

Report of Lichen, Moss and Sediment Sampling around the premises of Hindustan Unilever's Mercury Thermometer Factory in Kodaikanal



Community Environmental Monitoring
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www.sipcotcuddalore.com

www.kodaimercury.org

Background

Two studies in 2002-2003 by Greenpeace¹ and the National Centre for Compositional Characterisation of Materials², a Department of Atomic Energy (DAE) laboratory, reported mercury levels of 1.5 mg/kg and 1.99 mg/kg in lichen collected from the vicinity of Hindustan Unilever's now-closed mercury thermometer factory in Kodaikanal, India. The DAE study also reported that at 1.32 mg/m³, the mercury level in ambient air near the factory “is very much higher than the nominal Hg concentration range (0.5 to 10 ng/m³) reported as typical of non-contaminated areas.”

The studies were conducted between one and two years after Unilever's factory was shut down by the Tamil Nadu Pollution Control Board (TNPCB) for having dumped mercury-bearing wastes in and around the factory site, including in the ecologically sensitive Pambar Shola watershed. The factory sits atop a natural ridge that slopes into the Pambar Shola watershed to the south, and the Bombay Shola and Kodai Lake watershed to the North. Unilever admits to having discharged more than 1.3 tonnes of mercury into the Pambar Shola. Its own studies estimate that 366 kg of mercury remain mixed with soil and vegetation within the factory site³. Workers point to discrepancies in the data provided by Unilever to argue that the actual releases to the environment are far greater.

Till date, neither the TNPCB nor the Union Ministry of Environment, Forest and Climate Change have commissioned an independent verification of the depth and spread of contamination. Mercury constantly volatilises, resettles to ground, is carried by air currents and water ways to distant places, and changes form from metallic to inorganic to organic and vice versa. This underscores the need for an updated assessment to get an accurate picture of the contamination on and offsite. The new data collected by Community Environmental Monitoring shows that the contaminated site is functioning as a reservoir from which mercury continues to be released into the environment, including into the ecologically sensitive Pambar Shola Reserve Forest.

In April 2015, Community Environmental Monitoring collected samples of 14 samples, including four of lichen, three of moss, three water and four sediment samples from four locations outside the factory. Samples were stored and transported as per instructions of the analytical laboratory – Bhabha Atomic Research Centre, Hyderabad.

¹ “Atmospheric Dispersal of Mercury from Hindustan Lever Limited thermometer factory,

² “Study of mercury pollution near a thermometer factory using lichens and mosses” M.V. Balarama Krishna, D. Karunasagar, J. Arunachalam; National Centre for Compositional Characterisation of Materials (CCCM) 2003

³ “Environmental Site Assessment and Risk Assessment for Mercury HLL Thermometer Factory Site Kodaikanal, Tamilnadu, India” URS Dames & Moore. For Hindustan Unilever Ltd. May 2002

How Does Mercury Enter the Environment?

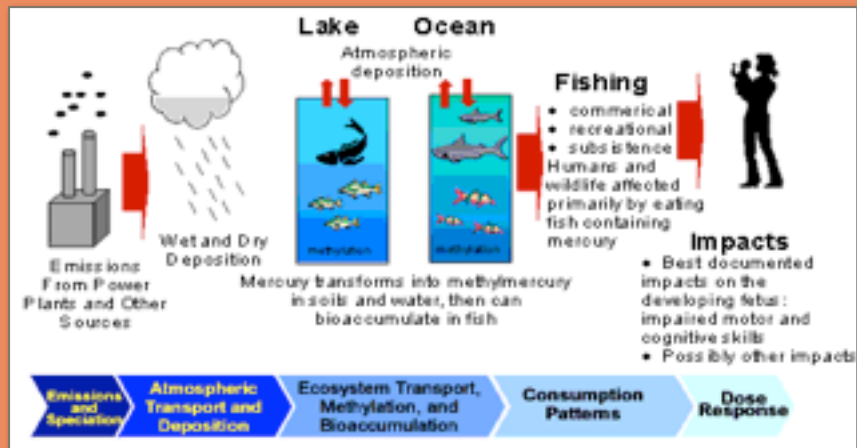


Photo Courtesy - <http://www.epa.gov/mercury/exposure.html>

About Mercury:

Mercury is a highly toxic element that is found both naturally and as an introduced contaminant in the environment. It is a neuro toxin and severely affects the Central Nervous System.

Mercury is usually found in metallic form, in the form of salts and as organic, carbon-containing compounds.

Metallic mercury is a heavy, odourless, silver coloured liquid. The liquid turns into vapour (gas) at room temperature. Mercury vapour can be inhaled into the lungs or pass through the skin and enter the blood stream, or it can be absorbed through eating mercury contaminated fish.

Chronic mercury poisoning – The Symptoms and After

Gum and dental problems, mood swings and nervous disorders.

Skin allergies may develop. Repeated exposure can lead to persistent and itchy rashes.

Birth defects in children born of exposed mothers.

Mild to severe tremors

Memory loss, behavioural changes, loss of hearing

Kidney and brain damage

Mercury in Environment:

Mercury in the air may settle into water bodies and affect water quality.

This airborne mercury can fall to the ground in raindrops, in dust, or simply due to gravity (known as “air deposition”).

After the mercury falls, it can end up in streams, lakes, or estuaries, where it can be transferred to methyl mercury through microbial activity.

Methyl mercury accumulates in fish at levels that may harm the fish and the other animals that eat them.

SAMPLING LOCATIONS ON A MAP



DISCUSSION

Lichen and Moss:

The results of analysis revealed high mercury levels in one moss, one sediment and two lichen samples. Lichen and moss are good bio-indicators of localized levels of mercury in ambient air. When mercury levels in lichen and moss exceed 1 milligram per kilogram (mg/kg), then mercury levels in local ambient air are likely to be above generally prevailing background levels⁴.

The most contaminated samples of lichen and moss were found on the Levange path in Pambar Shola Reserve Forest from around a stream that flows out of the factory into the Shola watershed. The lichen sample contained 53 mg/kg of mercury; moss contained 8.68 mg/kg. One lichen sample collected from around Charlemont – a private property across the street (St. Mary's Road) from the factory – contained 2.96 mg/kg of mercury, indicating higher-than-background mercury levels in the ambient air in this residential area. Other lichen and moss samples contained less than 1 mg/kg mercury.

⁴ Krishna, M. B., Karunasagar, D., & Arunachalam, J. (2003). Study of mercury pollution near a thermometer factory using lichens and mosses. *Environmental Pollution*, 124(3), 357-360.

Sediments:

The sediment samples with the highest levels of mercury were collected from inside the Pambar Shola. One sample (LS1), collected from a stream that flowed out of the factory site, was found to contain 1.52 mg/kg of mercury. Another (LS2) collected nearby contained 0.54 mg/kg.

For mercury levels in sediment, there are at least four standards for comparison that are currently being used in other parts of the world, all of which specify a range of values. These are:

United States Environment Protection Agency health-based standard

0.23-0.83 mg/kg

<http://www.epa.gov/waterscience/cs/report/2004/nsqs2ed-complete.pdf>

(assume sediment contains 1% total organic carbon)

Canadian health-based standard

0.17-0.49 mg/kg

<http://www.elaw.org/assets/pdf/sediment%5Fsummary%5Ftable.pdf>

(assume sediment contains 1% total organic carbon)

[State of Washington health-based standard](#)

0.41-0.59 mg/kg

http://www.ecy.wa.gov/programs/tcp/smu/sed_chem.htm

(assume sediment contains 1% total organic carbon)

State of Wisconsin health-based standard

0.18 - 1.1mg/kg

http://www.dnr.state.wi.us/org/aw/rr/technical/cbsqg_interim_final.pdf

The amount of mercury in sediment sample LS1 (at Lavange path) - 1.52 mg/kg - exceeds the higher end of the range of all the criteria above. The amount of mercury in sediment sample LS2 (at Lavange path) - 0.54 mg/kg - exceeds the lower end of the range of all the criteria above. Sediment samples at the Kodai Lake (LaS1 and LaS2), are below the limits of detection of 0.02 mg/kg hence do not fall in these ranges mentioned above.

The high levels in sediment taken from Pambar Shola indicate that leaching of mercury from the factory grounds continues to contaminate the Shola watershed. This has significance considering that the Pambar River drains the factory grounds and runs through several villages to join the Varaha River in the plains.

TABLE 1: Samples indicating high levels of mercury

	Sample ID	Type of sample	Date collected	Time collected	Location	Mercury Concentration (mg/kg)
1	LS1	Sediment	23 April 2015	11.35 am	On the Levange path, south of the fence of the unit and approx. 300m south of the factory building	1.52 (+/-0.03)
2	LL1	Lichen	23 April 2015	11.40 am	Same as in sample LS1	53 (+/- 3)
3	LM1	Moss	23 April 2015	11.45 am	On the Levange path, south of the fence of the unit	8.68 (+/-0.19)
4	LM2	Moss	23 April 2015	11.55 am	On the Levange path, south of the fence of the unit	0.14 (+/-0.04)
5	LS2	Sediment	23 April 2015	12.05 pm	On the Levange path, south of the fence of the unit	0.54 (+/-0.02)
6	OPL2	Lichen	23 April 2015	12.50 pm	Near Charlemont property on St. Mary's Road	2.96 (+/-0.33)
7	PM1	Moss	23 April 2015	1.05 pm	From the north west wall of the factory	0.48 (+/-0.13)

Water:

Three water samples were collected, LW1 at Lavange path approximately 100 meters south and 70 meters downhill of the former HLL thermometer factory in Kodaikanal, and LaW1 and LaW2 at two spots on the Kodai Lake. The level of mercury was less than 0.5 ng/mL (detection limit) in all the samples.

CONCLUSION

The factory site continues to release mercury into the environment. It serves as a reservoir of mercury that is also leading to heightened, above-background-level mercury in ambient air in the vicinity of the factory site.

The present and ongoing contamination underscore the need for an exhaustive and independent assessment of the depth and spread of contamination and speedy clean-up. The fact that mercury has been discharged and is being found inside the watershed Pambar Shola Reserve Forest highlights the importance of a long-term monitoring of mercury building up in the ecosystem.