat of Naruana Village of Bathinda District. The Panchayat informed us that the ground water of this village is not fit for drinking. They used the treated canal water provided by the water works department. They informed us that in this village 5 villagers are died due to

cancer disease and three children are mentally retarted and 15 to 20 children are suffering from stomach problems. It is also informed that 3 to 4 children are born with physical deformity. The village Panchayat also informed us that for the purpose of treatment of cancer they visited the cancer hospital situated at Bikaner city of Rajasthan.

We have visited the Government High School, Sahib Nagar Theri of Patiala district. In this school 355 students are studying out of which 172 are girls and 183 are boys. The Principal told us that the R.O. System is installed in the School and the water is drinkable. They used the water supplied by Punjab water works department.

We have also met the Gram Panchayat of this village. The Sarpanch of this village informed that they used the ground water as well as water supplied by water works department. The told us that the ground water is not drinkable. Many houses have installed their own R.O. System. They provide the information that about 10 persons are suffering from serious disease cancer and serious stomach problem. He know the reason that dirty water is the culprit of these ailment. He also informed that some children of this village are mentally retarted. He also informed that about 5 person are died of cancer in the last one year. Village head told us that no government agencies provided them any information regarding the side effects of untreated water.

We have visited the village Darwa of Patiala District. We have met the village head of this village. She has informed us that R.O. system installed by the Government in water works tank is not properly working. People of this village used the ground water and water tank water for drinking purpose. People has not installed the R.O. system in their houses. There is a common pond in the village filled with rain water. They informed that about 45 persons (25 females and 20 males) are suffering from cancer, serious stomach problem and memory loss. The stomach problem is commonly found among the villages. They know that it is due to the dirty/polluted water which they drank. The occupation of the

majority of people is agriculture and they excessively used the pesticides, weedicides etc without consulting the expert. They complaint that the children have memory loss problem. Three (3) persons of which (2 women & 1 men) is died of cancer during last one year. No government agencies provide them information about the side effects of polluted drinking water.

We have also visited the school of this village. There is a Government Elementary School in this village. Only 11 students are studying in this school out of which 5 are boys and 6 are girls. The children are mostly complained of stomach problem. They used the drinking water supplied by the Government agency. There is no R.O. System installed in the school.

Study of Law Relating to Water Pollution

Statutory control of water pollution under the Indian legal system broadly falls under three heads: (i) Statutory rights of riparian owners under Indian Easements Act, 1882; (ii) Penal and Public nuisance actions under earlier statues; and (iii) Administrative regulations under the recent central environmental statutes.

The Indian Easements Act, 1882 is one of the earlier statues dealing with the rights of individuals interstate in regard to pollution of waters. The Act has, in fact, codified the common law doctrine of riparian rights to unpolluted waters. The illustrations (f) and (h) of section 7 of the Act in particular, refer to water pollution. Illustration (f) says: "The right of every owner of land, within his own limits, the water which naturally passes or percolates by, over or through his land shall not, before so passing or percolating, be unreasonably polluted by other persons.

Penal and Public Nuisance under Indian Penal Code

A systematic approach to control of water pollution in India started with the enactment of Indian Penal Code in 1860. Problem of water pollution has been dealt with in the chapter on Public Health and Safety. Sections 277, 269 and 290 of the code refer to water pollution. Section 277 defines fouling of water and

prescribes the punishment for it. It reads: "whoever voluntarily corrupts or fouls the water of any public spring or reservoir so as to render it less fit for the purpose for which it is ordinarily used, shall be punished with imprisonment of either description for a term which may extend to three months or with fine which may extend to five hundred rupees or with both." The provision of section 277, however is very limited in scope, It covers voluntary fouling of water and does not cover an act committed involuntarily whatever the consequences of such an act might be. The section has been narrowly interpreted to include flowing water of rivers, canals and streams, and well in the terms 'public spring or reservoir.' The words 'corrupt and foul as used in the section simply takes care of purity of water but the pollution in modern technological sense would go beyond these words. The section also provides for a minimum punishment and fine for fouling of water keeping in view the seriousness of problem of water pollution the sanctions do not seem to have much force in recent times.

The other provision which provides for punishment against water pollution is section 269. It reads: "whoever unlawfully or negligently does any act which is and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, shall be punishable with imprisonment of either description for a term which may extend to six months or with fine or with both. "Section 284 of the code is also drafted in such wide terms as to include any handling of poisonous substances as to endanger human life or likely to cause hurt or injury to any person by poisoning of wells and rivers as well.

Section 290 covers the pollution of water other than springs and reservoirs. It says "whoever commits a public nuisance in any case not otherwise punishable by the code, shall be punishable with fine which may extend to two hundred rupees." A water polluter could also be prosecuted and punished under section 425 of the code for mischief if his act causes wrongful loss or damage to public or to any person or if his act causes destruction of any property or

diminishes its value or utility. Hence causing diminution of water supply may be treated as mischief and the possible direct cause may also be pollution.

Water (Prevention and Control of Pollution) Act, 1974

The water (Prevention and Control of Pollution) Act, 1974 (herein after called as Water Act of 1974) undoubtedly represents one of India's concerted effects to deal the problem of water pollution comprehensively at the national level. The Act was enacted under Article 252(1) of the Constitution, which empowers the Union Government to legislate on matters of State list, where two or more state legislatures consent to a central law, for water happens to be a state subject under state list of the Constitutions.

The Water Act is an enabling statue. The objective of the Act is to prevent and control water pollution and also maintain and restore the wholesomeness of water. The Act is quite comprehensive in terms of its area of application. It defines the term 'pollution' in quite elaborate manner-covering any contamination of water of alteration of properties of water, discharge of sewage or trade effluents or any other substance liquid, solid or gaseous into water, whether directly or indirectly, as may or is likely to create nuisance or injurious to life or health of human beings animals, plants, aquatic organism or legitimate uses of water.

The Act generally prohibits disposal of noxious, poisonous or polluting matter into streams or wells or sewer or onto the land in excess of the standards established by the State Boards. Committing such an act is an offence.

For persons who have been releasing water pollutants prior to the adoption of this Act, the Act requires them to meet the consent requirements of section 25. Penalties are imposed for contravention of the provisions of sections 24, 25 and 26. Persons contravening the provisions of Sec. 24 shall be punishable with imprisonment for a term which shall not be less than one year and six months but which may extend to six years and with fine. Giving false statement, knowingly or willfully for the purpose of obtaining any consent under sections 25

or 26 entails punishment of imprisonment for a term which may extend to three months or with fine which may extend to ten thousand rupees or with both. The contravention of the provisions contained in Section 25 and Sec. 26 is punishable with imprisonment for a term not loss than one year and six months which may extend to six years and with fine.

The Amendment Act of 1988 has introduced some provisions in the Water Act so as to remove some of the shortcomings in the functioning of the Boards by giving them additional powers. The newly introduced section 33-A, now empowers the state boards to issue directions to any officer, person, or authority, including order to close, prohibit or regulate any industry, operation, etc. and stop or regulate the supply of water, electricity or any other service. The state boards prior to the adoption of section 33-A had but limited power to issue direct orders to the polluters under section 32 in cases where the pollution arose from any accident or other unforeseen act or event. The power under section 33-A would certainly lead to a decrease of actions against polluters under section 33 which empowers the boards to apply to courts for injunctions to restrain apprehended pollution of water in streams or wells, etc.

The Act also provides for stringent penalties among others for failure to comply with a court order under section 33 or a direction from the board under section 33-A. The penalties range from a minimum imprisonment of three months to a maximum of seven years in some cases, and a fine from rupees one thousand to ten thousand. The Act also extends the liability for violations committed by companies to certain corporate employees and officials and to heads of government departments.

The consent procedure as provide in sections 25 and 26 is not satisfactory. In making consent orders by State Boards, there is no provision provide in the Act for public hearings. There is no public participation in decision-making process under the Act. The general public, who are the victims of pollution are kept in the dark in the absence of such a provision as to who applies for consent

and what kind of pollutions are discharged to water courses in their neighbouhood. There should have been a procedure providing for constituting small committees which could submit its written opinion after public hearing, to the water board. The boards then could take decision after written submission of the applicant against the report.

Provisions for fixing up standards of quality and targets for eradication of pollution are conspicuous by their absence in the scheme of the Act. Public participation in fixing standards of water quality or effluents is excluded. For giving public hearings for fixing standards, small committees possessing the necessary expertise may be constituted.

Board's officials are the only persons authorized to obtain information and take samples from polluting industries under sections 20 and 21 of the Act. A complainant has except with the intervention of the court, no other means under the Act to compel a board to investigate alleged water pollution or compel the alleged polluter to reveal information or provide samples. Moreover, a board is empowered to withhold the relevant information to complainant if it deems the release of information against the public interest. In the absence of any definition of the public interest, it is doubtful as under what circumstances the release of information be refused to a citizen.

The Act provides for quite stringent penalties. It takes care of the offences committed by company and its officials under section 47. The section lays down that every person who at the time of the offence was committed was incharge of and was responsible to the company for the conduct, as well as the company shall be deemed to be guilty of offence and shall be liable to be proceeded against and punished accordingly. In a way such provision imposes a fictional liability on the company officer. The latter, however, can escape the liability if he can prove that the offence had been committed without his knowledge or that he had exercised all due diligence to prevent its commission. Sub-section(2) of the same section, makes a Director, Manager, Secretary or other officer of the

company, who consented to or connived, the commission of the offence or where its commission is attributable to any negligence on his part. The scope of the sub-section is even wider in as much as its does not require actual participation or mental support of the officer. Hence, a company's production manager or technical director, thorough they may be miles away from the scene of the alleged offence but would be punishable if they have been remiss in ensuring the strict compliance of the regulations and may not have sanctioned the commission of offence.

Thus, given the threat of pollution form large industrial units, the provisions of section 47 may look sound. However, it has to be borne in mind that in most cases of big companies, these penal provisions, especially of fines, though may seem large but are meaningless when compared to the cost of compliance of environment standards which is often much more. Moreover, there has been a general tendency of courts to let off economic offenders rather easily. It would have been better if the penalties are measured by the amount of money saved by the companies in not installing proper pollution control equipment and an amount equivalent to the profits gained by non-compliance, is imposed as penalty.

Further, the provision as to imprisonment in the Act for company officials, is meaningless as the penal prosecution carries a stigma and courts are reluctant to attach this stigma to companies or their executives. It is further complicated by the fact that most large industrial establishments which are mainly responsible for violations are run by huge corporate bodies and it is an impossible task to precisely pin-point any particular individual responsible for lapses.

Conclusion

During the study of the problem of ground water pollution in Malwa Region of Punjab, it is emerged that there is no single reasons for this problem. There are different factors responsible for the problem. The combination of

these factors make the problem more serious. When we visited the district Bathinda one of the reasons of ground water pollution is the flyash of thermal plants. The Second major reason is the over use of pesticides, herbicides, weedicides and chemical fertilizers by the farmer. Third reason is the throwing of untreated water by industries into the seasonal revulets in this area.

When we visited the Mansa district there we found a Canal/Nala which carried the industrial waste/chemical waters from adjoining state of Haryana and it polluted the ground water of the adjoining villages and town. Secondly, the village comman ponds are used as a sewage tanks by most of the villages of this area. This open tank polluted the ground water. The misuse of pesticides, weedicides, and herbicides and chemical fertilizers is another common reason for this problem.

When we visited the different places of Patiala district the Ghaggar River, a seasonal rivulet carried the polluted water from industrial cities of Himachal Pradesh and Haryana States. The untreated water of this rivulet is used for irrigation by the farmers and is the culprit of polluting the ground water of villages and towns adjoining it. There are different industrial units in these area which through the untreated water into borewell which polluted the ground water to its maximum level. There are many examples of it prominent among them in the case of factory in Malerkotla.

In the district Ludhiana the Budha Nala (drain) is main culprit. The thousands of small industrials units from tanning to colouring the yarns and many more threw untreated polluted water into Budha Nalla (Drain). This drain become a havoc to environment and an example of laziness of our governmental at agencies. There are thousands of small industrial units in Mandi Gobindgarh town, Khanna town which through the untreated water either into bore well or nearby drains. It ultimately resulted into polluting the ground water. Small industries in Fatehgarh Sahib Districts also play its role for polluting the ground water.

This is the position of every districts, it is conclude that the main culprit of ground water pollution are the misuse/overuse of pesticides, weedicides, and herbicides and chemical fertilizers used by farmers in their field without consulting the experts. Secondly the small industries in every district through untreated/polluted water and industrial water into borewells or nearby drains in connivance with government officers. Third cultprit is the drain/nalas which carries the industrial waste from the nebhouring states. Fourth is the village tank which became the storage of sewage water of village. In the whole study the role of governmental agencies like Public health and sanitation department, Punjab Pollution Control Board, and Public Water Works department is very discouraging.

Sophisticated Analytical Instruments Laboratories Society

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Thapar Technology Campus, Bhadson Road, Patiala-147 004 (India)

TEST REPORT

Test Report No.:	NN/16-17/267	Date:	06.02.2017
Service No.	NN/16-17/267 (01-08)	Customer's Ref.	Sample Submitted by Customer dtd 01.02.2017

Customer's name and address:

M/s Punjabi University
Department of law
Patiala
Kind attn: Prof. Bupinder Singh Virk

Sample Description	Ground Water
Condition of the sample received	O.K.
Customer's sample identification No. (if any)	Sample Marked as 01 to 8
Quantity/number of samples	Eight
Sampling Procedure (if any)	--
Test parameters	Lead, Uranium, Strontium, Barium, Cadmium, Mercury, Arsenic
Standard/Specification/Method followed	APHA 22nd Edn
Deviations (if any)	--
Documents constituting this report (if any)	--

Date of Receipt of Job	Date of Completion of Job	Total Number of Pages
01.02.2017	06.02.2017	1

TEST RESULTS

S. No.	Parameters	Test Method	Unit	Results			
				01	02	03	04
1	Lead as Pb	APHA 22nd Edn.3120 B	mg/l	0.36	0.38	0.29	0.30
2	Uranium as U	APHA 22nd Edn.3120 B	mg/l	<0.10	<0.10	0.12	<0.10
3	Strontium as Sr	APHA 22nd Edn.3120 B	mg/l	10.3	8.35	1.20	5.65
4	Barium as Ba	APHA 22nd Edn.3120 B	mg/l	0.42	0.30	0.18	0.46
5	Cadmium as Cd	APHA 22nd Edn.3120 B	mg/l	<0.001	<0.001	<0.001	<0.001
6	Mercury as Hg	APHA 22nd Edn.3112 B	mg/l	<0.001	<0.001	<0.001	<0.001
7	Arsenic as As	APHA 22nd Edn.3114 C	mg/l	<0.005	<0.005	<0.005	<0.005

S. No.	Parameters	Test Method	Unit	Results			
				05	06	07	08
1	Lead as Pb	APHA 22nd Edn.3120 B	mg/l	0.16	0.35	0.32	0.20
2	Uranium as U	APHA 22nd Edn.3120 B	mg/l	<0.10	<0.10	0.13	<0.10
3	Strontium as Sr	APHA 22nd Edn.3120 B	mg/l	1.63	5.90	5.97	2.07
4	Barium as Ba	APHA 22nd Edn.3120 B	mg/l	0.59	0.12	0.14	0.22
5	Cadmium as Cd	APHA 22nd Edn.3120 B	mg/l	<0.001	<0.001	<0.001	<0.001
6	Mercury as Hg	APHA 22nd Edn.3112 B	mg/l	<0.001	<0.001	<0.001	<0.001
7	Arsenic as As	APHA 22nd Edn.3114 C	mg/l	<0.005	<0.005	<0.005	<0.005

.....end of the report.....

S. Chandra
Head, SAI Labs
(Authorized Signatory)

Note: 1. The results listed refer only to the tested samples and applicable parameters. Endorsement of products is neither inferred nor implied.
2. Samples will be destroyed after one month from the date of issue of the test report unless otherwise specified
3. This report is not to be reproduced wholly or in part and cannot be used as an evidence in the products is neither inferred nor implied. court of law and should not be used in any advertising media without special permission in writing.
4. In case any reconfirmation of contents of the test report is required, please contact the authorized signatory of the test report within 15 days of the issue of test report

Phone: +91(175) 2393552 Fax : +91(175) 2393548 Email: office.sailabs@thapar.edu, info@sailabs.org
URL: www.sailabs.org