



## EVALUATION OF HEAVY METAL CONTAMINATION IN INDIRA GANDHI CANAL WATER, SRI-GANGANAGAR, INDIA

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### Abstract

*The Indira Gandhi canal is the lifeline of Rajasthan which carries drinking and irrigation water from Harike barrage in Punjab to Rajasthan, it supplies water to 15 districts of Rajasthan. This paper discuss an integrated approach of heavy metal pollution discharged from various industries and municipal authorities. the water quality of the wetland has been studied with reference to various toxic metals. The metals analyzed include lead (Pb), chromium (Cr), copper (Cu), nickel (Ni) and Arsenic (As). The quality of water has drastically deteriorated due to the mixing of the heavy metals. Most of the metal ions were in higher concentration compared to the international standards. It has been observed that the quality of water is not safe for various aquatic and even unfit for human drinking and irrigation purposes, therefore, necessary conservation and management measures should be taken to improve the deteriorating water quality of this globally recognized wetland.*



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### Introduction:

A Canal is defined as a large artificial stream of water emptying into its fed areas. Canal and streams drain water that falls in down-land areas. Moving water, dilutes and decomposes pollutants more rapidly than standing water, but many rivers, streams and canals are significantly polluted all around the world (Bailey 2002).

A primary reason for this is that all three major sources of pollution (industry, agriculture and domestic) are concentrated along the running water streams. Industries and cities have historically been located along rivers because the rivers provide transportation and have traditionally been a convenient place to discharge waste. Agricultural activities have tended to be concentrated near rivers, because river floodplains are exceptionally fertile due to the many nutrients that are deposited in the soil when the river overflows (Wetzel 2002).

Water provides a unique medium to many physical, chemical and Biochemical reactions. Any minute change in water quality parameter may adversely and favourably affect the particular reaction as well as the whole ecosystem (Vanloon 2002). So water chemistry has a keen scope for this project. Much of literature has been reported the effect of the water quality on

human population. That is why analysis of the water quality of a natural water bodies has a great deal of interest. Water quality is directly affected by the geology of that particular region and water quality shows its own effect on biological system of that region (Montgomery 1989). So, if we are studying the biology of that particular region, we have to know water quality parameter, which provides many useful interpretations about the ecology and population studies of that region.

So, this study will helpful to many water quality analysts as well as biologist, ecologist and environmentalists and also very useful to Public Health Department and Municipal Corporation to improve public health.

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Since the industrial units and municipal authorities of Punjab are freely discharging the wastewater to Indira Gandhi Feeder canal that is passing through the Punjab territory. The consequence is that, the canal water has become hazardous to human health and is causing water-borne diseases in the Rajasthan state. Even Central Pollution Control Board (CPCB) has highlighted gravity of the issue in its November 2012 assessment report - Status of water quality: Canals originating from Punjab. So there is strong need to assess the water quality entities and damage to human as well as whole ecosystem.

#### **Methods and Material:**

All the samples were analysed according to the Standard Methods given by the APHA. For the analysis of heavy metals, samples were pre-treated as per following details. The 20 ml samples were acidified with cone.  $\text{HNO}_3$  and boiled for 10 minutes, and then filtered until a clear solution was obtained. The filtrate was concentrated and made up to a volume of 10 ml. Simultaneously, a blank solution containing deionized water and concentrated nitric acid was also boiled and concentrated and used as a blank sample.

This blank sample takes care of errors due to reagents and environment. The heavy metal contents of the samples were analysed by Atomic Absorption Spectrophotometer (Perkin-Elmer 5000 model). All furnace injections were made with micropipettes. There is no matrix interference since all the samples are pretreated and concentrated by above said procedure. During the samples analysis, the Atomic Absorption Spectrophotometer used the appropriate hollow cathode lamps and the signals were measured for each metal at their respective wavelengths to get the concentration.

## **Sample**

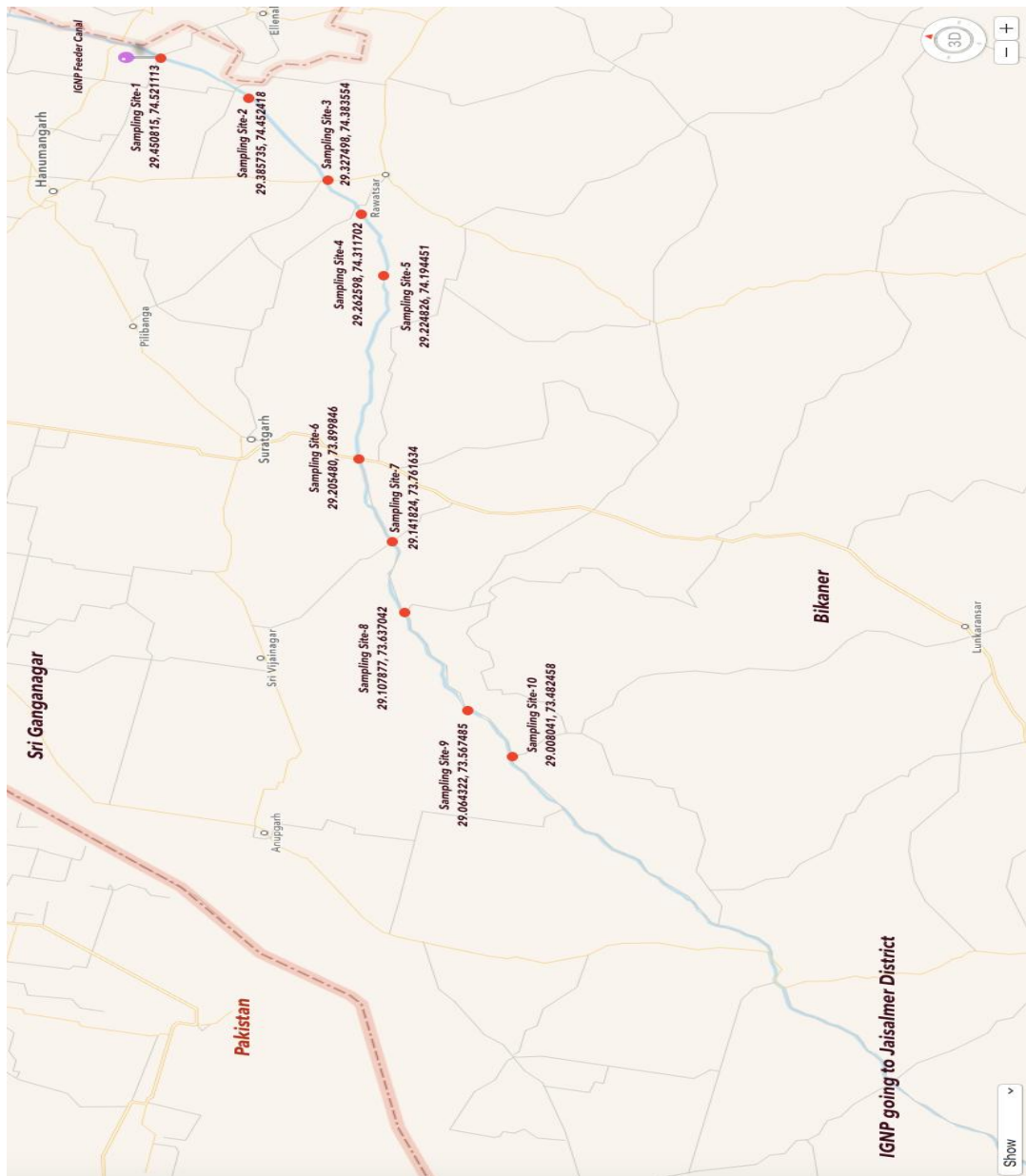
The area selected for the present study is Sri Ganganagar and Hanumangarh Districts of Rajasthan. This study area is climatically, the mixture of arid and semi-arid climates and local population have high dependency on the IGNP.

A total 10 sampling stations were chosen and 10 replicate samples were taken from each sampling sites, overall total 100 samples were analysed. The mean values of physico-chemical parameters of each sampling sites were shown in the Table 1.

The sampling sites are marked in topological map, along the entire selected canal stretch. The GPS coordinates of all 10 sampling sites are given here and also marked in the map (Figure-1).

- 1) Sampling Site-1 (GPS Cordinate-29.450815, 74.521113) — Mastiawali head (HMH)
- 2) Sampling Site-2 (GPS Cordinate-29.385735, 74.452418) — 3 RP & 4 RP (Lakhuwali Head)
- 3) Sampling Site-3 (GPS Cordinate-29.327498, 74.383554) — 56 RD & 1 STB, RWT Lakhuwali
- 4) Sampling Site-4 (GPS Cordinate-29.262598, 74.311702) — 15 KWD (Rawatsar)
- 5) Sampling Site-5 (GPS Cordinate-29.224826, 74.194451) — Jaisa Bhati (Rawatsar)
- 6) Sampling Site-6 (GPS Cordinate-29.205480, 73.899846) -450 RD Chhatargarh
- 7) Sampling Site-7 (GPS Cordinate-29.141824, 73.761634) — Vijaynagar SOG
- 8) Sampling Site-8 (GPS Cordinate-29.107877, 73.637042)— 2 BKM Vijaynagar/Ramsinghpur
- 9) Sampling Site-9 (GPS Cordinate-29.064322, 73.567485) — 11 GM Gomawali Ramsinghpur
- 10) Sampling Site-10 (GPS Cordinate-29.008041, 73.482458) — Gomawali Ramsinghpur, Anupgarh

The grab samples were collected in thoroughly cleaned polythene bottles once a month from each sampling site in between the Jan 2014 – Dec. 2015. After taking the samples, they were analysed for specified parameters in the laboratory and appropriate statistical test were performed.



### Result and Discussion:

Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning. Heavy metals are dangerous because they tend to bioaccumulate. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers, and groundwater. The heavy metal contents are ranging from Pb (198-185  $\mu\text{g/l}$ ), Cr (177-160  $\mu\text{g/l}$ ), Ni (99-91  $\mu\text{g/l}$ ), Cu (89-88  $\mu\text{g/l}$ ), and As (75-70  $\mu\text{g/l}$ ) that is much higher than the BIS disearable limits. It is indicating the clear cut mixing of the industrial effluents in the canal water (Islam 2015).

### **Lead**

The concentration of Lead was found 198-185 µg/l. In humans exposure to lead can result in a wide range of biological effects depending on the level and duration of exposure. Various effects occur over a broad range of doses, with the developing foetus and infant being more sensitive than the adult. High levels of exposure may result in toxic biochemical effects in humans which in turn cause problems in the synthesis of haemoglobin, effects on the kidneys, gastrointestinal tract, joints and reproductive system, and acute or chronic damage to the nervous system.

### **Chromium**

The concentration of Chromium was found 177-160 µg/l. It is used in metal alloys and pigments for paints, cement, paper, rubber, and other materials. Low-level exposure can irritate the skin and cause ulceration. Long-term exposure can cause kidney and liver damage, and damage too circulatory and nerve tissue. Chromium often accumulates in aquatic life, adding to the danger of eating fish that may have been exposed to high levels of chromium.

### **Nickel**

The concentration of Nickel was found 99-91 µg/l. Small amounts of Nickel are needed by the human body to produce red blood cells, however, in excessive amounts, can become mildly toxic. Short-term overexposure to nickel is not known to cause any health problems, but long-term exposure can cause decreased body weight, heart and liver damage, and skin irritation.

### **Copper**

The concentration of Copper was found 89-88 µg/l. Copper is an essential substance to human life, but in high doses it can cause anemia, liver and kidney damage, and stomach and intestinal irritation. People with Wilson's disease are at greater risk for health effects from overexposure to copper. Copper normally occurs in drinking water from copper pipes, as well as from additives designed to control algal growth.

### **Arsenic**

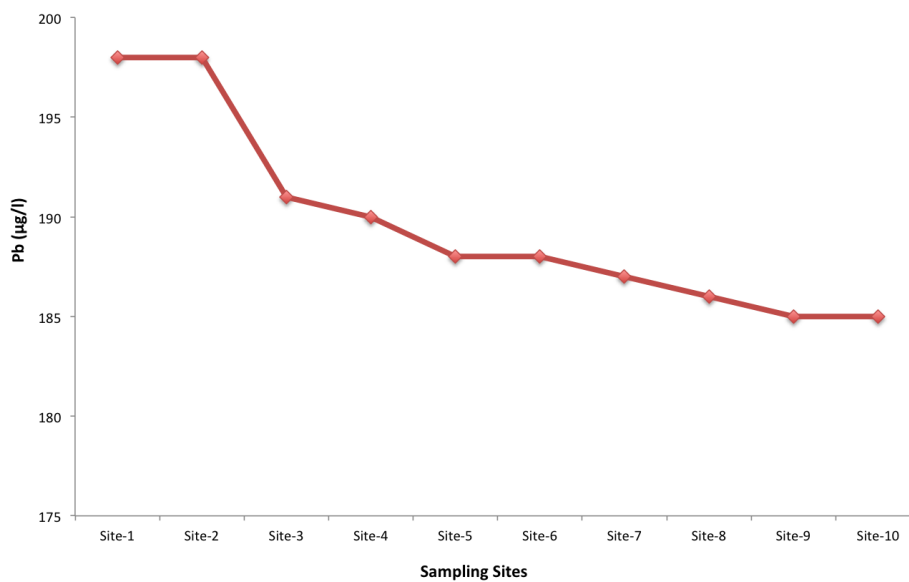
The concentration of Arsenic was found 75-70 µg/l. Arsenic is one of the most toxic elements that can be found. Despite their toxic effect, inorganic arsenic bonds occur on earth naturally in small amounts. Humans may be exposed to arsenic through food, water and air. Exposure may also occur through skin contact with soil or water that contains arsenic. Exposure to inorganic arsenic can cause various health effects, such as irritation of the stomach and intestines, decreased production of red and white blood cells, skin changes and

lung irritation. A very high exposure to inorganic arsenic can cause infertility and miscarriages with women, and it can cause skin disturbances, declined resistance to infections, heart disruptions and brain damage with both men and women. Finally, inorganic arsenic can damage DNA.

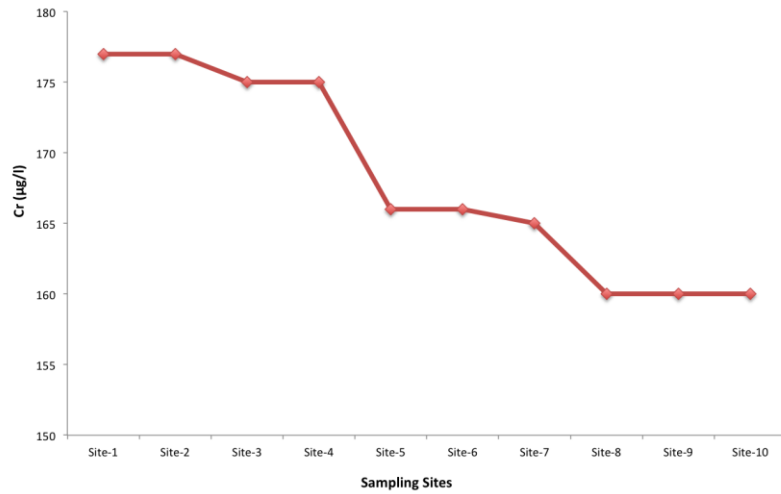
The present study reveals that these ranges are not safe for direct human consumption and agricultural practices.

**Table 1 Showing the average magnitude of various physico-chemical parameters and Heavy Metals content in all sampling sites**

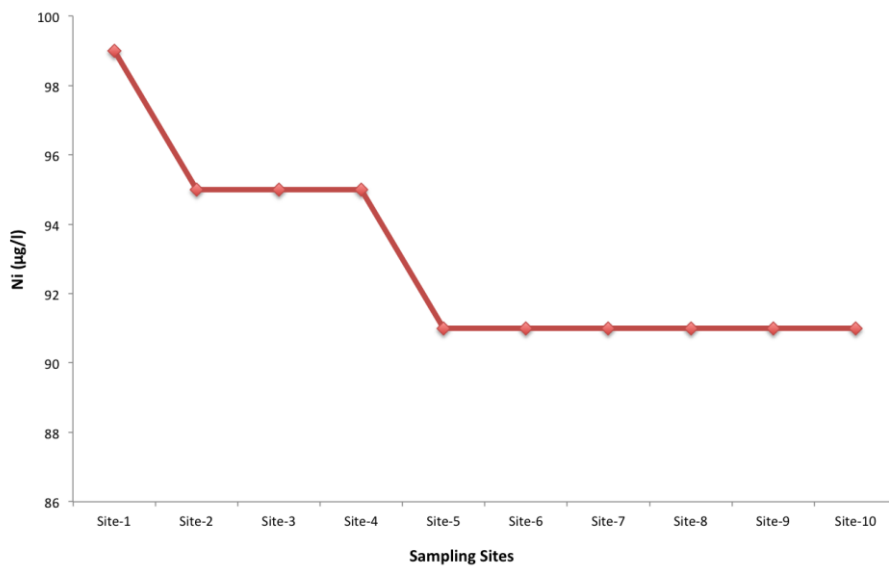
Sites Heavy Metals	BIS	Site-1	Site-2	Site-3	Site-4	Site-5	Site-6	Site-7	Site-8	Site-9	Site-10
Pb (µg/l)	50	198	198	191	190	188	188	187	186	185	185
Cr (µg/l)	50	177	177	175	175	166	166	165	160	160	160
Ni (µg/l)	20	99	95	95	95	91	91	91	91	91	91
Cu (µg/l)	50	89	89	89	89	88	88	88	88	88	88
As (µg/l)	50	75	75	75	75	75	71	71	70	70	70



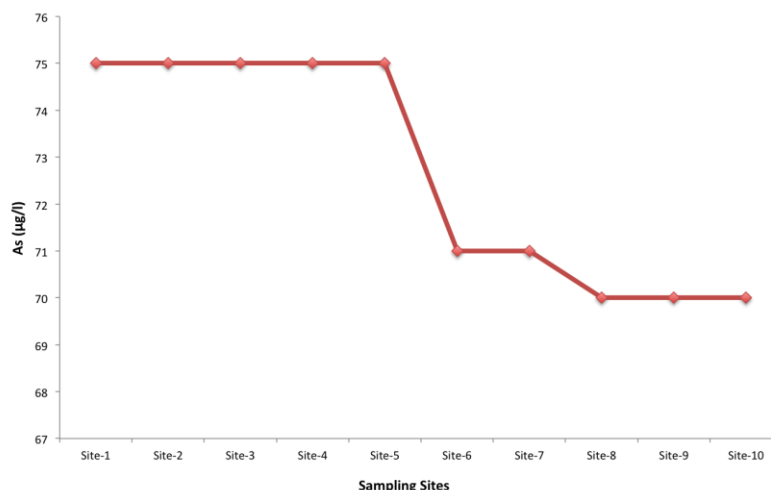
**Figure 1 Showing spatial variability in Pb among all sampling sites**



**Figure 2 Showing spatial variability in Cr among all sampling sites**



**Figure 3 Showing spatial variability in Ni among all sampling sites**



**Figure 4 Showing spatial variability in As among all sampling sites**

### **Conclusion**

The study shows that the water of Indira Gandhi canal water exhibits high concentration of all heavy metals. Fluctuations in concentration of various heavy metals have been observed in different seasons. The investigation reveals that the quality of canal water at these sampling sites is found to be not safe and cannot be used for the domestic purposes without any treatment. Surely this water is hazardous to the human and can become the cause of many diseases. The revelations during the present study are startling and summons immediate attention from the stake holder agencies for its conservation management and sustainable development so that optimum utilization of this wetland may be carried out.

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