To,

The Registrar,
National Green Tribunal,
New Delhi

SUBJECT: O.A. No. 346-2022- H.C.Arora v. State of Punjab:-Next date+20.01.2023

Sir,

I am enclosing herewith my rejoinder to the status report filed by JOINT Committee in the aforesaid OA.

Kindly allow it to be placed on record.

Yours Sincerely,

(H.C.ARORA)

APPLICANT IN PERSON

9814013764

Dated: 17.01.2023

(1)

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH AT
NEW DELHI

Original Application No. 346 of 2022

H.C. Arora ***...Applicant***

Versus

State of Punjab and others ***...Respondents***

Rejoinder to Status Report submitted by Punjab Pollution Control Board (Nodal Agency) on behalf of Committee constituted by this Hon'ble Tribunal vide orders 17-05-2022 and 21-09-2022.

Respectfully Sheweth,

PRELIMINARY SUBMISSIONS:-

1. The Applicant humbly submits that the Joint Committee has taken this fundamental right as enshrined under Article 21 of the Constitution of India in a very casual way for residents of Village Dharangwala, Fazilka (Punjab) and has not produced the complete and real facts before this Hon'ble Tribunal, & has submitted the Status report by wrongly mentioning that there is no ill impact of canal water (Abohar branch of Sirhind feeder) on the health of children and farming of Citrus Gardens. The working as well as report prepared by the Joint committee with Nodal Agency as Punjab Pollution Control Board is incomplete and has been prepared just to escape from their lawful responsibility of providing safe and healthy environment to the citizens residing in the Village of Dharangwala, Fazilka on the grounds as under:

GROUNDS:

(i) That the tests which have been performed on water samples taken from Canal (Abohar branch of Sirhind Feeder) are just basic tests i.e. only ions and bacterial tests are performed and major tests for detection of toxicity (including Heavy Metals) have deliberately been not been done by the Joint Committee.

(ii) That the team of Health Department of Civil Surgeon, Fazilka has not done proper door to door survey and has relied upon the undertaking/document of Sarpanch whereas as per one list available with the Applicant, 40 Children are suffering from diseases line Mental disorder

and/or physical disability and/or blindness etc. Further 12 Cancer Patients had died in Village Dharangwala in just one year i.e. year 2021 and 9 patients are still suffering from this disease but the joint committee failed to mention such important information in its report.

(iii) That the Health team of Civil Surgeon, Fazilka has even failed to take samples of blood of affected Children and have just conducted the physical examination of Children only. Since Children of different ages are suffering from diseases like mental/physical disability, many amongst them have problems by birth, it was important for Health Team to conduct tests of their Parents too and the blood test for both (Children & their parents) should have included Kidney Functional Test, Liver Functional Tests, finger nail analysis, hair analysis, electro cadiograms, X-rays, and heavy metal test in Urine analysis but the Health Team restricted themselves to physical check-up only.

(iv) That as per one advisory through letter No. 567/Part dated 16-05-2022 issued by the Chief Engineer (Irrigation-I), Department of Water Resources, Punjab Chandigarh to Supervising Engineer, Ferozepur Canal Circle, Ferozepur, it was advised not to use Canal Water for drinking purposes but the joint committee failed to produce & record such important information in its Status Report.

(v) That the Abohar branch of Sirhnd feeder canal originated from Harike Wetlands where both River Satluj & Beas meets & merges. It is a well-known fact that Water River Satluj is carrier of highly pollutants including heavy metals) of hundreds of polluting industries of Ludhiana through Budha Nallah. However, none of the committee members have tried to explore such major factor which may be the primary source and root cause problem of disease.

(vi) That after seasonal closure of Canal Water (Nehar Bandi) from Barrage, when the Canal Water is again released, the toxicity level of water is too high due to illegal dumping of Effluents by Industries located along the Sirhind Canal &Abohar Branch as well as untreated sewerage being disposed by Villages.

2. **Facts/reply in detail:** It is well known fact that the Southern Malwa Belt (including Village in question) is fed by surface water supply through Abohar Branch of Sirhind Feeder. This Sirhind Feeders originates from Harike Wetland where River Satluj & River Beas meets. It is a well-

known fact that **River Satluj carries effluents with toxic chemicals** of Electroplating Industries and Dyeing Industries of Ludhiana (through Budha Nallah). **Besides this, many Industries located along Sirhind Feeder also dump untreated effluents directly into the canal and large number of villages dump untreated sewerage too**. After the dry-off (Nehr Bandi) i.e., when supply of water is released from Barrage at Harike Wetland, the toxicity due to such illegal dumping of untreated effluent/sewerage is much higher. It is a well-known fact that Surface water i.e. Abohar branch of Sirhind feeder canal is only source of drinking water for village Dhrangwala, these pollutants especially Heavy Metals are being consumed by Villagers directly as well as indirectly (through grains & vegetables). Thus the report prepared by Punjab Pollution Control Board (Nodal Agency) is just a basic report whereas the matter is very serious in nature and is directly affecting fundamental right under Article 21 of Constitution of India for residents of villages along the Sirhind Feeder Canal including Village Dhrangwala of District Fazilka.

3..Since the Nodal Agency has submitted one cumulative status report by compiling reports of various departments, the applicant humbly submits reply to tests reports/letters of various departments attached as part of the Status Report from Page No. 7 onwards as under:

(i) **Reply to Page No. 7 to 11 of Status Report pertaining to test reports of Water Samples:** That the tests which have been performed on water samples taken from Canal are just basic tests i.e. only ions and bacterial tests are performed and major tests for detection of toxicity i.e. Heavy Metals (as specified at Table 3 – Parameters Concerting Toxic Substances of IS 10500: 2012) have deliberately been not done by the Joint Committee. The copy of Table 3 is reproduced herewith as **Annexure PR-1.** It is pertinent to submit here that as per some research conducted by "Department of Zoology and environment Sciences, Punjabi University, Patiala in 2015, **the water of Harike Wetlands (from which the Canal to concerned area originates) comprises of many heavy metals beyond permissible limits.** The copy of research paper published in 2015 is produced herewith as **Annexure PR-2.** Even as per news published in newspaper, The Tribune on April 20, 2022 with headline as "Pollution impacts fish at Harike, Nangal wetlands: Study" mentions that **the Harike Wetland also has a heavy load heavy metal pollution index (HPI) and Heavy Metal Index (MI)** The copy of news published in the Tribune on April 20, 2022 is produced herewith as **Annexure PR-3.**

(ii) **Reply to Page No. 12 to 17 (Regarding tests of 20 children):**That the Health Team has not done proper door to door survey and has relied upon the undertaking of Sarpanch whereas as per one list available with the Applicant, 40 Children are suffering from diseases line Mental disorder and/or physical disability and/or blindness etc. The Health team of Civil Surgeon, Fazilka has even failed to take samples of blood of affected Children and have just conducted the physical examination of Children only. Since Children of different ages are suffering from diseases like mental/physical disability, many amongst them have problems by birth, **it was important for Health Team to conducts tests of their Parents too and the blood test for both (Children & their parents) should have included Kidney Functional Test, Liver Functional Tests, fingernail analysis, hair analysis, electrocadiograms, X-rays, and heavy metal test in Urine analysis** but the Health Team restricted themselves to some basic tests. The list of children suffering from various diseases is produced herewith as **Annexure PR-4. Further 12 Cancer Patients died in Village Dharangwalin just one year i.e. year 2021 and 9 patients are still suffering from this disease but the joint committee failed to update such important information in its report.**It is pertinent to submit here that the population of village Dhrangwala is just around 5200 and keeping in view of number of known Cancer Patients as well as Physically/mentally disabled Children in the village, the matter becomes more serious. However, the Committee has mentioned that there is no ill impact of canal water on the health of children and farming of Citrus Gardens but has not tried to find out the root cause problem of diseases and restricted themselves to physical examination of some children with age upto 14 years only, whereas the Medical team should have done medical tests of their parents too. It is pertinent to submit here that as per contents of news published in the Tribune on 22 January 2019 with Headline as "Cancer Scare: Water samples of Abohar Village to be tested" it is published that;

Taking cognizance of reports that some residents of waterlogged Dharangwala village, 14 km from here, are suffering from disabilities and cancer, SDM Poonam Singh on Monday visited the area and interacted with the affected families. The SDM was accompanied by officials of other state departments.

"The Health Department has conducted a survey that indicated the spread of diseases due to contamination water not only at Dangarkhera but also in the neighbouring belt.

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The copy of news published on 22-01-2019 in the tribune is produced herewith as **Annexure PR-5.**

(iii) **Reply to Page No. 17 & 18:** That at Page No. 17 of status report, letter dated 1665 dated 14-11-2022 of Office of Deputy Direction, Horticulture, Abohar, it is specifically mentioned that Orchids of Circus fruits do not give good performance due to poor quality of Water. It is pertinent to submit here that the Joint Committee failed in collecting the data to find the impact of poor quality of canal water on orchards in the month of July 2022. It is pertinent to submit here that the poor quality of canal water had worst impact on orchids of Citrus fruits as well as its trees in the month of July as the trees completely dried and fruit got rotten and turned black due to Canal Water and it evidently clear from Six Photographs produced as **Annexure PR-6.** However, the Joint Committee has failed to record such facts in the Status Report submitted by PPCB to this Hon'ble Tribunal, as per one advisory through letter No. 567/Part dated 16-05-2022 issued by the Chief Engineer (Irrigation-I), Department of Water Resources, Punjab Chandigarh to Supervising Engineer, Ferozepur Canal Circle, Ferozepur, it was advised not to use Canal Water for drinking purposes but the joint committee failed to produce & record such important information in its Status Report. The translated copy of letter No. 567/Part dated 16-05-2022 is reproduced as **Annexure PR-7.** As already submitted above, the River Satluj take along Toxic Chemicals of Electroplating Industry as well as Dyeing Industries of Ludhiana, it was very important for **Horticultural Department as well as Punjab Pollution control Board to conduct toxicity tests of various crops of locality too**. Further, it is well known fact that after the dry-off season (Nehar-Bandi) i.e. when the water is again released from Barrage, the toxicity tests of Canal Water passing through the Village Dhrangwala will also clear the picture, however, despite having ample time during harvesting season, the Joint Committee failed to conduct such tests and conducted the visit during Mid of November when the discharge of water from Barrage is at peak level.

It is therefore, apparent that the Joint Committee has not produced the complete and real facts before this Hon'ble Tribunal & has submitted the Status report by wrongly & deliberately mentioning that there is no ill impact of canal water (Abohar branch of Sirhind feeder) on the health of children and farming of Citrus Gardens. The working as well as report prepared by the Joint committee with Nodal Agency as Punjab Pollution Control Board is

incomplete and has been prepared just to shell out it responsibility and cover their failure in providing safe and healthy environment to the citizens residing in the Village of Dharangwal,a Fazilka.

Prayer:

1. That since the Sirhind Canal water is also used for drinking purposes by people of Rajasthan, a technical committee comprising of Members from Rajasthan Pollution control Board, IIT Roorkee, CPCB, MoEF&CC may kindly be directed to be constituted to investigate the illegal discharge of effluents by various Industries located along Sirhind Feeder, Abohar Branch as well as to conduct tests of water pollution of Sirhind Canal & its Abohar branch as well as toxicity level of crops.

2. That a health committee comprising of team of doctors from PGI Chandigarh, AIIMS Bathinda and Guru Gobind Singh Medical Hospital, Faridkot may kindly be constituted to check the actual condition of affected Children & health of their parents at Village Dhrangwala, Fazilka by conducting the requisite tests.

3. That the State of Punjab may please be directed to make arrangements for free proper medical treatment and to make arrangements for supply of Safe Drinking water for the residents of affected village immediately.

4. That lawful action as enshrined in Section 43 read with section 24 of The Water (Prevention & Control of Pollution) Act 1974 may please be directed to be initiated against all the Industries which are found dumping the effluent directly into water stream and all such industries may be directed to be sealed till they fulfill the condition of ETP as per law.

5. That Sewerage Treatment Plants in villages along Sirhind Canal Feeder &Abohar Branch in similar terms of Natural Sewerage Treatment Plant set up at Moga (Punjab) and treated water may be used strictly for irrigation purposes.

6. Any other as deemed to be fit by this Hon'ble Tribunal.

PLACE: CHANDIGARH
DATED: 17.01.2023

(H.C ARORA)

APPLICANT

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VERIFICATION:

Verified that contents of Para no.1 of Preliminary Submissions, and Para No.2 (of rejoinder to Facts/Reply) and those of Para No.3 of this rejoinder , are true and correct. No part of the same is false or incorrect, and nothing relevant has been concealed therefrom.

PLACE: CHANDIGARH

DATED: 17.01.2023

(H.C ARORA)

APPLICANT

Annexure PR-1

Table 3 Parameters Concerning Toxic Substances

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, *Max*	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, *Max*	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, *Max*	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, *Max*	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, *Max*	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, *Max*	0.000 5	No relaxation	ASTM 5175* or APHA 6630	—
ix)	Polynuclear aromatic hydrocarbons (as PAH), mg/l, *Max*	0.000 1	No relaxation	APHA 6440	—
x)	Total arsenic (as As), mg/l, *Max*	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 52)	—
xii)	Trihalomethanes:				
	a) Bromoform, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	b) Dibromochloromethane, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	c) Bromodichloromethane, mg/l, *Max*	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
	d) Chloroform, mg/l, *Max*	0.2	No relaxation	ASTM D 3973-85* or APHA 6232	—

True Copy

Applicant in Person

Annexure P-R-2

International Journal of Scientific and Research Publications, Volume 5, Issue 2, February 2015
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Evaluation of Water Quality Pollution Indices for Heavy Metal Contamination Monitoring in the Water of Harike Wetland (Ramsar Site), India

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Abstract- The diverse functions of wetlands are being adversely affected by human activities. Harike wetland has high ecological significance as it provides home to diverse flora and fauna, habitat for feeding and breeding and social interactions. This paper discusses an integrated approach of pollution indices and statistical techniques to assess the intensity of heavy metal pollution discharged from various industries in Harike wetland. This wetland is highly polluted due to the rapid industrialization, urbanization and dumping of solid wastes. The water quality of the wetland has been studied with reference to various toxic metals. The metals analyzed include lead, chromium, iron, copper, nickel, zinc and cadmium. 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.

Index Terms- Harike wetland; Ramsar site; Heavy metals; Pollution; Water quality

I. INTRODUCTION

From the very dawn of human civilization, due to uncontrolled greed, the over utilization of natural resources has been taken place which caused unparallel devastation. Recently, with the unplanned growth of industrialization, rapid urbanization and degradation of aquatic resources, by using them as dumping grounds for sewage, deforestation, depletion of water resources has played a crucial role in deterioration of aquatic ecosystems on the earth. Wetlands are more affected these days because they receives polluted water from various sources through rivers and streams. Wetlands support unique aquatic biodiversity which is facing a serious threat. Some of the important organisms came under threatened categories of IUCN. Heavy metals, including both essential and non-essential elements, have a particular significance in eco-toxicology. They are highly persistent and have the potential to be toxic to the living organisms. Heavy metal concentrations in aquatic ecosystems are usually monitored by measuring their concentration in water (Ebrahimpour and Mushrifah, 2008). Human activities have led to accumulation of toxic metals in the natural environment (Karbassi and Bayati, 2005) and the extensive exploitation of natural resources has led to increased pressure on aquatic ecosystems. Resultantly, due to an increased load of heavy metals the aquatic ecosystems have severely disrupted. Elevated concentrations of pollutants in these systems have resulted in bioaccumulation of toxic metals and a serious environmental problem, which threatens aquatic organisms and human health (Sasmaz et al., 2008).

Many large industrial factories including cement factories, paint manufacturing plants, dying industries, pesticide and insecticides factories, leather industries and tanneries are located along the banks of the river Sutlej and discharges polluted water into it and this water ultimately reaches at Harike wetland. Effluents from these factories have caused severe contamination of water in this wetland. The purpose of this study was to determine the concentrations of lead (Pb), chromium (Cr), copper (Cu), nickel (Ni), zinc (Zn), cadmium (Cd), aluminum (Al) and iron (Fe) in water of Harike wetland. The data collected will be shared with the Stake holder agencies to start immediate pollution mitigation and conservation measures.

II. MATERIALS AND METHODS

Study Area

The study area is situated in three districts of Punjab state i.e. Kapurthala, Tran Taran and Ferozepur with 4100ha area (Figure.1). This wetland included into the list of Ramsar sites in 1990. Harike wetland located at latitude of 31.17° N and longitude of 75.20° E. This wetland is also important because situated on the confluence of two rivers of the Indus river system i.e. Beas and Sutlej. The journey of the river Beas ends here and the river Sutlej flows downstream and enters into Pakistan. This is a riverine wetland, but due to large area it supports different type of habitats like palustrine, lacustrine and swamps. Due to its diverse nature, it supports vast variety of valuable flora and fauna. Unfortunately, this important aquatic ecosystem receives large quantity of untreated industrial effluents from adjoining cities through the inflow Rivers which are posing a serious threat to its existence.

Water Sampling

Water samples were collected from March, 2013 to February, 2014 in four different seasons of the year from five sites in Harike wetland. The surface water samples were thoroughly filtered through cellulose nitrate filter paper to eliminate suspended solids and stored in plastic bottles with one liter capacity. 1 ml of concentrated nitric acid was added to it for

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preservation. Heavy metal analysis has been done using Atomic Absorption Spectrophotometer (AAS).

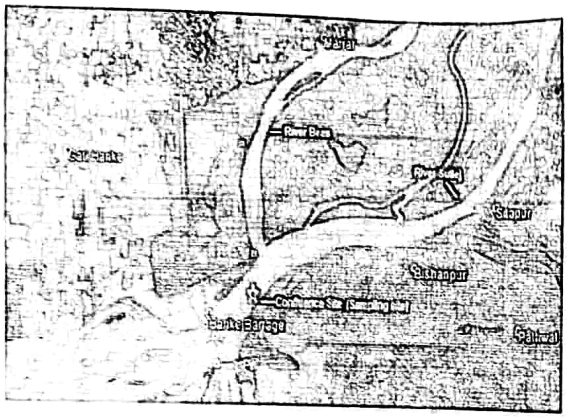

Figure 1. Map of Harike wetland.

Pollution evaluation indices

Generally, pollution indices are applied to estimate the pollution of the water samples under consideration. The indices used in this study, are heavy metal pollution index (HPI), heavy metal evaluation index (HEI) and degree of contamination (C_d). These indices are used to evaluate quality water for drinking as well as irrigation purposes. The HPI and HEI methods provide an overall quality of the water with regard to heavy metals.

Heavy metal pollution index (HPI)

HPI index was developed by assigning a rating or weightage (W_i) for each chosen parameter. The rating system is an arbitrarily value between 0 to 1 and its selection depends upon the importance of individual quality considerations or it can be defined as inversely proportional to the standard permissible value (Reddy, 1995; Mohan et al. 1996). In computing the HPI for the present water quality data, the concentration limits i.e. the standard permissible value (S_i) and highest desirable value (I_i) for each parameter were taken from the WHO standards.

The HPI is determined by using the expression below (Mohan et al. 1996):

$$HPI = \frac{\sum_{i=1}^{n} WiQi}{\sum_{i=1}^{n} Wi}$$

Where Q_i is the sub-index of the ith parameter. W_i is the unit weightage of the ith parameter and n is the number of parameters considered. The sub-index (Q_i) is calculated by

$$Q_i = \sum_{i=1}^{n} \frac{\{Mi(-)Ii\}}{(Si-Ii)} \times 100$$

Where *Mi*, *Ii* and *Si* are the monitored value of heavy metal, ideal and standard values of the ith parameter, respectively. The sign (-) indicates numerical differences of the two values, ignoring the algebraic sign.

Heavy metal evaluation index (HEI)

The HEI method gives an overall quality of the water with respect to heavy metals (Edet and Offiong, 2002) and is computed as:

$$HEI = \sum_{i=1}^{n} H_c / H_{mac}$$

Where H_c is the monitored value of the ith parameter and H_{mac} the maximum admissible concentration of the ith parameter.

Degree of contamination (C_d)

The contamination index (C_d) sumarises the combined effects of several quality parameters considered harmful to domestic water (Backman et al. 1997) and the contamination index is calculated from equation below:

$$C_d = \sum_{i=1}^{n} C_{fi}$$

Where

$$C_{fi} = \frac{C_{Ai}}{C_{Ni}} - 1$$

Where C_{fi}, C_{Ai} and C_{Ni} represent contamination factor, analytical value and upper permissible concentration of the ith component, respectively (N denotes the 'normative value').

Statistical analysis

To identify the relationship between various heavy metals in the water samples statistical analysis has been done by using Pearson's correlation matrix with the help of SPSS software.

III. RESULTS

Heavy metal pollution is a serious and widespread environmental problem due to persistent toxicity, non biodegradable and bio-accumulation properties of these contamnants. The mean values of heavy metals detected in water from Harike wetland are presented in Table 1 and are compared to the WHO maximum permissible limits. Most of the heavy metals are above permissible limits prescribed under WHO standards.

Heavy Metals in Water

Lead

The level of Pb is 0.53 ppm which is above permissible limits in water comes from various industries like paint industry, refining and manufacturing of Pb coating goods. It is very toxic in nature and causes many diseases. A remedy must be sought for the gradual phasing out of Pb from various industries by using new technologies.

Copper

The Cu content in water is 0.26 ppm considered above permissible limit. The source of copper is mining, metal production, storage batteries and fertilizer production industries. Aquatic organisms are potentially at risk from Cu exposures, mitigation measures are required to reduce Cu inflow into the wetland.

Cadmium

The average Cd content in water is 0.01 ppm. Cadmium is non-essential element. The source of Cd in water is electroplating, alkaline batteries, mining and plastic industries. It interferes with metabolic processes in plants and can bioaccumulate in aquatic organisms and enters in food chain (Adriano, 2001). The concentration obtained during present course of work is above permissible limits.

Chromium

The average concentration of Cr in water is reported to be 0.12 ppm. This is possibly due to release of Cr in the effluent during various industrial operations. The effluents with high Cr content should be treated before discharge.

Nickel

The concentration of Ni is reported as 0.01ppm. Nickel can be toxic to aquatic organisms such as reduction in skeletal calcification and diffusion capacity of gills (Moore, 1991). The

source industries are electroplating, steel industries, ceramics, storage batteries, dying and colouring of glass.

Zinc

The average concentration of Zn in water is 0.69 ppm which is below permissible limit. Zinc is used in plastic industries, cosmetics, steel processing, printing ink and in rubber production.

Manganese

The average abundance of manganese is 0.02 ppm which is below permissible limit. It is used in metallurgical processes, manufacturing of dry cell batteries and fertilizers.

Cobalt

The concentration of cobalt is 0.007 ppm which is within the acceptable range. Cobalt is present in industrial effluent coming from chemical industries, electrical and electronics and auto part manufacturing.

Correlation matrix analysis

In the present study, the correlation coefficient among various heavy metals has been calculated. The statistical analysis (Table 2) showed both positive and negative correlation among different metals. It is clear from the results that copper was positive correlated with most of the other metals whereas lead (Pb) is negatively correlated with other metals. Cadmium and Chromium is highly correlated with each other.

Pollution indices

The heavy metal pollution index of all the heavy metal have been calculated individually using the standards Table 3 and is represented by HPI, with range 115.4-7000 and mean concentration value 1304.65 of all metals, including all the seasons. The components considered include Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn. The results of pollution evaluation indices are presented in Table 4. The result of indices showed that the HPI for all the metals were above the critical limit of 100 proposed for drinking water by Prasad and Bose, 2001.

The degree of contamination (C_d) was used as reference to estimate the extent of metal pollution (Al-Ami et al. 1987). C_d may be grouped into three categories as follows: low ($C_d<1$), medium (C_d = 1-3) and high ($C_d>3$). The range and mean values of C_d were 0.4-352.33 and 44.85. The value of contamination index exceed 3, suggesting that water is highly polluted.

The heavy metal evaluation index used for a better understanding of pollution indices. The mean value of HEI was 45.85. By following the approach of Edet and Offiong (2002), the proposed HEI criteria for the samples are as follows: low (HEI $<$ 10), medium (HEI = 10-20) and high (HEI $>$ 20). The present level of HEI shows that the water quality falls within high zone of pollution.

IV. DISCUSSION

Metals are reported to be well concentrated in the water (Simpson, 1982; Everall et al., 1989). Bioaccumulation of these metals in many fish species and their organs have been reported world widely by Kumada et al., 1980; Wasternhagen et al., 1980; Osborne et al., 1981; Norris and Lake, 1984 and Evans, 1987. These metals in trace amount may play important role in the biochemical life process of the aquatic organisms (Tay et al., 2009). However, their high concentration becomes lethal to fish and other aquatic organisms when the duration of exposure to these metals is prolonged (Deekay et al., 2010). Harike wetland also receives heavy metals pollution from various sources which persists through out the year. As, observed during present investigation the level of some highly toxic metals is above permissible limits. The high concentration is posing a big threat to valuable flora and fauna existing there.

Elmaci et al., 2007 reported that in water samples of Lake Uluabat Zn and Cu concentrations were significantly higher due to the industrial and domestic discharge. The same observations are found in inland waters of Hong Kong (Zhou et al., 1998). Panday et al., 2010 observed that in Ganga river, more than 80% of the water samples Cd and Ni levels above the recommended maximum permissible concentration, the kind of results was reported in Ona river by Adefemi and Awokumi, 2010. Similar observations are found in present study, concentration of Cd and Ni is above the maximum permissible concentration recommended by WHO.

Khan et al., 2005 states that some elevated concentration of heavy metals (Pb, Cr, Hg, Cd, Fe, Cu, Ni, Zn) were recorded in the surface water bodies near NLC corporation due to the untreated wastewater discharge, fly ash ponds and industrial effluents from the Neyveli mines industrial complex. Davis et al., 2006 and Abdulah, 2007 stated that high concentration of heavy metals present in the sediments than the water, because sediments accumulate more heavy metals. Glenn et al., 2009 observed the presence of heavy metals in the coastal lagoon of manila bay are due to the direct deposition of these metals from air pollution.

Thus, the present study is an attempt to detect the heavy metal concentration in the water of Harike wetland. If this trend is allowed to continue unabated, it is most likely that the food web complexes in this wetland might be at the highest risk of induced heavy metal contamination. This alarming concentration may also escort discomfort to the people living in the vicinity of this wetland. Hence, strict management actions should be taken into consideration in order to protect the ecological sustainability of this wetland.

V. CONCLUSION

The study shows that the water of Harike wetland exhibits high concentration of heavy metals like Cd, Cu, Pb, Cr, Ni, Co and Fe. The contamination index C_d (>3) place water quality in high contamination level and heavy metal pollution index HPI on the other hand consider the level of contamination critical. Fluctuations in concentration of various heavy metals have been observed in different seasons. The correlation coefficient indicates positive and negative correlation of these metals with each other. 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.

ACKNOWLEDGMENT

We express our special thanks to the Head, Department of Zoology and Environmental Sciences, Punjabi University Patiala for providing necessary laboratory facilities funding by UGC-BSR scheme to carry out this work.

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Table 1. Heavy metal analysis of surface water of Harike wetland

Site	Season	Copper (Cu)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Zinc (Zn)	Nickel (Ni)	Chromium (Cr)	Manganese (Mn)	Beryllium (Be)	Cobalt (Co)
Harike wetland	Winter	0.283	2.231	0.536	0.026	1.003	-	0.042	-	0.054	0.021
	Spring	0.10	0.032	0.7021	0.034	-	-	0.251	-	-	0.0067
	Summer	0.5435	1.895	-	-	0.907	0.042	0.217	0.086	-	-
	Autumn	0.116	1.067	0.907	0.011	0.872	0.0289	-	0.0319	0.239	-
Mean±S.D.		0.26±0.20	1.30±0.98	0.53±0.38	0.01±0.01	0.69±0.46	0.01±0.02	0.12±0.12	0.02±0.04	0.07±0.11	0.0021±0.0 67
WHO Permissible Limits (mg/l)		0.02	1	0.05	0.005	1	0.02	0.05	0.05	-	-

International Journal of Scientific and Research Publications, Volume 5, Issue 2, February 2015
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Table 2. Correlation matrix among different heavy metals in surface water of Harike wetland

	Copper	Iron	Lead	Cadmium	Zinc	Nickel	Chromium	Manganese	Beryllium	Cobalt
Copper	1									
Iron	0.70424	1								
Lead	-0.96668	-0.53932	1							
Cadmium	-0.68919	-0.49035	0.54835	1						
Zinc	0.52997	0.91237	-0.30033	-0.64405	1					
Nickel	0.58924	0.28634	-0.47913	-0.97532	0.47187	1				
Chromium	0.2851	-0.41707	-0.51357	0.10069	-0.66139	0.0093644	1			
Manganese	0.78644	0.36039	-0.72542	-0.94171	0.41907	0.94922	0.23868	1		
Beryllium	-0.47614	-0.021724	0.67051	-0.2259	0.37008	0.23813	-0.8256	-0.073327	1	
Cobalt	-0.099122	0.37376	0.095811	0.62507	0.12961	-0.78142	-0.26087	-0.6775	-0.26574	1

Table 3. Standard used for the indices computation.

	W	S	I	MAC
Cu	0.001	1000	2000	1000
Fe	0.005	300	200	200
Pb	0.7	100	10	1.5
Cd	0.3	5	3	3
Zn	0.0002	5000	3000	5000
Ni	0.05	20	20	20
Cr	0.02	50	50	50
Mn	0.02	100	500	50

W weightage (1/MAC)
S Standard permissible in ppb
I Highest permissible in ppb
MAC Maximum admissible concentration/upper permissible (Adapted from Siegel, 2002)

International Journal of Scientific and Research Publications, Volume 5, Issue 2, February 2015
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Table 4. Evaluation indices.

Parameter	C_d	HPI	HEI
Cu	0.74	174	0.26
Fe	5.5	1100	6.5
Pb	352.33	577.77	353.33
Cd	2.33	350	3.33
Zn	0.862	115.5	0.13
Ni	0.5	1000	0.5
Cr	1.4	7000	2.4
Mn	0.6	120	0.4
Maximum	0.5	7000	353.33
Minimum	352.33	115.5	0.4
Mean	44.85	1304.65	45.85

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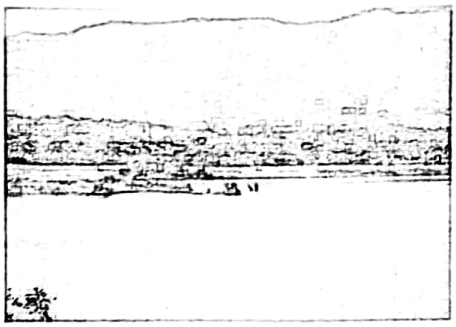
Annexure PR-3

PUNJAB

Pollution impacts fish at Harike, Nangal wetlands: Study

Pollution level at Harike wetland is high in comparison to Nangal wetland

Updated At: Apr 20, 2022 11:51 AM (IST)



Tribune News Service

Ravneet Singh

Patiala, April 19

Nutritional value of fish, an important source of food, found at the Harike wetland, also known as Ha Pattan, and Nangal wetland in the state, is directly affected due to rising pollution levels caused by di industrial effluents into the water bodies says a latest study on the Harike and Nangal wetlands carri an assistant professor and a research scholar of Zoology and Environmental Sciences at Punjabi Univ Patiala.

Water quality poor

- The study points out that pollution level at the Harike wetland is high in comparison to the N wetland
- The water quality index (WQI) of Harike wetland is poor at 56.68, while that of Nangal is gooc and safe for the ecosystem, it says
- The Harike wetland also has a high load of heavy metal pollution index and high metal index
- In the journal, the WQI of both wetlands and the nutritional value of liver and intestine of fis discussed

Nutritional value hit

There is a significant decline in polyunsaturated fatty acids (that serv source of energy for human organs) and saturated fatty acids (that h lower risk of diseases upon consumption) among fish. — Onkar Singh Brraich, Assistant Professor

The research paper — Impact of industrial effluents on physico-chemical parameters of water and fa profile of fish, Labeo rohita (Hamilton), collected from the Ramsar sites of Punjab, India — published Assistant Professor Onkar Singh Brraich and scholar Navpreet Kaur in Springer's Environmental Sci Research Journal discusses the water quality index (WQI) of both wetlands and the nutritional value and intestine of fish found there.

The study points out that pollution level at Harike wetland is high in comparison to Nangal wetlands of Harike wetland is poor at 56.68, while that of Nangal wetland is good (39.54) and safe for the ecosy says. The Harike wetland also has a heavy load of heavy metal pollution index (HPI) and high metal i (concentration of metal).

"Discharge of unprocessed industrial effluent, agricultural run-off and domestic sewage into the Har has become a major source of pollution. This has resulted in a significant decline in polyunsaturated (that serve as a source of energy for human organs) and saturated fatty acids (that help lower risk of upon consumption) among fish at the Harike wetland. In other words, it has deteriorated the nutritic of fish," Brraich points out.

— 17 -

He says stringent legislation and guidelines should be implemented to thwart direct discharge of poll natural aquatic ecosystem. Brraich said about half (48 per cent) of the fish (inedible portion), produc fishery industry worldwide as well as in the country, is discarded in landfills or dumped at sea as wa adds to rising pollution levels. It should rather be processed and used for its contents of bio-molecule lipids, protein and also to add economic value and minimise environmental pollution," he said.

#Environment #harike wetland #Nangal #Pollution

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ANNEXURE PR-4

No.	Category	Name	Father/Husband	Age	Disability
1	A	Santosh Kumari	Swaran Kumar	23	Disable, Mental Disorder
2	A	Manoj Kumar	Anil Kumar	23	Disable, Mental Disorder
3	A	Jyoti	Hari Ram	17	Blind
4	B	Kailash Rani	Dharampal	15	Disable, Mental Disorder
5	B	Ramna Devi	Krishan Kumar	17	Mental Disorder
6	C	Rahul	Ved prakash	8	Disable
7	C	Kanchan Kumari	Lal Chand	6	Mental Disorder
8	C	Santosh Kumari	Chotu Ram	25	Mental Disorder
9	C	Meenu Kumari	Banwari Lal	21	Disable, Mental Disorder
10	C	Dipika Kaur	Baldev Singh	13	Mental Disorder
11	C	Sunil Kumar	Lal chand Tak	16	Deaf Dumb Mental Disorder
12	C	Sona Rani	Angrej Singh	22	Mental Disorder
13	C	Payal Kumari	Ramji Lal	12	Deaf Dumb, Disable, Mental Disorder
14	C	Bandhna	Ram Kumar	13	Disable, Eyes defect, Orphan
15	C	Vipun	Madan Lal	13	Disable
16	C	Ramandeep Kaur	Harnek Singh	23	Disable, Mental Disorder
17	C	Rekha	Sadhu Ram	18	Disable
18	C	Navi	Mandar Singh	28	Mental Disorder
19	C	Sarabjit Kaur	Kulwant Singh	35	Disable
20	C	Vidhya Devi	Jasram	16	Mental Disorder
21	C	Saroj Devi	Jagdish	35	Disable
22	C	Gogi	Karnail Singh	45	Need of Treatment
23	D	Manjeet Singh	Soma Singh	22	Deaf & Dumb
24	D	Lovepreet Singh	Tarsem Singh	15	Deaf, Dumb, disable
25	D	Manpreet	Sahi Ram Lalesar	13	Mental Disorder
26	D	Rajji	Kala Singh	7	Mental Disorder
27	D	Shaminder	Kala Singh	5	Mental Disorder
28	D	Manpreet singh	Amandeep singh	8	Hole in Heart
29	D	Neha Sharma	Naresh Kumar	2	Eyes Defect
30	D	Kulwinder Kaur	Krishan Singh	20	Heart Valve Damage
31	D	Komal	Raj Kumar	9	One Eye Defect
32	D	Saroj Rani	Badri Prashad	35	Deaf Dumb
33	D	Sukhpreet Kaur	Labh singh	20	Orphan
34	D	Mohanpal	Kulwant Singh	18	Eyes Defect
35	D	Karan	Dana Ram	17	Mental Disorder
36	D	Karan singh	Sukha Singh	8	Mental Disorder
37	D	Savita Devi	Krishan Lal	40	Mental Disorder
38	D	Swaran Singh	Gurudarshan singh	42	Disbale
39	D	Gurdita Singh	Satpal Singh	8	Eyes Defect (Kundal)
40	D	Gayatri	Reshma Devi (G-Mother)	5	Orphan

True Copy

Applicant in Person

Annexure PR-4

Cancer scare: Water samples of Abohar village to be tested

ABOHAR: Taking cognisance of reports that some residents of waterlogged Dharangwala village, 14 km from here, are suffering from disabilities and cancer, SDM Poonam Singh on Monday visited the area and interacted with the affected families.

Updated At: Jan 22, 2019 06:42 AM (IST)

SDM Poonam Singh interacts with a resident of Dharangwala village in Abohar on Monday. Tribune photo

Raj Sadosh

Abohar, January 21

Taking cognisance of reports that some residents of waterlogged Dharangwala village, 14 km from here, are suffering from disabilities and cancer, SDM Poonam Singh on Monday visited the area and interacted with the affected families. The SDM was accompanied by officials of other state departments.

The team observed that there was no fresh case of any physical disability and cancer cases were also old.

The SDM, however, directed officials of the Public Health and Sanitation Department to collect water samples and get them tested at a Mohali-based lab to ascertain the presence of uranium. The SDM also formed a committee comprising Tehsildar Avinash Chander, Senior Medical Officer Dr Amita Chaudhary and psychiatrist Dr Mahesh Kumar to conduct a comprehensive survey and submit a fact-based report for further action. Earlier, experts had referred another village, Dangarkhera, located on the Abohar-Fazilka road, as cancer-prone with at least 12 deaths reported in 2014. Most of the villagers were found suffering from water-borne diseases.

The then Chief Minister Parkash Singh Badal had also organised a sangat darshan programme at the village after reports were highlighted at the international level.

The Health Department had conducted a survey that indicated the spread of diseases due to contaminated water not only at Dangarkhera but also in the neighbouring belt.

RO systems in government

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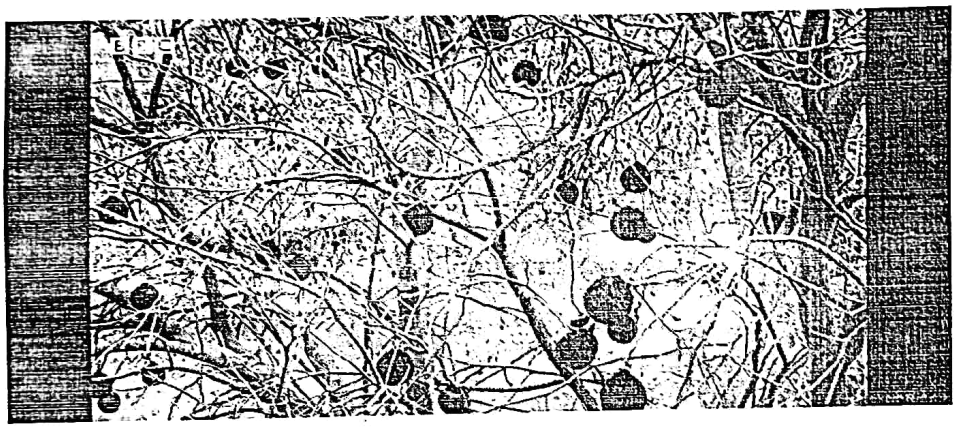
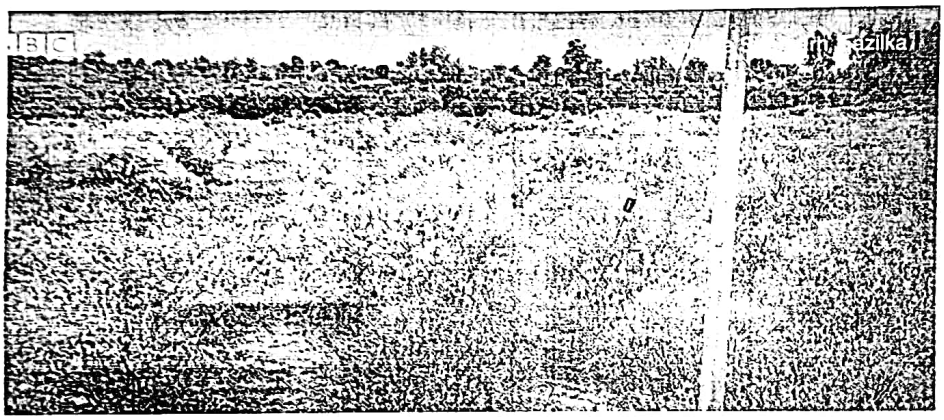
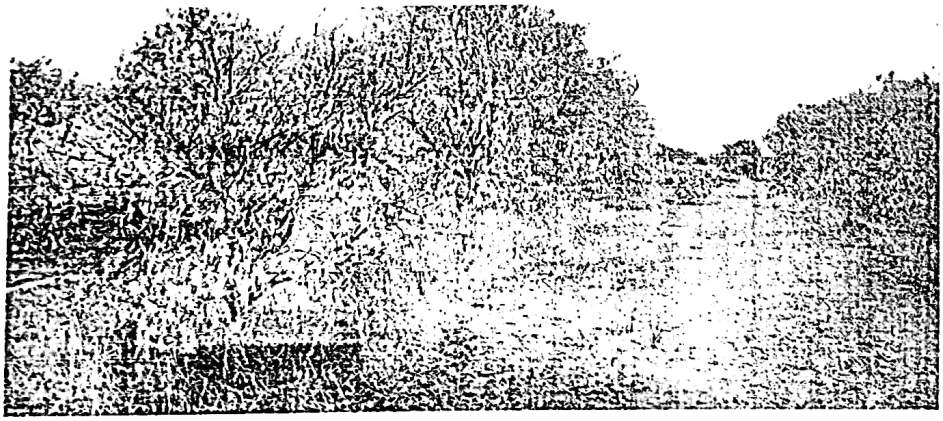
Annexure PR-6

ANNEXURE PR-6




(Zilka)



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Applicant in Person

ANNEXURE PR-7

Translated copy of Letter issued to the Chief Engineer (Canals-I), Department of Water Resources, Punjab, Chandigarh AND Supervising Engineer, Ferozepur Canal Circle, Ferozepur

No. 567/Part **Dated: 16-05-2022**

To,

Chief Engineer/Canals-I,
Department of Water Resources, Punjab
Chandigarh

Supervising Engineer,
Ferozpur Canal Circle
Ferozepur.

Subject: Advisory for water being released in Canals not to be used water for drinking purposes

As per the cited subject, it is informed to you that as per SOP for operation of Harike Headworks prepared by BBMB to prevent polluted water to enter canals is under progress. A meeting was held today dated 16-0-5-2022 via VC to review in regard with the same. During meeting, after analysis of reports of sampling done by Punjab Pollution Control Board as well as State of Rajasthan, it is found that the water reaching the Harike Headworks can only be used for irrigation purposes. During meeting, due to more demand of water in regions dependent on Bikaner Canal, the demand was raised again and again to release more water for irrigation and in the end of meeting, it was decided to release more water from tomorrow dated 17-05-2022 from 6 AM from Ferozepur Feeder for irrigation and it has been told by Rajasthan that this water will be used only for irrigation purposes and advisory would be issued in regions dependent on Bikaner canals advising not to use the water for drinking purposes.

You are advised that water flowing through Ferozepur Feeder in various regions of Punjab State shall be used for irrigation purposes only and for the present time, an advisory should be released to all concerned departments for not using the water for drinking purposes.

This is for your information and further action and should be given main priority.

-sd/-

Executive Engineer/Regulation-I
For: Chief Engineer/Canals-I
Department of Water Resources, Pb
Chandigarh

True Copy

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