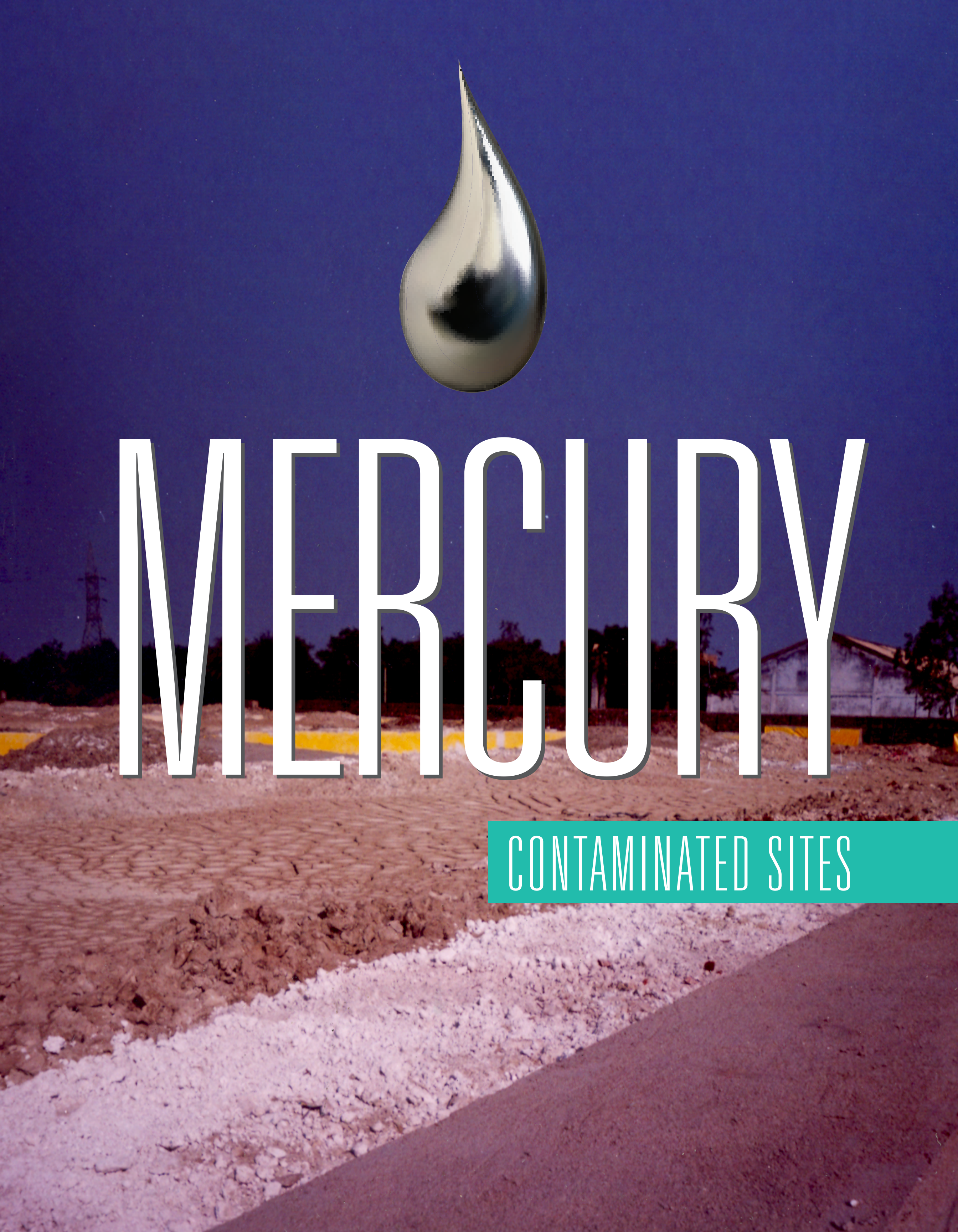
MERCURY

CONTAMINATED SITES



Toxics Link
for a toxics-free world

MERCURY CONTAMINATED SITES

Study by Toxics Link

About Toxics Link

Toxics Link is an Indian environmental research and advocacy organization set up in 1996, engaged in disseminating information to help strengthen the campaign against toxics pollution, provide cleaner alternatives and bring together groups and people affected by this problem.

Toxics Link's Mission Statement - "Working together for environmental justice and freedom from toxics. We have taken upon ourselves to collect and share both information about the sources and the dangers of poisons in our environment and bodies, and information about clean and sustainable alternatives for India and the rest of the world."

Toxics Link has a unique expertise in areas of hazardous, medical and municipal wastes, international waste trade, and the emerging issues of pesticides, Persistent Organic Pollutants (POPs), hazardous heavy metal contamination etc. from the environment and public health point of view. We have successfully implemented various best practices and have brought in policy changes in the afore mentioned areas apart from creating awareness among several stakeholder groups.

FOR FURTHER INFORMATION:
Toxics Link
H-2, Jungpura Extension
New Delhi – 110014
Phone: +91-(11)-24328006, 24320711
Fax: +91-(11)-24321747
Email: info@toxicslink.org
Web: www.toxicslink.org

Supervised by Piyush Mohapatra
Research and compiled by Dr. Prashant Rajankar and Tripti Arora

CONTENTS

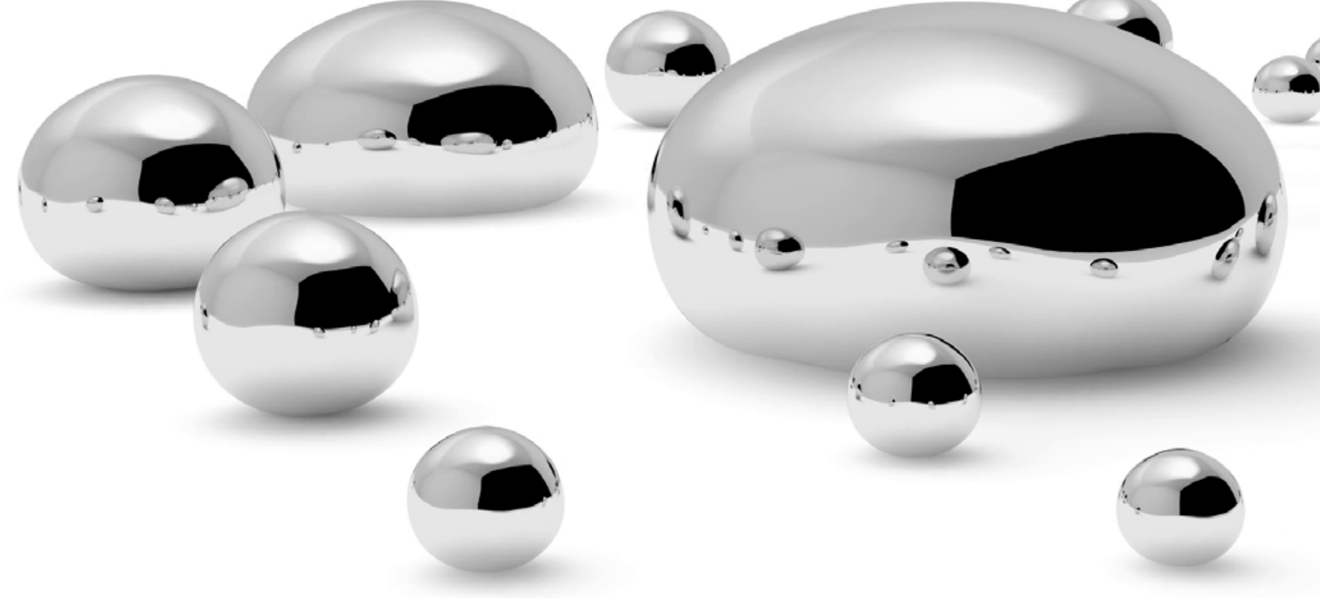
About Mercury		v
1.	Minamata convention and contaminated sites	1
2.	Risk assessment in determining mercury contaminated site	2
3.	Determining factors for mercury contaminated sites	3
4.	Issue of mercury contaminated sites in India	3
5.	Research studies on mercury presence in various ecosystems in India	5
6.	Observation	9
Bibliography		10
Annexure 1		11
Annexure 2		12

List of Figures

Figure 1:	The three Tiers in contaminated land risk assessment. The steps may be somewhat different in different countries and risk assessment frameworks.	2
Figure 2:	Mercury contamination at various locations in India (based on some secondary research paper)	11
Figure 3:	Location wise chlor alkali plants in India	14

List of Tables

Table 1:	Guideline values of mercury from different countries to determine mercury contaminates sites	3
Table 2:	List of mercury contaminated sites in India	4
Table 3:	Mercury concentration at Vembanad lake, Kerala	6
Table 4:	Mercury concentration in air, soil and sediment at Korba basin, Chattisgarh	6
Table 5:	Mercury concentration in soil samples around industrial park at Surat, Gujarat	7
Table 6:	Mercury concentration in water, blood, hair and nails around Singrauli area (Sonbhadra district), Uttar Pradesh	7
Table 7:	Mercury concentration in sediment collected around artisanal gold mining, Nilambur, Kerala	8
Table 8:	Mercury concentration in soil and groundwater around Bhilai steel plant, Chattisgarh	8
Table 9:	Chlor alkali plants in India	12



ABOUT MERCURY

Mercury is a highly toxic heavy metal that poses a global threat to human health and the environment. Together with its various compounds, it has a range of severe health impacts, including damage to the central nervous system, thyroid, kidneys, lungs, immune system, eyes, gums and skin. Victims may suffer memory loss or language impairment, and the damage to the brain cannot be reversed. There is no known safe exposure level for elemental mercury in humans, and effects can be seen even at very low levels. Fetuses, newborn babies and children are amongst the most vulnerable and sensitive to the adverse effects of mercury. Mercury is transported around the globe through the environment, so its emissions and releases can affect human health and environment even in remote locations.

140 countries

signed the Minamata Convention on Mercury treaty on 19 January 2013 in Geneva and adopted and signed later that year on 10 October 2013 at a Diplomatic Conference held in Kumamoto, Japan.

1. MINAMATA CONVENTION AND CONTAMINATED SITES

The objective of the Minamata Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. Article 12 of the Minamata Convention on Mercury states that '**each Party will endeavor to identify and assess sites contaminated by mercury and mercury compounds and that actions to reduce the risks posed by these sites will be performed in an environmentally sound manner** '(ESM).

The convention is yet to develop detailed guidelines on mercury contaminated sites. However, some of the suggested measures for developing guidance documents for contaminates sites are;

- Site identification and characterization
- Human health and environmental risk assessments
- Options for managing the risks posed by contaminated sites
- Evaluation of benefits and costs
- Engaging the public
- Validation of outcomes

Further, some of the important factors can be considered for identification of mercury contaminated sites are;

- What are the forms of mercury present (metallic mercury, methyl mercury...)?
- The amount of mercury; What are the environmental compartments impacted?
- What is the extent of the contaminated area?
- The behavior of mercury in environmental compartments
- What are the consequences of the pollution, both in and out of the site?

2. RISK ASSESSMENT IN DETERMINING MERCURY CONTAMINATED SITES

Risk assessment (RA) of mercury contaminated sites is an important component in determining exposure of human and environmental receptors and for making the decision whether to manage or remediate a site. Risk assessment can also provide a useful tool for prioritizing the remediation of numerous contaminated sites based on those that provide the greatest risk.

Figure 1: **The three Tiers in contaminated land risk assessment. The steps may be somewhat different in different countries and risk assessment frameworks.**[1]

TIER I

Generic Criteria

- Risk based
- Conservative default fate and transport and risk assessment parameters

TIER II

Site Specific Criteria

- Relevant physical/chemical data
- Relevant exposure times
- Analytical fate & transport modeling

TIER III

Site Specific Criteria or Quantification of Risk

- More detailed site characterization (e.g. (bio)available concentrations, dose-response studies)
- More sophisticated analyses (Statistical, exposure, fate & transport, etc.

Increasing level of detail and complexity

1 Ohlsson. Y., Back.P. and Vestin., J. (2014) Risk Assessment of Mercury Contaminated Sites. SNOWMAN NETWORK-Knowledge for sustainable soils Project No. SN-03/08

3. DETERMINING FACTORS FOR MERCURY CONTAMINATED SITES

In case of mercury contamination, it is important to know the definition of a **"site"** and also **the concentration of mercury** (in different forms) present at the site that will constitute "contamination" as opposed to naturally occurring levels. The countries have set certain parameters for mercury contaminated sites based on the presence of mercury in soil, water and sediment.

Table 1: Guideline values of mercury from different countries to determine mercury contaminates sites

Guidelines	Methyl mercury	Elemental mercury
National guidelines for contaminated sites of Australia	10 ppm	15 ppm
Dutch Intervention Levels (Netherlands Ministry of Housing, Spatial Planning and the Environment 2010)[3]	-	10 ppm
United Kingdom (U.K)	11 ppm	1 ppm (lower limit)

4. ISSUE OF MERCURY CONTAMINATED SITES IN INDIA

The Ministry of Environment Forest and Climate Change and Central Pollution Control Board have also developed the definition for **contaminated site** and **probably contaminated site** which is as follows.

"Contaminated sites - contaminated sites are delineated areas in which the constituents and characteristics of the toxic and hazardous substances, caused by humans, exist at levels and in conditions which pose existing or imminent threats to human health and/or the environment".

"Probably contaminated site - sites with alleged (apparent, purported) but not scientifically proven presence of constituents of contaminants or substances caused by humans at concentrations and characteristics which can either pose

2 http://ipen.org/sites/default/files/documents/Guidance-on-ID-mgmnt-remediation-Hg-contaminated-sites-Nov-2016-EN.pdf

a significant risk to human health or the environment with regard to present or future land use plan [pattern] or exceeding specific concentrations or guidelines values prescribed for human health and/or the environment"[3] However there are no specific guidance documents to categorize a site with mercury contaminated sites.

The Central Pollution Control Board (CPCB) has identified 71 contaminated sites in the country and out of it, 6 mercury sites are considered the primary contaminant.[4] Following are the designated mercury contaminated sites considering the various parameters.

Table 2: List of mercury contaminated sites in India

Sn	Location of the site	Name of the Industry	Number of Sites	Products	Type of Waste generated	Quantity/Area of the Waste/ Contamination
1	**Ganjam (Orissa)**	Jayashree Chemicals	3	Alkali Chlorine	Brine Sludge, Mercury Waste	5000MT, 33000MT, 18000MT at 3 locations
2	**Kodaikanal (Tamilnadu)**	Hindustan Unilever Ltd.	1	Thermometers	Mercury bearing scrap	3 acres of mercury contaminated soil to a depth of 1 m.
3	**Durgapur (West Bengal)**	Durgapur Chemicals Limited	1	Chlor-Alkali	Mercury bearing sludges	Not known
4	**Khardah (West Bengal)**	Hindustan Heavy Limited	1	Chlor-Alkali	Mercury bearing sludges	Not known

3 Ministry of environment, forest & climate change, Inventory and mapping of probably contaminated sites in India, December 2015

4 http://cpcb.nic.in/displaypdf.php?id=aHdtZC9MSVNUX09GX0hXX0NPTlRBTUlOQVRFRF9TSVRFUy5wZGY=

5. RESEARCH STUDIES ON MERCURY PRESENCE IN VARIOUS ECOSYSTEMS IN INDIA

In India, there are certain sites which have been demarcated as the mercury contaminated sites. However, research studies have indicated the presence of mercury in various sites and which also need to be considered. (Annex 1)

Deep Raj, et al (2017) [5] in their research on ecological risk assessment of mercury and other heavy metals in soils of coal mining area, they collected soil samples from the eastern part of a Jharia coal field and tested for mercury and other heavy metals. The roadside soil sample found the highest mercury concentration i.e. 2.32 ppm. Mercury concentration in roadside soil indicates high potential ecological risk, it was concluded that roadside soils show highest Ecological Risk Index (ERI) value of 339, indicating considerable ecological risk, and Hg alone contributes 64% of ERI value. Higher ERI and mercury were due to the deposition of coal dust from mining activities and transportation.

E.V Ramasamy, et al (2017)[6] collected the samples from Vembanad, a tropical backwater lake situated at the southwest coast of India. The authors collected water, pore water, sediment, and fish samples from the lake and analysed for total mercury (THg) and methyl mercury (MHg) contents. The varied levels of total and methyl mercury were observed in the collected samples. The maximum concentrations of THg and MHg in surface water samples were 31.8 and 0.21 ng/L, respectively, and those in bottom water samples were 206 and 1.22 ng/L, respectively. Maximum concentration of THg in surface sediment was observed during monsoon season (2850 ng/g) followed by that in the pre-monsoon season (2730 ng/g) and the post-monsoon season (2140 ng/g). The highest sediment concentration of MHg (202.02 ng/g) was obtained during monsoon season. The spatial variation in the mercury contamination clearly indicates that the industrial discharge into the Periyar River is a major reason for pollution in the lake. The mercury pollution was found to be much higher in Vembanad lake than in other wetlands in India.

5 Deep Raj, Abhiroop Chowdhury & Subodh Kumar Maiti (2017) Ecological risk assessment of mercury and other heavy metals in soils of coal mining area: A case study from the eastern part of a Jharia coal field, India, Human and Ecological Risk Assessment: An International Journal, 23:4, 767-787, DOI: 10.1080/10807039.2016.1278519

6 E.V Ramasamy, K. K. Jayasooryan, M.S. Shylesh Chandran, Mahesh Mohan (2017) Total and methyl mercury in the water, sediment, and fishes of Vembanad, a tropical backwater system in India. Environmental Monitoring and Assessment 189(3)

Table 3: Mercury concentration at Vembanad lake, Kerala

Samples	Maximum Total Hg conc.	Maximum methyl Hg conc.
Surface water	31.8 ng/L	0.21 ng/L
Bottom water	206 ng/L	1.22 ng/L

Reetu Sharma, et al (2015)[7] studied the air, soil and sediment contamination for mercury and lead at Korba basin which is one of the largest coal exploitation area in the country. The concentration of Hg in different sample types are presented in the below mentioned table. The result indicates that the mercury gets released in the environment during mining, handling and burning of coal as the coal is contaminated with toxic metals at the trace levels.

Table 4: Mercury concentration in air, soil and sediment at Korba basin, Chattisgarh

Sample type	Mercury concentration	Mean value
Air	7.4- 29 ng/m3	18 ± 4 ng/m3
PM10	23- 86 mg/kg	52 ± 13 mg/kg
Soil	0.11- 0.39 mg/kg	0.22 ± 0.03 mg/kg
Sediment	0.12- 0.82 mg/kg	0.44 ± 0.08 mg/kg

Alpa Varsani and Kapila Manoj (2015)[8] studied the soil samples collected (October 2012 - March 2013) from three different sampling stations of industrial creek at Surat and analysed for Mercury and other heavy metals. It was observed at varied levels of mercury at all locations. Mercury concentration at location 1 was found high while compared with Interim Sediment Quality Guidelines Low (ISQG) High concentrations (i.e. 1 ppm) in all the months where as at location 2 and location 3 somewhere it exceeded ISQG Low (0.15 ppm) concentrations and some where it exceeded ISQG High concentrations. The highest concentration of mercury was observed at location 3 and it was 12.060 ppm.

7 Reetu Sharma, Shobhana Ramteke, Khageshwar Singh Patel, Sudhanshu Kumar, Bighnaraj Sarangi, Shankar Gopal Agrawal, Lesia Lata, Huber Milosh. (2015) Contamination of Lead and Mercury in Coal Basin of India. Journal of Environmental Protection, 2015, 6, 1430-1441

8 Alpa Varsani* and Kapila Manoj. Analysis of Heavy Metals in Soil Samples Collected at three Different Industrial Creeks of Surat, India. Int.J.Curr.Microbiol.App.Sci (2015) 4(6): 281-286

Table 5: Mercury concentration in soil samples around industrial park at Surat, Gujarat

Location No.	Mercury Concentration
Location 1	1.440-4.558 ppm
Location 2	0.823-2.047 ppm
Location 3	0.752-12.060 ppm

R. Sahu, et al (2014) studied drinking water, soil, human blood, hair and nail in the Sonbhadra district (Singrauli area) of Uttar Pradesh, India. From the results mentioned in the table below, the authors concluded that all sampled residents of Sonbhadra could be suffering from mercury toxicity as the area is polluted by Hg released from the coal-fired thermal power plants.

Table 6: Mercury concentration in water, blood, hair and nails around Singrauli area (Sonbhadra district), Uttar Pradesh

Samples	Concentration of Mercury
Water	3 to 26 μg/L 20% of 23 drinking water samples contained mercury from 3 to 26 μg/L
Soil	0.5–10.1 mg/kg
Human blood	34 μg/L (Average)
Human hair	7.4 mg/kg (Average)
Human nails	0.8 mg/kg (Average)

M. S. Rahul Ramesh et al (2012) analysed the sediment samples collected from the artisanal gold mining areas of Nilambur. All of the sediment samples found total mercury.[9]

9 M. S. Rahul Ramesh Mahesh Mohan, , K. Shylesh Chandran and Sreedharann. Mercury contamination in the artisanal gold mining regions of Nilambur, Kerala, South India. Journal of Environment (2012), Vol. 01, Issue 01, pp. 7-13

Table 7: **Mercury concentration in sediment collected around artisanal gold mining, Nilambur, Kerala**

Samples	Concentration of Mercury
Sediment	Total mercury was detected for all the samples analysed ranging from 0.103±0.039 mg/kg to 0.468±0.085 mg/kg

Anubhuti Koshle et. al (2008)[10] studied the environmental pathways and distribution pattern of total mercury among soils and groundwater matrices around an integrated steel plant in India. In this study, the authors have collected the samples of soil and groundwater around Bhilai steel plants and tested using Inductive coupled plasma atomic emission spectrophotometer (ICPAES). They have observed 16.58 $\pm$ 5.32 ppm of mercury in soil and 0.44 $\pm$ 0.12 ppm of mercury in groundwater. According to them, the results are 4-5 times higher while compared with the background levels. A similar pattern of spatial distribution and seasonal trends of soil and groundwater Hg has been observed in the study.

Table 8: **Mercury concentration in soil and groundwater around Bhilai steel plant, Chattisgarh**

Samples	Total Mercury
Soil	16.58 $\pm$ 5.32 ppm
Groundwater	0.44 $\pm$ 0.12 ppm

A Ram et al (2003) evaluated Hg pollution in water and sediment of Ulhas Estuary, which were under considerable environmental stress due to indiscriminate release of effluents from a variety of industries including chlor-alkali plants. Concentration ranges of dissolved (0.04–0.61 g/L) and particulate (1.13–6.43 g/L) Hg revealed a definite enhancement of levels in the estuary. High content of T-Hg in sediment were found below the weir and varied seasonally (highest concentration recorded being 38.45 g/g).[11]

10 Anubhuti Koshle, Yasmeen F. Pervez, R. P. Tiwari and Shamsh Pervez. Environmental pathways and distribution pattern of total mercury among soils and groundwater matrices around an integrated steel plant in India. Journal of scientific and industrial research, Vol. 67, July 2008, pp. 523-530

11 A. Ram, M.A. Rokade, D.V. Borole, M.D. Zingde, Mercury in sediments of Ulhas estuary, Mar. Pollut. Bull. 46 (2003) 846–857.

6. OBSERVATION

In India, there are studies indicating the presence of mercury in various conditions like soil, water and sediments. However, at present, no limit has been prescribed globally or nationally to designate any site as mercury contaminated sites. Most of the recent studies in India where mercury has been reported has been linked to the thermal power plants where as no recent studies have reported the mercury presence in Chlor-Alkali plants. In this context, perhaps, there are requirements to generate more data from in and around Chlor –Alkali plants which are historically the biggest consumer of mercury in past (Annexure 1). Further, there is an urgent need for Govt. of India to develop a policy to remediate the mercury contaminated sites.

BIBLIOGRAPHY

Ohlsson. Y., Back.P. and Vestin., J. (2014) Risk Assessment of Mercury Contaminated Sites. SNOWMAN NETWORK - Knowledge for sustainable soils Project No. SN-03/08

http://ipen.org/sites/default/files/documents/Guidance-on-ID-mgmnt-remediation-Hg-contaminated-sites-Nov-2016-EN.pdf

Ministry of environment, forest & climate change, Inventory and mapping of probably contaminated sites in India, December 2015

http://cpcb.nic.in/displaypdf.php?id=aHdtZC9MSVNUX09GX0hXX0NPTlRBTUlOQVRFRF9TSVRFUy5wZGY=

Deep Raj, Abhiroop Chowdhury & Subodh Kumar Maiti (2017) Ecological risk assessment of mercury and other heavy metals in soils of coal mining area: A case study from the eastern part of a Jharia coal field, India, Human and Ecological Risk Assessment: An International Journal, 23:4, 767-787, DOI: 10.1080/10807039.2016.1278519

E.V Ramasamy, K. K. Jayasooryan, M.S. Shylesh Chandran, Mahesh Mohan (2017) Total and methyl mercury in the water, sediment, and fishes of Vembanad, a tropical backwater system in India. Environmental Monitoring and Assessment 189(3)

Reetu Sharma, Shobhana Ramteke, Khageshwar Singh Patel, Sudhanshu Kumar, Bighnaraj Sarangi, Shankar Gopal Agrawal, Lesia Lata, Huber Milosh. (2015) Contamination of Lead and Mercury in Coal Basin of India. Journal of Environmental Protection, 2015, 6, 1430-1441

Alpa Varsani* and Kapila Manoj. Analysis of Heavy Metals in Soil Samples Collected at three Different Industrial Creeks of Surat, India. Int.J.Curr.Microbiol.App.Sci (2015) 4(6): 281-286

Reetu Sharma, Shobhana Ramteke, Khageshwar Singh Patel, , Sudhanshu Kumar, Bighnaraj Sarangi, Shankar Gopal Agrawal, Lesia Lata, Huber Milosh. Contamination of Lead and Mercury in Coal Basin of India. Journal of Environmental Protection, 2015, 6, 1430-1441environment.

M. S. Rahul Ramesh Mahesh Mohan, , K. Shylesh Chandran and Sreedharann. Mercury contamination in the artisanal gold mining regions of Nilambur, Kerala, South India. Journal of Environment (2012), Vol. 01, Issue 01, pp. 7-13

Anubhuti Koshle, Yasmeen F. Pervez, R. P. Tiwari and Shamsh Pervez. Environmental pathways and distribution pattern of total mercury among soils and groundwater matrices around an integrated steel plant in India. Journal of scientific and industrial research, Vol. 67, July 2008, pp. 523-530

A. Ram, M.A. Rokade, D.V. Borole, M.D. Zingde, Mercury in sediments of Ulhas estuary, Mar. Pollut. Bull. 46 (2003) 846–857.

https://www.pressreader.com/india/chemical-industry-digest/20180128/282218011233927

http://www.lordschloro.com/profile.html

https://economictimes.indiatimes.com/lords-chloro-alkali-ltd/infocompanyhistory/companyid-13396.cms

https://dcmshriram.com/about-us

http://sanmargroup.com/chlorochemicals.php

http://www.greenbusinesscentre.com/EES2010/Presentations/National%20Award-2010/DCW,%20Sahupuram.pdf

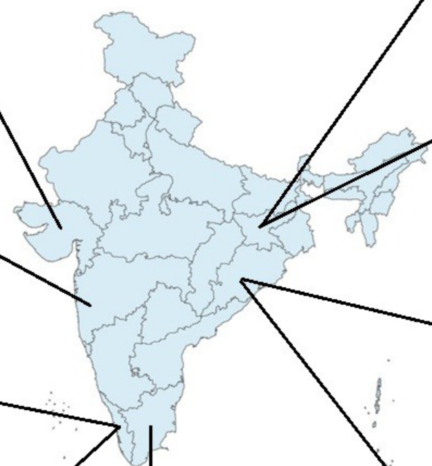
http://www.adityabirlachemicals.com/companies/ab_chem_india.html

http://www.durgachem.com/pdf/EC.pdf

http://www.chemfabalkalis.com/index.html

ANNEXURE 1

Figure 2: Mercury contamination at various locations in India (based on some secondary research paper)



Gujarat	
Industrial Creek Surat	
Location No.	Mercury Concentration
Soil @ Location 1	1.440-4.558 ppm
Soil @ Location 2	0.823-2.047 ppm
Soil @ Location 3	0.752-12.060 ppm
Source of Pollution – Industrial pollution	

Maharashtra		
Ulhas Estuary		
Samples	Hg conc.	Mean Value
Ambient Air (n=10)	7.4 to 29 ng/m³	18 ± 4 ng/m³
Particulate Matter (PM10) (n=10)	23 to 86 mg/kg	52 ± 13 mg/kg
Soil (n=30)	0.11 to 0.39 mg/kg	0.22 ± 0.03 mg/kg
Sediment (n=26)	0.12 to 0.82 mg/kg	0.44 ± 0.08 mg/kg
Source of Pollution – Industries including chlor-alkali plant		

Kerala	
Nilambur	
Samples	Total Hg Conc.
Sediment	0.103±0.039 - 0.468±0.085 mg/kg
Source of Pollution – Artisanal gold mines	

Kerala		
Vembanad Lake		
Samples	Max. Total Hg	Max. methyl Hg
Surface water	31.8 ng/L	0.21 ng/L
Bottom water	206 ng/L	1.22 ng/L
Surface sediment	2850 ng/L	-
Source of Pollution - Industrial Pollutions		

Tamil Nadu		
Kodai Lake		
Samples	Total Mercury	Methyl Mercury
Kodai waters	356–465 ng/L	50 ng/L
Sediment	276 to 350 g/kg	6% of Total Hg
Fish	120 to 290 g/kg	-
Source of Pollution – Thermometer industry		

Jharkhand
Jharia coal field
2.32 ppm of Hg @ road side soil samples
Source of Pollution - Coal

Jharkhand
Jharia coal field
2.32 ppm of Hg @ road side soil samples
Source of Pollution - Coal

Chattisgarh	
Bhilai	
Samples	Total Mercury
Soil	16.58 ± 5.32 ppm
Groundwater	0.44 ± 0.12 ppm
Source of Pollution - - Steel plant	

Chattisgarh		
Korba basin		
Sample	Hg conc.	Mean value
Air	7.4 - 29 ng/m3	18 ± 4 ng/m3
PM10	23 - 86 mg/kg	52 ± 13 mg/kg
Soil	0.11 - 0.39 mg/kg	0.22 ± 0.03 mg/kg
Sediment	0.12 - 0.82 mg/kg	0.44 ± 0.08 mg/kg
Source of Pollution - - Mining, handling and burning of coal		

ANNEXURE 2

Table 10: Chlor alkali plants in India

S. No.	State	Name of the Unit	Year of operation	Year of Shifting	Place
1	**Andhra Pradesh**	Andhra Sugars	1947	30.06.2005	Kovvur
2	**Assam**	Hindustan Paper Corp ltd	1970	2010	Hailakandi
					Maligaon
3	**Gujarat**	Gujarat Alkalies and Chemicals Ltd.	1977	1991	Bhuj
		DSCL	1995	March 2005	Bharuch
		Atul	1960	December, 2012	Valsad
4	**Jharkhand**	Bihar Caustic and Chemical Ltd.		2006	Rehla
5	**Karnataka**	Aditya Birla Chem (Formerly Solaris Chemtech)	1970	2012	Karwar
6	**Kerala**	Travancore Cochin Chemicals ltd.		2006	Udyogmandal
7	**Madhya Pradesh**	Aditya Birla (Grasim Industries)			Nagda
		HJI- Prop : Gmmco Ltd	1946	2012	Amlai
8	**Maharashtra**				Thane
9	**Odisha**	Aditya Birla Chem (Formerly known as Jayshree Chemicals)	1967	November 2010	Ganjam
		Orient Paper Mills Ltd.			Brajrajnagar
10	**Punjab**	Punjab Alkalis	1975	1998	Nangal
11	**Rajasthan**	Lords Chloro Alkali Ltd.	1979	1992	Alwar
		DCM Shriram	1990	2005	Kota

S. No.	State	Name of the Unit	Year of operation	Year of Shifting	Place
12	**Tamil Nadu**	Chemplast Sanmar Ltd.	1962	2007	Mettur
		Darangadara Chemical Works Limited (DCW)	1959	2008	Shahupuram
		Chem fab Alkalis	1985	1985	Puducherry
13	**Uttar Pradesh**	Aditya Birla Chemicals Pvt. Ltd (Formely Kanoria Chemicals and Industries Ltd.)	1984	Phase-I conversion in 2006, phase-II conversion in 2008 & Full Conversion by March, 2012	Renukoot
14	**West Bengal**	Hindustan Heavy		Plant closed in 2010	Khardah
		Durgapur Chemicals Ltd	1963	2008	Durgapur

Figure 3: Location wise chlor alkali plants in India

Toxics Link
for a toxics-free world

H2 (Ground Floor),
Jungpura Extension,
New Delhi - 110014
India
Tel: 91-11-24328006, 24320711
Fax: 91-11-24321747

https://www.facebook.com/toxicslink
https://twitter.com/toxicslink
https://www.youtube.com/user/toxicslink2012