Centre for Science and Environment’s Study

Mercury Pollution in Sonbhadra, Uttar Pradesh and its health impacts

Lucknow, October 19, 2012
About CSE

- One of India’s leading non-profit public interest research institutions
- Set up in 1980 to promote sustainable development
- Works on a wide array of environment and development issues including water and waste management, industrial pollution & regulations, environmental health, food safety, climate change, renewable energy, air pollution and mobility management etc.
About Pollution Monitoring Laboratory (PML)

- PML was set up in 2000 to monitor environment pollution and food contamination.
- Setup as an independent lab to support communities and to investigate issues of public health concern.
- Has state of the art equipments (GC-MS, HPLC, AAS etc.) to monitor trace organics and metals, criteria air and water pollutants and other food and environmental samples.
Key Study and Impacts

- Feb 2001: Endosulfan study in Kasaragod, Kerala
  - 2001: Kerala government suspended the use of endosulfan in the state
  - May, 2011: Supreme Court of India banned the production, sale, exports and use of endosulfan across the country

- Feb 2003: Analysis of pesticide residues in bottled water
  - July 2003: Govt. notifies norms for pesticide residues in bottled water
Key Study and Impacts

- **August 2003 & 2006: Analysis of pesticide residues in carbonated beverages**
  - August 2003, The fourth Joint Parliamentary Committee (JPC) was set up to investigate the CSE study
  - Based on JPC recommendations, new food law was enacted replacing the old one and the entire food safety governance structure was changed; the draft pesticide safety rules in parliament
  - August 2008: Union Health Ministry notified rules for maximum levels of pesticides in carbonated water; the first in the world
Key Study and Impacts

• June 2005: Analysis of blood samples of farmers in the cotton belt of Punjab – cancer registry established

• Feb 2009: Fatty acid profile of edible oil and fats in India – setting-up of transfats standards

• August 2009: Analysis of lead content in paints – companies voluntarily agreed to remove lead

• November 2009, Bhopal contamination – established that contamination still continues
Key Study and Impacts

• Sept 2010: Analysis of antibiotic residues in honey – advisory issued and standards in the process of notification

• March 2011: Nutritional analysis of junk food – UP bans junk food in schools

• February, 2012: Environmental contamination and chronic kidney disease in Sri Lanka
Sonbhadra Study

• Mid-2011: Communities in Sonbhadra approached CSE to help them fight pollution from thermal power plants and coal mines in the district

• Banwasi Sewa Ashram (BSA) also approached to test heavy metal, especially mercury, pollution in the district

• CSE decided to do the study in association with BSA
Background

• Singrauli coalfields has one of the largest coal reserves in the country – more than a billion tonnes.

• The coalfields spreads over the Sonbhadra district of Uttar Pradesh and Singrauli district of Madhya Pradesh

• Presently, the maximum thermal power plants are in the Sonbhadra part and coal mining in the Singrauli part.
<table>
<thead>
<tr>
<th>District</th>
<th>Coal mining (million tonnes/year)</th>
<th>Thermal power plant (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonbhadra, UP</td>
<td>17</td>
<td>9940</td>
</tr>
<tr>
<td>Singrauli, MP</td>
<td>66</td>
<td>3260</td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>1320</td>
</tr>
</tbody>
</table>
Pollution in Singrauli

• Singrauli is known be a polluted area for a long time.
• In 2009, it was finally declared as 9th most critically polluted area of the country by MoEF/CPCB.
• A moratorium was put on any new or expansion projects.
• But moratorium was removed in 2010 after UP and MP pollution control boards submitted their 'action plan' to reduce pollution.
## Action Plan

- Action plan commits to:
  - 100% utilise flyash
  - Meet all pollution norms
  - Regular monitoring of pollution

- Most of these were to be done by 2012
- No mention of mercury pollution in action plan
- But what is the present status??
Pollution in Sonbhadra

• Fly ash dumping in vast open areas is still a common practice: **NTPC Shaktinagar fly ash pond**
Pollution in Sonbhadra

- Fly ash mixed with water is being discharged into nallahs that drain into the GBPS reservoir or rivers:
  Fly ash slurry discharged in Renuka river
Pollution in Sonbhadra

- Untreated effluent still being discharged into nallahs meeting the GBPS reservoir:
  Dongiya nallah carrying effluent from Aditya Birla Chemicals
Mercury pollution

• In 1998, Indian Institute of Toxicology Research, Lucknow carried out an extensive epidemiological study involving 1,200 people from Singrauli.

• It found high levels of mercury in humans, water, food items, etc. **But as the study was financed by NTPC Ltd it was never made public.**

• In 2002-2003, CPCB found mercury in water, milk, food items, air, etc. CPCB was asked by Supreme Court.
Health impacts of Mercury

- Mercury is a neurotoxin and affect the central nervous system.
- Gets bio-concentrated and biomagnified within the food chain.
- Chronic exposure causes tremors, spasms and loss of memory, severe depression, and increased excitement, delirium, hallucination and personality changes.
- Renal damages can also happen
Minamata Disease

- Minamata disease is the first well studied and the most serious mercury poisoning which occurred in Minamata, Japan.

- It happened due to consumption of fish and other seafood contaminated with methyl mercury.

- Mercury was discharged from a chemical factory in Minamata Bay which contaminated the fish.

- Thousands died and thousands are still suffering.
Objective of the Study

- To assess the exposure of the people of Sonbhadra district of Uttar Pradesh to heavy metal pollution especially mercury pollution.

- The study area selected was Dhudhi subdivision of Sonbhadra district as it has largest concentration of thermal power plants, coal mines and many other polluting industries.
Methodology

- Primary survey of the area and meeting doctors and local communities in Sonbhadra
- Questionnaire-based health survey conducted
- Based on the above, decided on sampling area and identified affected people
- Sample collection
- Samples were properly preserved and transported to Delhi for testing at PML
- CSE team visited Sonbhadra in May & August 2012
Samples

- 19 human blood and hair and 18 human nail samples
- 23 water samples – 15 drinking water, 3 surface water and 5 effluent
- 7 soil samples, 5 cereal sample and 3 fish samples
- A total of 57 samples collected from the following affected areas – Chilika Daad, Dibulganj, Anpara, Renukut, Shaktinagar, Obra, Khairahi, Kirwani and Kushmaha
Analysis

• All tests conducted using internationally-accepted methodologies – USEPA, AOAC, American Public Health Association, Water Environment Federation etc.

• Heavy metals (lead, cadmium, chromium, arsenic and mercury) tested with AAS

• Methyl mercury analysis done with GC-ECD
Results – Human Samples

**Blood:**

- Safe limit (USEPA): 5.8 ppb
- Mercury found in 84% blood samples
- Range: 0-113.5 ppb
- Average: 34.3 ppb *(about 6 times the safe limit)*
Results – Human Samples

• **Hair:**
  - Safe limit (Health Canada): 6-30 ppm is 'increasing risk' category and more than 30 ppm is 'at risk' category
  - Mercury found in 58% hair samples
  - Range: 0-31.3 ppm
  - Between 6 – 30 ppm mercury levels found in 26% hair samples, 10.5% samples had more than 30 ppm
  - Average: 7.4 ppm *(increasing risk category)*
Results – Drinking water

- Drinking water in study area high in hardness, total dissolved solids, calcium and fluoride – *not fit for drinking without treatment*
- On top of it, mercury has started contaminating the groundwater
- Mercury found in 20% drinking water samples in range of 0 – 0.026 ppm
- BIS limit of mercury in drinking water – 0.001 ppm
- Highest concentration found in hand pump at Dibulganj – 0.026 ppm, **26 times higher than the limit**
Results – Drinking water

• Fluoride found in 80% drinking water samples

• Range: 0 – 2.1 ppm

• Fluoride problem in the district is well known. The state government had installed filters in hand pumps in 2009 but poor maintenance has done little for the water quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Filtered water</th>
<th>Unfiltered water</th>
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<tbody>
<tr>
<td>Hardness (ppm)</td>
<td>389</td>
<td>335</td>
</tr>
<tr>
<td>Calcium (ppm)</td>
<td>80</td>
<td>48</td>
</tr>
<tr>
<td>Fluoride (ppm)</td>
<td>1.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Results – Surface water

- **Rihand (GBPS) reservoir** contaminated with mercury.
- Mercury level 0.01 ppm – 10 times higher than the drinking water standard
- **Obra dam** contaminated with fluoride (1.8 ppm) and Arsenic (0.019 ppm)
- Arsenic was also found in **Renuka river** at Obra (0.008 ppm)
Results – Effluents

- Water of Dongiya nala, which carries the effluent of Aditya Birla Chemicals (previously Kanoria Chemicals) had 4370 ppm TDS (Std: 2100 ppm), 4.5 ppm fluoride (Std: 2 ppm) and 0.127 ppm mercury (0.01 ppm).

- These results show that Aditya Birla Chemicals is one of the major sources of pollution of water of Rihand dam.
Results – Fish

- Two Rohu (*Labeo Rohita*) and one Malli (*Wallago attu*) fish samples tested
- Methylmercury detected in both Rohu samples and not in Malli
- Highest concentration found in Rohu sample from Shaktinagar – 0.505 ppm, which is twice the safe limit of 0.25 ppm of
- Rohu sample collected from Rihand near Dongiya nallah contained 0.447 ppm of methylmercury.
- **Rohu fish of Rihand reservoir not fit for consumption**
Results – Soil

- Mercury found in 100% soil samples in range of 0.42 – 10.09 ppm. No standard for mercury in soil exists.

- Highest concentration in soil sample from Rihand dam near Dongiya nallah – 10.09 ppm.

- Arsenic also found in all soil samples in the range of 0.52 – 7.67 ppm.

- Highest found in Khairahi which is above the 7.2 ppm standard set by the Agency for Toxic Substances and Disease Registry of the US.
Results – Cereals

- Mercury was not found in any of the cereal samples.
- Arsenic found in 60% of the samples in the range of 0 – 0.173 ppm; **all within the 1.1 ppm limit set by FSSAI**
<table>
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<tbody>
<tr>
<td>Blood Mercury Level</td>
<td>66% samples exhibited more than 5 ppb</td>
<td>79% samples exhibited more than 15 ppb</td>
</tr>
<tr>
<td></td>
<td>79% samples exhibited more than 15 ppb</td>
<td></td>
</tr>
<tr>
<td>Hair Mercury Level</td>
<td>48% samples exhibited more than 1 ppm</td>
<td>26% samples exhibited more than 6 ppm</td>
</tr>
<tr>
<td></td>
<td>26% samples exhibited more than 6 ppm; more than 50% had</td>
<td></td>
</tr>
<tr>
<td></td>
<td>more than 1 ppm</td>
<td>1 ppm</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>15% samples had more than 0.001 ppm</td>
<td>20% samples had more than 0.003 ppm</td>
</tr>
<tr>
<td></td>
<td>15% samples had more than 0.001 ppm of mercury in drinking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>water</td>
<td></td>
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</tbody>
</table>
What is the source of mercury?

- Thermal power plant, coal mines and Aditya Birla Chemicals
- CPCB: 0.09 – 0.487 ppm mercury in Singrauli coal
- CSE: 0.15 ppm of mercury in coal from Anpara

- This means the 13200 MW TPPs are releasing between 15-50 tonnes of mercury in a year – **detailed survey required**
More mercury in future if no action taken

## Industrialisation in Singrauli

<table>
<thead>
<tr>
<th>Sector</th>
<th>Present capacity</th>
<th>Proposed capacity</th>
<th>Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal mining (MTPA)</td>
<td>83</td>
<td>50</td>
<td>Northern Coalfields Limited, Mahan Coalfields Limited</td>
</tr>
<tr>
<td>Thermal power plants (MW)</td>
<td>13,200</td>
<td>9,600</td>
<td>Uttar Pradesh Rajya Vidyut Nigam Ltd NTPC, Lanco, Hindalco</td>
</tr>
</tbody>
</table>

*MTPA: Million tonnes per annum*

*Source: Centre for Science and Environment analysis,*
Health Survey by the State

- According to Annual Health Survey of Uttar Pradesh 2010-11, high incidence of acute illnesses in Sonbhadra -- 30,664 people per 100,000 population – compared to the state average of 12,561 per 100,000 people

- High incidence of chronic illnesses 17,000 per 100,000 population; state average – 8,380 per 100,000
Health Survey by CSE

- High incidence of vitiligo (skin discolouration), shivers, reduced vision, burning sensation in the limbs and impaired language skills.

- All these are known to be symptoms of mercury exposure.

- They indicate the beginning of mercury poisoning

- Take action now!!!!!!
Recommendations

• Put moratorium on new and expansion project till a mercury control action plan is put in place.

• Undertake regional impact assessment to assess how many more industries can the environment sustain

• Mercury standards must be set for TPPs, coal washeries and mining

• Aditya Birla Chemicals must be penalised and asked to stop mercury discharge and decontaminate its site
Recommendations

- Mercury is present in fish and water. These should be regularly monitored. Advisory must be issued to people not to consume them.

- Treated water must be provided in all hamlets, villages and towns and the polluting industries should pay for it

- People affected by mercury poisoning must be given medical assistance